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The Forests of Toro Negro

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SUMMARY

A forest inventory of the Toro Negro region, Puerto Rico, was conducted in 1983. Eight different forest classes were sampled: active coffee shade, abandoned coffee shade, secondary forest, eucalyptus plantation, other timberland, upper mountain forest, palm forest, and dwarf forest. The study found the region is 61 percent forested with 20,100 hectares of timberland and 2,300 hectares of other forest land. *Eucalyptus robusta* accounts for 19,000 cubic meters or 37 percent of the growing-stock volume in the public forest. Seven valuable hardwood species add 16,000 cubic meters to the growing stock on public timberland. Private timberland also includes valuable timber, but the large trees are more scattered and the average volume only one-third of that in public forests. Most eucalyptus plantations are ready for harvest and regeneration. Other public timberland contains good sapling and poletimber stocking and would benefit from release cutting. Private timberland has adequate sapling stocking, which could be released in many cases by removal of rough and rotten overstory trees.

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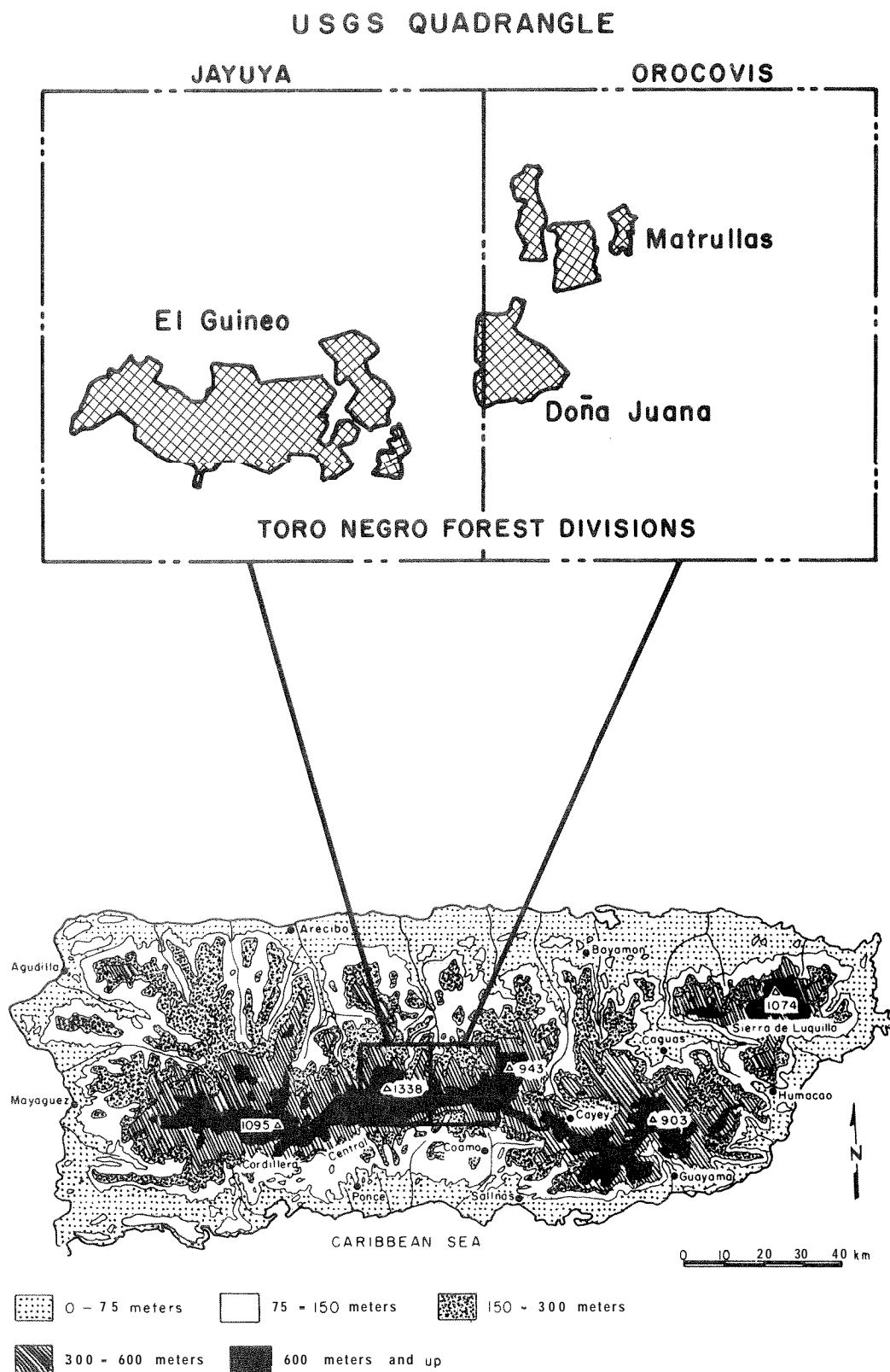


Figure 1.—Major physiographic features of Puerto Rico, and location of study area.

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INTRODUCTION

The Toro Negro forest inventory in Puerto Rico had two objectives: To develop field methods for subtropical and lower montane wet forests, and to provide a detailed assessment of the region's forest resources. Need for an evaluation of field methodology became evident after a 1980 survey of Puerto Rico's timberland (Birdsey and Weaver 1982). The Toro Negro region was chosen for study because it included an important Commonwealth Forest and a surrounding area with good forestry development potential. While the Luquillo Mountains of Puerto Rico have been studied intensively for many years (Brown et. al. 1983), data has been sparse for the Toro Negro highlands. Further, on a worldwide basis, little information covers the forest classes and conditions represented in Toro Negro, especially the secondary forest types.

The variety of forest cover types and diverse human impacts provided an appropriate area to test and evaluate field techniques. Similar forest conditions are found on most Caribbean islands and in countries bordering the Caribbean Sea (Lugo et. al. 1981). Thus the methodology and forest characteristics reported here may have some regional significance.

The data will be used to guide management decisions within the Toro Negro Commonwealth Forest, and to promote forestry development in the surrounding region. The information will also contribute to the growing pool of knowledge about tropical forests and their role in the biosphere, by providing information about forest recovery after extensive deforestation and about management opportunities in secondary forests. Current data may be used to develop biomass estimates, and subsequent surveys may be used to estimate productivity.

This paper presents a detailed assessment of the forests of the Toro Negro region. Field methods, while outlined, will be analyzed in detail elsewhere.

STUDY AREA

The inventory was conducted within the boundaries of two U.S. Geological Survey quadrangle maps, Jayuya and Orocovis, located between 18°07'30" and 18°15'00" latitude, and 66°22'30" and 66°37'30" longitude. The region straddles Puerto Rico's central mountain range and includes the Toro Negro Commonwealth Forest, which has three major divisions, El Guineo, Doña Juana, and Matrullas (fig. 1).

The Toro Negro region includes three forest life zones: subtropical moist, subtropical wet, and lower montane wet (Ewel and Whitmore 1973; Holdridge 1967). Average annual rainfall ranges from about 1600 to 2900 millimeters (Commonwealth of Puerto Rico 1979). Elevation ranges from 140 meters near the town of Villalba to 1338 meters at Cerro de Punta, the highest point on the island. Average annual temperature ranges from about 20 to 24 degrees centigrade. Rainfall usually declines between November and April, but there is seldom a prolonged dry period. Occasional hurricanes or intense rainstorms strongly influence the character of the vegetation by causing landslides or toppling trees.

The central mountains run from east to west and form the island's principal hydrologic divide. The area of the Toro Negro Forest consists of a complex of mountain ranges of volcanic origin that were eroded during the Cretaceous period to an advanced stage of topographic development. Uplift and subsequent erosion have cut the entire area into a complex series of valleys and intervening narrow ridges. Steep slopes, rugged terrain, and numerous streams and gorges characterize the topography. Most of the soils are deep or shallow clays, with an area of granitic intrusion producing sandy clays in the northwestern part of the study area. Soil depth varies greatly over short distances depending on weathering and erosion. The most common soil orders are Inceptisols and Ultisols.

The Toro Negro Forest is located on the island di-

vide and presently protects the headwaters of four rivers that flow to the south coast and three that flow to the north coast. Water for power and irrigation is stored in the Guineo and Matrullas reservoirs. Both reservoirs and the entire Toro Negro forest are especially critical for soil and water conservation.

The Toro Negro Forest was designated in 1935 as a purchase unit of the Caribbean National Forest. Most of the region, including the accessible parts of the Toro Negro Forest, was cultivated or pastured at that time. Coffee production under tree shade was common, although marginal areas in the higher elevations had already been abandoned to other crops. Most of the accessible timber in the region has been cut. At the time of purchase, there were about 15 families living within the Toro Negro Forest, farming degraded lands (Wadsworth and Solis 1949).

Changes occurred in the Toro Negro Forest under National Forest management. Mature timber and charcoal wood were harvested regularly, and the better sites were planted with *Eucalyptus robusta* (eucalyptus), *Swietenia macrophylla* (mahogany), and *Montezuma speciosissima* (maga). Roads were constructed to open up the more remote areas, a public recreation area was developed, and some farming was allowed to continue. Additional settlement within the public forest was encouraged under the Civilian Conservation Corps relief program, and later under local employment programs. These programs were intended to provide forestry employment and accomplish reforestation goals (Wadsworth and Solis 1949). After 1955 a new series of plantings with additional species such as *Pinus caribaea* Morlet (pine), *Hibiscus elatus* Sw. (mahoe) and *Anthocephalus chinensis* (Lam.) A. Rich ex Walp. (kadam) were initiated (Watson 1982).

In April, 1970, the Puerto Rican Department of Agriculture purchased 1,677 acres of forest land adjacent to the Luquillo Division of the Caribbean National Forest, and exchanged this with the U.S. Forest Service for complete transfer of the Toro Negro Division to the Commonwealth of Puerto Rico. The Department of Natural Resources was legally created in 1972, and by 1973 the Puerto Rican Department of Agriculture transferred the property titles of the Toro Negro forest to the Department of Natural Resources. The Commonwealth continues to protect the forest from encroachment, and regulates disturbances that may affect watershed protection.

Current nonforest land uses in the region surrounding the Toro Negro Forest include unimproved pasture, coffee production (under shade and shadeless), and production of crops such as plantains, taniers, yams, bananas, oranges, mango, avocado, or other garden crops planted in various mixtures. Small farms are interspersed with coffee plantations and forests in various successional stages, giving the re-

gion a characteristic patchwork appearance. The public forest contains successional types and plantations, as well as some extensive, relatively undisturbed high elevation forests, especially in the El Guineo division. These natural forests include the dwarf and palm types, and the colorado and tabonuco types which are described elsewhere (Little and Wadsworth 1964).

METHODS

The data on forest acreage, timber volume, and species composition were obtained by a sampling method involving both a land cover classification on aerial photographs and on-the-ground measurements. A dot count method was used to obtain an initial estimate of area by land cover class. This estimate was adjusted on the basis of a ground check of actual land cover at each of the sample locations.

Ground sample locations were selected on U.S. Geological Survey topographic maps and transferred to the aerial photographs. The center of each forest location was determined on the ground by running a computed azimuth and distance from a selected starting point. Each plot at a sample location was marked so that future surveys can reestablish the plot and estimate growth, mortality, removals, and changes in land use.

The field survey was designed with several levels of detail. The region bounded by the 2 USGS quadrangles was sampled to provide some data about private forest lands. Field sample locations were selected at the intersections of the same grid of lines used in the 1980 survey. Sample locations measured in 1980 were not remeasured in 1983. Grid spacing was 3 kilometers and each sample location represented about 900 hectares.

The sample was intensified in the public forests to provide enough detail to formulate broad management guidelines, to characterize the major forest classes, and to select enough sample trees to estimate timber volume with a standard error of approximately 10 percent. The minimum number of plot locations required was estimated by reviewing statistics from similar plot locations measured in 1980. Actual sampling errors for each division and for public and private forests are discussed in the appendix.

Two sampling intensities were used in the public forest. The lower intensity survey was used for El Guineo division, which is composed principally of high elevation, noncommercial forests that are somewhat less diverse than forests at lower elevation. Each field sample location in El Guineo represented approximately 56 hectares, and detailed measurements were taken on half of these plots. All locations were visited to check current cover condition.

The Doña Juana and Matrullas divisions were sam-

pled at twice the intensity of the El Guineo division because most of the forest area is managed for timber production. Each field sample location was selected to represent approximately 28 hectares. This intensity allowed the crude delineation of stand boundaries, and preparation of a preliminary stand map to guide future management compartment selection.

A total of 41 field sample locations were visited on private land, 18 of which were forested. Five of the forested locations had been measured in 1980. On public land, 64 sample locations were visited, 62 were forested, and 40 were measured. Due to steep and rugged terrain, four sample locations were inaccessible for detailed tree measurement.

A cluster of 3 permanent sample plots was established at each sample location. Sample plots were located 25 meters apart. At each sample plot, trees larger than 12.5 centimeters in diameter at breast height (d.b.h.) were tallied on a variable-radius plot, with each tree representing 2.5 square meters of basal area per hectare. Trees less than 12.5 centimeters d.b.h. were tallied on a fixed radius plot of approximately 40 square meters around the plot center.

Each sample location was classified by numerous site characteristics. Each sample tree 12.5 centimeters and larger was measured and assessed to determine timber volume and quality. Species was accurately determined for all sample trees. Detailed field measurements were assembled into a handbook (Birdsey 1982). All definitions and inventory standards are listed in the appendix, along with a species list and some useful conversion factors.

In this study, all field data were recorded on tally sheets, transferred to the computer, and edited for errors prior to compilation. Errors were kept to a minimum by careful training, diligent field work, and a detailed edit procedure that checks all items for consistency and reasonableness.

All field work was done during 1983. Photointerpretation for area estimation was done prior to field work, using 1:20,000 scale panchromatic photography acquired during 1977.

TORO NEGRO FORESTS

Forest Classification

Public timberland is composed of plantations and "other timberland", a catch-all category including a variety of forest classes on productive sites, none extensive enough to be treated independently in this study. Other timberland includes abandoned coffee shade, reverting pasture and cropland, older secondary forests, partially successful plantations, and other disturbed timberland that could not be classified as plantation.

All of the plantations sampled are forests in which Eucalyptus comprised at least 25 percent of current basal area. Although other plantation species are found, they are restricted to very small parcels, or had poor survival rates.

Timberland classes tend to occur on moderate sites that are reasonably accessible (table 1). Noncommercial forest classes are located in relatively inaccessible, high elevation regions where climatic extremes preclude agricultural development and produce forests with undesirable timber characteristics. The noncommercial forest classes include the upper mountain or colorado type, the palm forest, and the dwarf forest occupying the highest exposed ridges and mountaintops.

Only a small proportion of private forests in the Toro Negro region was classed as noncommercial. Private timberland forests included 3 principal classes: secondary forests or volunteer stands, abandoned coffee shade, and active coffee shade. The principal physiographic difference among these classes is that coffee production under shade trees is currently restricted to the better, low elevation sites (table 2).

The forest classes have significant structural differences. Public timberland has higher stocking and volume than private timberland, especially the plantations with more than 3 times the average timber volume (tables 3 and 4). A comparison of public "other timberland" with all private classes shows the current poorly-stocked nature of most private forests. Among the noncommercial forest classes, palm forest shows a high mean diameter which reflects the high number of stems in the 20 cm. diameter class (table 5).

Forest Area

The Toro Negro region is 61 percent forested, compared with about 31 percent forest cover for the whole island (Birdsey and Weaver 1982). Timberland totals 20,000 hectares, mostly in private ownership (table 6). The relatively few hectares of other forest land are extremely important because this cover protects some critical watersheds in the upper mountain regions. Sixty-five percent of other forest land is protected under public ownership. Toro Negro water supplies cities and towns throughout central Puerto Rico, provides hydroelectric power, and is used for irrigation in the dry, southern region.

Most of the manageable public timberland is found in the Doña Juana and Matrullas forest divisions (table 7). Most of the noncommercial forest classes are located in the El Guineo division, with the exception of about 150 hectares of palm forest scattered elsewhere. Timberland in El Guineo consists of scattered plantation remnants, abandoned coffee shade, and other isolated tracts on the fringes of the division. This area was not intensively sampled and is excluded from subsequent discussion.

All of the public timberland is located within the subtropical wet forest life zone (table 8). The more extreme climate of the lower montane wet forest life zone precludes development of commercial timber stands. Instead, this life zone is characterized by the dwarf and palm forest classes, with pockets of upper mountain forest developing on protected ridges and upper slopes. The palm type is the only noncommercial forest class found in the subtropical wet forest life zone.

A small portion of the private timberland extends into a third life zone, the subtropical moist forest, in the lowest and driest portions of the region (table 9). Secondary forests are most common and account for 59 percent of the private timberland.

Most of the noncommercial forest area has been spared human disturbance for the past 35 years, and probably much longer (table 10). In contrast, more than half of the timberland in Doña Juana and Matrullas was still in coffee shade, pasture, or early succession brush in 1950. These past uses can still be identified from residual species characteristic of the small farms common at that time.

The Doña Juana division contains some small, relatively undisturbed tracts of mature timber. A small area of Tabonuco forest in the northwest corner is one of the few remnants of this type under public ownership in the Central Cordillera. The tract borders a much larger one in private ownership.

Species Composition

Current species composition in each forest class is strongly influenced by past land use practices, and by site conditions which are quite variable in the Toro Negro region. *Eucalyptus* plantations have the least complex overstory, with *Eucalyptus robusta* accounting for 63 percent of the total basal area and dominating the sawtimber size class (table 11). The next most common species, *Micropholis chrysophylloides* (caimitillo), totals only 4 percent of the basal area but is relatively common in the poletimber class. A few species are common in the understory: *Eugenia jumbos* (pomarrosa) has edible fruits but little timber value; *Nephelea portoricensis* (helecho gigante espinosa) is the common tree fern of the area; and *Tabebuia heterophylla* (roble blanco) and *Alchornea latifolia* (achitillo) are the most common timber species.

Other public timberland has a much more complex composition which reflects the various cover types and sites which compose this class (table 12). *Prestoea montana* (palma de sierra) and *Cecropia peltata* (yagrumo hembra) are the most common species. The most common saplings are the same as plantation forests, with the addition of *Casearia arborea* (rabo

ratón). Some of the more common species produce high quality cabinet timber.

Composition of the upper mountain forest is similar to the Colorado forest of the Luquillo Mountains, except that *Cyrilla racemiflora* (palo colorado) does not dominate the overstory (table 13). *Prestoea* and *Micropholis* together account for 43 percent of the basal area. Tree ferns and *Matayba domingensis* (negralora) are also common in the understory.

The palm forest is one of the few vegetation associations in Puerto Rico dominated by a single species. *Prestoea* accounts for 60 percent of the basal area and 73 percent of the trees in the poletimber class (table 14). These percentages are remarkably similar to those reported for palm forest in the Luquillo Mountains (Brown et. al. 1983). Other abundant species such as the tree fern are those found throughout the Toro Negro uplands.

The dwarf forest includes species found in other classes, but of much smaller size and with different rates of occurrence. The composition is also quite different from the dwarf forest in the Luquillo Mountains. Three tree fern species (*Cyathea arborea*, *C. aquilina*, and *Nephelea portoricensis*) together account for 34 percent of the basal area (table 15). *Prestoea* is again common, along with two species less common in other classes, *Clusia grisebachiana* and *Calycogonium squamulosum*. Occasional sawtimber-size trees appear in protected pockets.

Private timberland species composition is most similar to that found elsewhere on the island, except for a higher abundance of *Prestoea* (table 16; Birdsey and Weaver 1982). Most of the species are typical of secondary or coffee shade forests. The most common sapling is *Coffea arabica* (coffee), with many individuals persisting for years after plantation abandonment, and others established as volunteers in secondary forests. Despite the prevalence of *Prestoea* in the Toro Negro region, it is never found on active or abandoned coffee shade sample plots. Thus the absence of palm and the presence of residual coffee saplings is a good indicator that coffee was once cultivated.

Seedling occurrence may foretell future forest composition, although major disturbances may radically alter the site conditions, introduce new seeds, or prompt others to germinate. With this uncertainty in mind, it may be useful to note that *Prestoea* is the most common seedling in plantations while being relatively scarce among larger tree size classes (table 17). A variety of sapling species is found in other public timberland. The small understory species *Daphnopsis philippiana* is most common in the upper mountain forest, and found along with the *Prestoea* in the palm forest. Another understory species, *Myrcia deflexa*, is prevalent among seedlings in the dwarf forest.

Timber Volume

Eucalyptus robusta dominates public timberland, accounting for 82 percent of plantation growing-stock volume and 37 percent of all public growing-stock volume in Doña Juana and Matrullas (tables 18 and 19). Most of the volume is in large sawlogs in trees greater than 30 centimeters d.b.h. Although *Eucalyptus* can be used as utility lumber, its tendency to warp unevenly limits usefulness. Altogether more than 19,000 cubic meters of *Eucalyptus* growing stock are available for harvest.

About 16,000 cubic meters of valuable hardwood growing stock are also available from seven common species in Doña Juana and Matrullas (fig. 2). A high proportion of this is in poletimber, although the percentage varies for each species (tables 18 and 19). There are many additional species which contain cabinet-quality or utility timber, but none are particularly common throughout the area.

The most valuable growing stock found on private timberland includes *Guarea guidonia* (guaraguao) and *Inga fagifolia* (guama), both common in public timberland, and *Andira inermis* (moca), *Montezuma speciosissima* (maga), and *Cordia alliodora* (capa prieto; table 20). Much of this is available in large sizes, with the exception of *Andira*. Although the volumes are much larger on private land, the large trees are more scattered and availability is more questionable. The average timber volume in public plantations is 184.5 cubic meters per hectare, more than 3 times the average of 58.4 cubic meters on private timberland. Other public timberland averages 124.6 cubic meters per hectare.

A comparison of diameter distributions for the 3 timberland classes illustrates the differences among stand structure (fig. 3). The *Eucalyptus* plantations are reaching maturity, the other public timberland is composed of mixed ages, and the private timberland

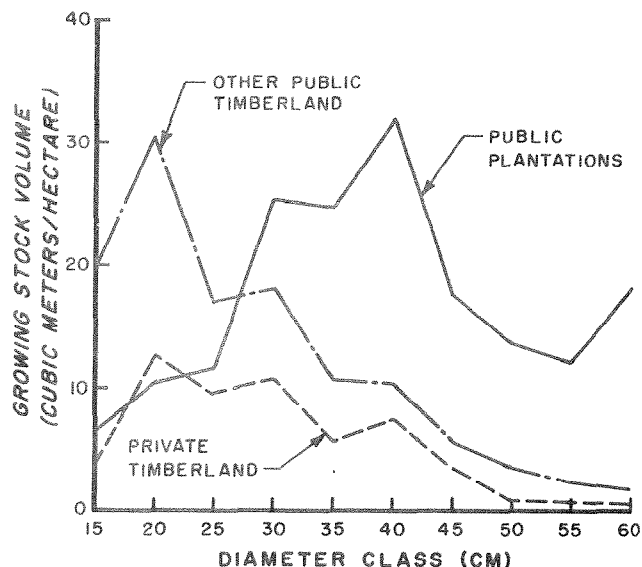


Figure 3.—Growing-stock volume by diameter class, Toro Negro timberland.

tends toward the younger age classes. The plantations appear somewhat erratic due to an irregular planting history.

The potential uses of standing timber strongly affect marketability, and will ultimately determine the feasibility of developing a timber industry in the region. Other public timberland contains the highest concentration of quality sawtimber species with an average of 41 cubic meters per hectare (table 21). Most of the unusable timber in this forest class is *Prestoea montana* and *Eugenia jambos*.

Another important factor affecting the economics of timber utilization is tree quality. *Eucalyptus* plantations are clearly desirable from this standpoint since most of the volume is in large sawlogs. The favorable species mix found on private timberland is somewhat tempered by the high percentage of timber in rough

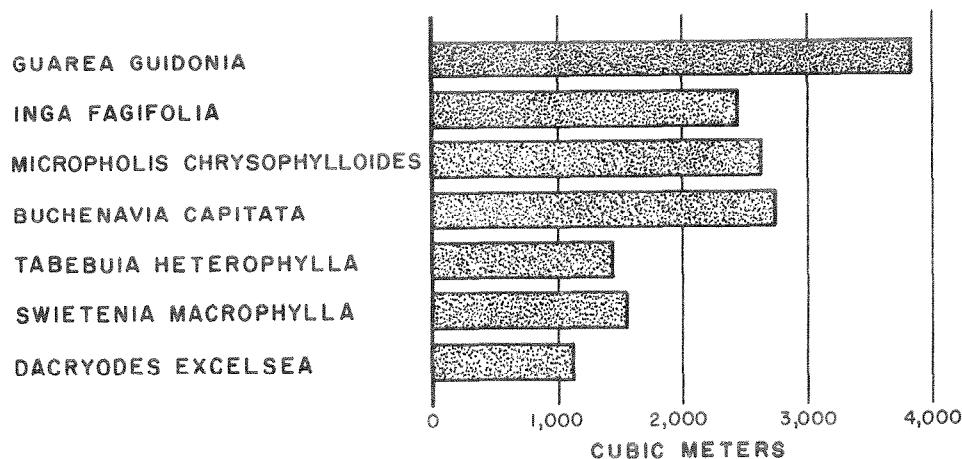


Figure 2.—Growing-stock volume of some common valuable timber species in Doña Juana and Matrullas.

and rotten trees (table 22). This wood is often uneconomical to recover. Poletimber trees on other public timberland contain a particularly high percentage of sound cull volume.

Yet another factor that must be considered is accessibility. Site characteristics indicate a range of slope classes from 20 to 90 percent, and a range of hauling distances from 0 to 800 meters for timberland. Many tracts would require access roads, special logging equipment for steep slopes, and great care to avoid site degradation.

In sum, the most immediate utilization problem for public timberland is to find a suitable market for the mature *Eucalyptus*. Harvesting the large stems would primarily be limited by equipment availability and access. Much of the sawtimber of other species is scattered. Extensive harvesting on private timberland should be deferred until promising young stands mature. In all cases, timber harvesting should be done within the context of a management plan which ensures a future timber stand and preserves the many valuable non-timber attributes of the Toro Negro forest.

MANAGEMENT OPPORTUNITIES

Forest inventory data can provide guidelines for developing a timber management strategy for Toro Negro timberlands. These broad guidelines should not be directly applied to a particular stand of timber without a detailed stand examination to determine if the actual composition is similar to this characterization of the whole forest.

The first step to develop a timber management plan is to tally the number of trees by size class, and attach a use code to the more common species. Then the number of sapling and poletimber trees can be compared to a standard to decide if there is sufficient stocking of desirable species to establish a manageable timber stand. In the absence of stocking guides developed through experimentation, a local "rule-of-thumb" can be used. For Puerto Rico, a minimum stocking per hectare of 100 poletimber trees or 250 saplings of desirable species can be considered adequate for a manageable stand (Wadsworth and Birdsey 1982).

Toro Negro plantations are dominated by mature *Eucalyptus* which is ready for harvest. The timber could be replaced by artificial or natural regeneration. Currently, poletimber stocking of high quality sawtimber species averages 72 trees per hectare, chiefly *Micropholis* and *Guarea* (table 23). Utility species provide an additional 110 poletimber trees per hectare. Total utilizable sapling stocking averages about 190 trees per hectare. Saplings and poletimber together clearly exceed minimum stocking, however, harvesting large eucalyptus logs would probably

cause excessive damage to residual trees, making the after-harvest stocking closer to borderline conditions. Considering the actual understory variability from stand to stand, each case would have to be evaluated separately. Most likely a mixture of artificial and natural regeneration would be prescribed.

Additional consideration must be given to the ecological characteristics of the resultant species mix. Do *Eucalyptus* and *Micropholis* have compatible growth rates? There may also be opportunities to deaden undesirable competitors such as *Eugenia jambos*. Common understory species such as the tree ferns could be left since many do not affect timber volume growth significantly, and may have other important roles in the forest ecosystem.

Other public timberland lacks the dominance of a single, harvestable species, making selective harvests of a few valuable stems much more likely. This could be coupled with timber stand improvement treatments that would favor the currently adequate stocking of desirable immature trees of *Guarea*, *Inga fagiifolia*, *Micropholis*, and *Tabebuia* (table 24). High quality growing stock averages 249 saplings and 105 poletimber trees per hectare, with utility timber species adding another 225 saplings and 116 poletimber trees. Common desirable species comprise 20 percent of all saplings and 48 percent of all poletimber. Many of the less desirable species are small understory trees and would not compete with the desirable timber species. Conversion of other public timberland to plantation species would probably not be warranted due to the adequacy of current stocking.

Private timberland has adequate sapling stocking but lacks a good poletimber component (table 25). An additional problem concerns the high proportion of rough and rotten poletimber and sawtimber trees (table 26). Poor tree quality renders many of the sawtimber trees undesirable for harvest, and cull poletimber cannot be considered part of the manageable stand. These trees must be deadened along with undesirable saplings to release the good saplings and establish a timber stand.

Although there is more uncertainty when relying on saplings for a future stand, many private stands include sufficient stocking to warrant close inspection. *Guarea* is particularly common and could be featured as the principal species in many private forests.

Timber management in the Toro Negro region will always be subject to the constraints of management for other forest resources. The value of forest cover for watershed protection increases each year as island population grows. Every forest disturbance will affect the water supply, and so every management activity must be evaluated carefully. Both public and private owners control critical forest watersheds and, although the most critical areas are not suitable for timber production, they are surrounded by timber-

lands which must be carefully managed if brought into production.

The Toro Negro Forest includes recreation sites and hiking trails that make the unique forests accessible to all. The cool climate and scenic beauty attract many visitors each year. Forest management to enhance these qualities is essential, and produces returns that cannot be measured in dollars.

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APPENDIX

Reliability of the Data

Reliability of the estimates may be affected by two types of errors. The first stems from the use of a sample to estimate the whole and from variability of the items being sampled. This is termed "sampling error"; it is expressed in a mathematical evaluation of the probability of error. The second type—referred to as "reporting error" or "estimating error"—derives from mistakes in measurement, judgment, or recording, and from limitations of methods or equipment. This type of error is held to a minimum by proper staff training, supervision, and precision.

Statistical analysis of the data indicates a sampling error of plus or minus 3.5 percent for private forest area and 0.4 percent for public forest area. Timber volume sampling errors were estimated to be 26.5 percent for private forests and 9.8 percent for public forests. As these totals are broken down by species, tree size, or other classifications, the possibility for error increases and is greatest for the smallest subdivisions. The order of this increase is suggested in the following tabulation, which includes sampling error estimates for area and volume by land class and forest division:

Forest area and timber volume sampling errors¹ by owner, forest division, and land class, Toro Negro region, 1983

| Owner and forest division | Land class | | Total forest | Timber volume |
|------------------------------|----------------------------|-------------------|--------------|------------------|
| | Timberland | Other forest land | | |
| | ----- <i>percent</i> ----- | | | |
| Public | | | | |
| El Guineo | 3.7 | 3.7 | 0.5 | --- |
| Doña Juana | 9.0 | 8.9 | 0.7 | 12.9 |
| Matrullas | 9.6 | 9.4 | 0.9 | 13.9 |
| Total | 4.2 | 4.2 | 0.4 | 9.8 |
| Private | | | | |
| Total | 3.5 | 0.5 | 3.5 | 26.5 |

¹Standard error.

DEFINITIONS

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 1/2 hectare, and the minimum width for forest strips is 35 meters. Unimproved roads and trails, streams, and clearings in forest areas are classed as forest if less than 35 meters in width.

Timberland—Forest land that is producing or is capable of producing crops of industrial wood and not withdrawn from timber utilization.

Nonstocked land—Commercial forest land less than 10 percent stocked with growing-stock trees. This includes areas covered by inhibiting vegetation (brush, vines, ferns, etc.) classed as forest land.

Secondary forest land—Forest land resulting from the abandonment of cropland or pasture, and forest resulting from the regeneration of previously cutover or disturbed forest land. Abandoned coffee shade is excluded from this class.

Coffee shade—A multi-story, multi-crop system used principally for the production of coffee. An upper story of shade trees is characteristic.

Abandoned coffee shade—Secondary forest land resulting from the abandonment of coffee production under shade trees.

Growing-stock trees—Sawtimber trees, poletimber trees, saplings, and seedlings; that is, all live trees except rough and rotten trees.

Rough and rotten trees—Live trees that are unmerchantable for sawlogs now or prospectively because of defect or rot.

Sawtimber trees—Growing-stock trees, 22.5 centimeters and larger in d.b.h. for softwoods and 27.5 centimeters and larger for hardwoods, and containing at least one 3.5 meter sawlog.

Poletimber trees—Growing-stock trees 12.5 to 22.5 centimeters in d.b.h. for softwoods and 12.5 to 27.5 centimeters for hardwoods, and of good form and vigor.

Saplings—Growing-stock trees 2.5 to 12.5 centimeters in d.b.h., and of good form and vigor.

Volume of sawtimber—Net volume of the sawlog portion of sawtimber trees in cubic meters, calculated according to the International rule, 0.635 centimeter (1/4 inch) kerf.

Volume of growing stock—Volume of sound wood (less cull volume) in the bole and branches of sawtimber and poletimber trees from stump to a minimum 10 centimeter diameter outside bark or to the point past which a one-meter section meeting minimum qualifications can no longer be measured because of limbs or other cull.

Volume of timber—Volume of all sound wood (including sound cull) in the bole and branches of growing stock, rough, rotten, and salvageable dead trees 12.5 centimeters and larger in d.b.h., from stump to a minimum 10-centimeter diameter outside bark. The minimum length of any section included is one meter.

Basal area—The area in square meters of the cross section at breast height of a single tree or of all the trees in a stand, expressed as square meters per hectare.

D.b.h. (diameter at breast height)—Tree diameter in centimeters, outside bark, measured at 1.3 meters above ground.

SPECIES LIST

Tree species tallied in the Toro Negro survey, 1983¹

| Code number | Scientific name | Common name |
|-------------|--|-----------------|
| 1 | <i>Cyathea arborea</i> (L.) J.E. Smith | Helecho gigante |
| 7 | <i>Prestoea montana</i> (R. Grah.) Nichols. | Palma de sierra |
| 12 | <i>Piper aduncum</i> L. | Higuillo |
| 16 | <i>Trema micrantha</i> (L.) Blume | Guacimilla |
| 20 | <i>Cecropia peltata</i> L. | Yagrumo hembra |
| 22 | <i>Ficus citrifolia</i> Mill. | Jaguey blanco |
| 24 | <i>Ficus perforata</i> L. | Jaguey colorado |
| 27 | <i>Coccoloba swartzii</i> Meisn. | Ortegon |
| 32 | <i>Pisonia subcordata</i> Sw. | Corcho blanco |
| 33 | <i>Guapira fragrans</i> (Dum.-Cours.) Little | Corcho |
| 34 | <i>Magnolia portoricensis</i> Bello | Jaguilla |

Tree species tallied in the Toro Negro survey, 1983¹—(Continued)

| Code number | Scientific name | Common name |
|-------------|---|------------------|
| 37 | <i>Annona muricata</i> L. | Guanabana |
| 48 | <i>Ocotea leucoxylon</i> (Sw.) Mez | Laurel geo |
| 51 | <i>Persea americana</i> Mill. | Aguacate |
| 55 | <i>Brunellia comocladifolia</i> Humb. & Bonpl. | Palo bobo |
| 56 | <i>Weinmannia pinnata</i> L. | Oreganillo |
| 62 | <i>Inga fagifolia</i> (L.) Willd. | Guama |
| 63 | <i>Inga quaternata</i> Poepp. & Endl. | Guama venezolano |
| 64 | <i>Inga vera</i> Willd. | Guaba |
| 81 | <i>Andira inermis</i> (W. Wright) DC. | Moca |
| 84 | <i>Erythrina poeppigiana</i> (Walp.) O.F. Cook | Bucayo gigante |
| 86 | <i>Lonchocarpus pentaphyllus</i> (Poir.) DC. | Retama |
| 87 | <i>Ormosia krugii</i> Urban | Palo de matos |
| 100 | <i>Citrus sinensis</i> Osbeck | China |
| 102 | <i>Zanthoxylum martinicense</i> (Lam.) | Espino rubial |
| 106 | <i>Dacryodes excelsea</i> Vahl | Tabonuco |
| 107 | <i>Tetragastris balsamifera</i> (Sw.) Oken. | Masa |
| 108 | <i>Cedrela odorata</i> L. | Cedro hembra |
| 109 | <i>Guarea guidonia</i> (L.) Sleumer | Guaragua |
| 111 | <i>Swietenia macrophylla</i> King | Caoba hondurena |
| 114 | <i>Trichilia pallida</i> Sw. | Gaeta |
| 115 | <i>Byrsonima coriacea</i> (Sw.) DC | Maricao |
| 116 | <i>Byrsonima crassifolia</i> (L.) H.B.K. | Maricao cimarron |
| 118 | <i>Alchornea latifolia</i> Sw. | Achiotillo |
| 119 | <i>Alchorneopsis portoricensis</i> Urban | Palo de gallina |
| 121 | <i>Drypetes glauca</i> Vahl | Varital |
| 129 | <i>Sapium laurocerasus</i> Desf. | Tabaiba |
| 131 | <i>Mangifera indica</i> L. | Mango |
| 133 | <i>Spondias dulcis</i> Parkinson | Jobo de la India |
| 136 | <i>Cyrilla racemiflora</i> L. | Palo colorado |
| 139 | <i>Matayba domingensis</i> (D.C.) Radlk. | Negra lora |
| 141 | <i>Sapindus saponaria</i> L. | Jaboncillo |
| 143 | <i>Thouinia striata</i> Radlk. | Ceboruquillo |
| 144 | <i>Meliosma herbertii</i> Rolfe | Aguacatillo |
| 149 | <i>Sloanea berteriana</i> Choisy | Motillo |
| 150 | <i>Hibiscus tiliaceus</i> L. | Emajagua |
| 151 | <i>Montezuma speciosissima</i> Sesse & Moc. | Maga |
| 156 | <i>Guazuma ulmifolia</i> Lam. | Guacima |
| 161 | <i>Calophyllum calaba</i> L. | Maria |
| 162 | <i>Clusia grisebachiana</i> (Planch. & Triana) Alain. | Cupeillo |
| 169 | <i>Casearia arborea</i> (L. C. Rich) Urban | Rabo raton |
| 170 | <i>Casearia decandra</i> Jacq. | Tostado |
| 171 | <i>Casearia guianensis</i> (Aubl.) Urban | Palo blanco |
| 172 | <i>Casearia sylvestris</i> Sw. | Cafeillo |
| 173 | <i>Homalium racemosum</i> Jacq. | Caracolillo |
| 177 | <i>Daphnopsis philippiana</i> Krug & Urban. | Majagua brava |
| 180 | <i>Buchenavia capitata</i> (Vahl) Eichl. | Granadillo |
| 185 | <i>Calyptanthus krugii</i> Kiaersk | Limoncillo |
| 186 | <i>Eucalyptus robusta</i> J. E. Smith | Eucalypto |
| 187 | <i>Eugenia domingensis</i> Berg. | Guasabara |
| 188 | <i>Eugenia jambos</i> L. | Pomarrosa |
| 190 | <i>Eugenia rhombea</i> (Berg) Krug & Urban | Hoja menuda |
| 191 | <i>Eugenia stahlia</i> (Kiaersk.) Krug & Urban | Guayabota |
| 192 | <i>Myrcia deflexa</i> (Poir.) DC | Cieneguillo |

Tree species tallied in the Toro Negro survey, 1983¹—(Continued)

| Code number | Scientific name | Common name |
|-------------|--|------------------------------|
| 193 | <i>Myrcia splendens</i> (Sw.) DC | Hoja menuda |
| 196 | <i>Calycogonium squamulosum</i> Cogn. | Jusillo |
| 197 | <i>Heterotrichum cymosum</i> (Wendl.) Urban | Camasey peludo |
| 198 | <i>Miconia prasina</i> (Sw.) DC | Camasey |
| 200 | <i>Dendropanax arboreus</i> (L.) Decne. & Planch. | Pollo |
| 201 | <i>Didymopanax morototoni</i> (Aubl.) Decne. & Planch. | Yagrumo macho |
| 203 | <i>Rapanea coriacea</i> (Sw.) Mez. | Mantequero |
| 204 | <i>Rapanea guianensis</i> Aubl. | Badula |
| 205 | <i>Chrysophyllum argenteum</i> Jacq. | Lechecillo |
| 211 | <i>Micropholis chrysophylloides</i> Pierre | Caimitillo |
| 213 | <i>Pouteria multiflora</i> (A. DC.) Eyma | Jacana |
| 215 | <i>Symplocos martinicensis</i> Jacq. | Aceituna blanca |
| 221 | <i>Cordia alliodora</i> (Ruiz & Pav.) Oken | Capa prieto |
| 224 | <i>Cordia sulcata</i> DC. | Moral |
| 230 | <i>Vitex divaricata</i> Sw. | Higuerillo |
| 231 | <i>Solanum rugosum</i> Dunal | Tabacon |
| 236 | <i>Tabebuia heterophylla</i> (DC.) Britton | Roble blanco |
| 240 | <i>Coffea arabica</i> L. | Cafe |
| 242 | <i>Faramia occidentalis</i> (L.) A Rich. | Cafeillo |
| 244 | <i>Guettarda scabra</i> (L.) Vent. | Palo de cucubano |
| 245 | <i>Ixora ferrea</i> (Jacq.) Benth. | Cafeillo |
| 248 | <i>Rondeletia portoricensis</i> Krug. & Urban. | Juan Tomas |
| 251 | <i>Cyathea aquilina</i> (Christ) Domin | Helecho gigante |
| 252 | <i>Cyathea tenera</i> (J. E. Sm.) Moore | Helecho gigante |
| 255 | <i>Nephelea portoricensis</i> (Spreng.) Tryon | Helecho gigante espinosa |
| 256 | <i>Alsophila bryophila</i> Tryon | Helecho gigante de la sierra |
| 279 | <i>Piper amalago</i> L. | Higuillo de limon |
| 280 | <i>Piper blattarum</i> Spreng. | Higuillo |
| 298 | <i>Trophis racemosa</i> (L.) Urban | Ramon |
| 313 | <i>Coccoloba sintenisii</i> Urban | Uvero de monte |
| 330 | <i>Nectandra antillana</i> Meisn. | Aguacatillo |
| 332 | <i>Nectandra membranacea</i> (Sw.) Griseb. | Laurel prieto |
| 333 | <i>Nectandra patens</i> (Sw.) Griseb. | Laurel geo colorado |
| 341 | <i>Phoebe montana</i> (Sw.) Griseb. | Avispillo |
| 364 | <i>Inga fastuosa</i> (Jacq.) Willd. | Guaba venezolana |
| 413 | <i>Guarea rameiflora</i> Vent. | Guaraguadillo |
| 485 | <i>Meliosma obtusifolia</i> (Bello) Krug & Urban | Arroyo |
| 489 | <i>Rhamnus sphaerosperma</i> Sw. | West Indian buckthorn |
| 518 | <i>Clusia minor</i> L. | Cupez de monte |
| 523 | <i>Banana portoricensis</i> Krug & Urban | Palo de ramon |
| 540 | <i>Daphnopsis americana</i> (Mill.) J. R. Johnst. | Majagua de sierra |
| 548 | <i>Cassipourea guianensis</i> Aubl. | Palo de gongoli |
| 549 | <i>Myrcia citrifolia</i> (Aubl.) Urban | Limoncillo del monte |
| 550 | <i>Myrcia leptoclada</i> DC. | Guayabacon |
| 554 | <i>Calyptranthes pallens</i> Griseb. | Tapon blanco |
| 560 | <i>Eucalyptus resinifera</i> J.E. Smith | Eucalipto |
| 568 | <i>Eugenia eggersii</i> Kiaersk. | Guasabara |
| 578 | <i>Eugenia sintenisii</i> Kiaersk. | Murta |
| 579 | <i>Eugenia stewardsonii</i> Britton | |
| 585 | <i>Myrcia fallax</i> (A. Rich.) DC. | Hoja menuda |
| 586 | <i>Myrcia paganii</i> Krug & Urban | |
| 592 | <i>Clidemia umbrosa</i> (Sw.) Cogn. | |
| 598 | <i>Mecranium amygdalinum</i> (Desr.) C. Wright | Camasey almendro |

Tree species tallied in the Toro Negro survey, 1983¹—(Continued)

| Code number | Scientific name | Common name |
|-------------|---|-----------------------|
| 600 | <i>Miconia foveolata</i> Cogn. | Camasey |
| 601 | <i>Miconia impetiolearis</i> (Sw.) D. Don | Camasey de costilla |
| 602 | <i>Miconia laevigata</i> (L.) DC. | Camasey de paloma |
| 603 | <i>Miconia mirabilis</i> (Aubl.) L.O. Wms. | Camasey cuatrocanales |
| 605 | <i>Miconia pachyphylla</i> Cogn. | Camasey racimoso |
| 608 | <i>Miconia racemosa</i> (Aubl.) DC. | Camasey felpa |
| 610 | <i>Miconia serrulata</i> (DC.) Naud. | Camasey |
| 611 | <i>Miconia sintenisii</i> Cogn. | Camasey |
| 612 | <i>Miconia subcorymbosa</i> Britton | Camasey |
| 617 | <i>Ossaea krugiana</i> Cogn. | |
| 619 | <i>Tetrazygia biflora</i> (Cogn.) Urban | Camasey |
| 620 | <i>Tetrazygia stahlii</i> Cogn. | Camasey |
| 621 | <i>Tetrazygia urbanii</i> Cogn. | Camasey |
| 624 | <i>Dendropanax laurifolius</i> (E. March.) R. C. Schneid. | Gongoli |
| 625 | <i>Didymopanax gleasonii</i> Britton & Wils | Yuquilla |
| 635 | <i>Wallenia pendula</i> (Urban) Mez | Jacanillo |
| 657 | <i>Haenianthus salicifolius</i> Griseb. | Palo de hueso |
| 687 | <i>Brunfelsia americana</i> L. | Aguacero |
| 692 | <i>Cestrum macrophyllum</i> Vent. | Galan del monte |
| 709 | <i>Tabebuia schumanniana</i> Urban | Roble colorado |
| 727 | <i>Guettarda ovalifolia</i> Urban | Cucubano |
| 738 | <i>Palicourea riparia</i> Benth. | Cachimbo |
| 741 | <i>Psychotria berteriana</i> DC. | Cachimbo comun |

¹Species and codes as listed in Little and Wadsworth (1964) and Little et. al. (1974).

Unit Conversion Factors

Metric to English and English to Metric Conversions

| | |
|--------------------------------|---------------------------------|
| 1 cm. = 0.3937 in. | 1 in. = 2.54 cm. |
| 1 m. = 3.281 ft. | 1 ft. = .3048 in. |
| 1 km. = .6214 mi. | 1 mi. = 1.6093 km. |
| 1 sq.m. = 10.7639 sq.ft. | 1 sq.ft. = 0.0929 sq.m. |
| 1 sq.km. = 0.3861 sq.mi. | 1 sq.mi. = 2.59 sq.km. |
| 1 ha. = 2.471 ac. | 1 ac. = 0.4047 ha. |
| 1 cu.m. = 35.3145 cu.ft. | 1 cu.ft. = 0.0283 cu.m. |
| 1 sq.m./ha. = 4.356 sq.ft./ac. | 1 sq.ft./ac. = 0.2296 sq.m./ha. |
| 1 cu.m./ha. = 14.29 cu.ft./ac. | 1 cu.ft./ac. = 0.07 cu.m./ha. |

Metric Inventory Standards

| Item | Metric standard |
|--------------------------|---|
| Prism size | BAF 2.5 |
| Grid spacing | 3 km. |
| Cluster point spacing | 25 m. |
| Fixed plot size | 40 m. ² (r = 3.6 m.) 15 m. ² (r = 2.2 m.) |
| Breast height | 1.3 m. |
| Stump height | 30 cm. |
| Diameter classes | 5 cm. = 2.5 to 7.5 cm. d.b.h. 10 cm. = 7.5 to 12.5 cm. d.b.h. 15 cm. = 12.5 to 17.5 cm. d.b.h. 20 cm. = 17.5 to 22.5 cm. d.b.h. etc. |
| Tree size classes | |
| Sapling | 2.5 to 12.5 cm. d.b.h. |
| Poletimber (hardwood) | 12.5 to 27.5 cm. d.b.h. |
| Sawtimber (hardwood) | 27.5 cm. + d.b.h. |
| Sawtimber (softwood) | 22.5 cm. + d.b.h. |
| Minimum top D.O.B | |
| Cubic volume | 10 cm. |
| Hardwood sawlog | 22.5 cm. |
| Softwood sawlog | 17.5 cm. |
| Sapling | 2.5 cm. |
| Minimum D.I.B. | |
| sawlog | |
| Hardwood | 20 cm. |
| Softwood | 15 cm. |
| Minimum length | |
| Cubic section | 1 m. |
| Sawlog | 2.5 m. |
| Sawtimber tree | 3.5 m. sawlog |

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Table 1.-*Physiographic characteristics by forest class, Toro Negro public forest, 1983*

| Characteristic (units) | Statistic | Forest class | | | | | All classes |
|-------------------------------------|-----------|--------------|------------------|----------------|------------|-----------|-------------|
| | | Plantations | Other timberland | Upper mountain | Palm | Dwarf | |
| Elevation (meters) | Mean: | 830 | 820 | 1010 | 980 | 1150 | 920 |
| | Range: | 730-890 | 710-950 | 900-1200 | 780-1200 | 1050-1250 | 710-1250 |
| Rainfall ¹ (millimeters) | Mean: | 2500 | 2450 | 2560 | 2570 | 2670 | 2520 |
| | Range: | 2400-2600 | 2300-2600 | 2400-2800 | 2300-2900 | 2300-2800 | 2300-2900 |
| Slope ² (percent) | Mean: | 40 | 50 | 70 | 55 | 70 | 55 |
| | Range: | 20-50 | 20-70 | 60-80 | 30-70 | 70-80 | 20-80 |
| Distance to road (meters) | Mean: | 320 | 280 | 770 | 720 | 670 | 520 |
| | Range: | 100-600 | 0-800 | 200-1600 | 0-1800 | 100-1100 | 0-1800 |
| Distance to water (meters) | Mean: | 290 | 300 | 380 | 310 | 330 | 320 |
| | Range: | 40-460 | 20-740 | 80-830 | 10-760 | 120-680 | 10-830 |

¹Mean annual precipitation from isohyet map (Commonwealth of Puerto Rico 1979).²Average slope at each plot location.Table 2.-*Physiographic characteristics of private timberland by forest class, Toro Negro region, 1983*

| Characteristic (units) | Statistic | Forest class | | | All classes |
|-------------------------------------|-----------|------------------|------------------------|---------------------|-------------|
| | | Secondary forest | Abandoned coffee shade | Active coffee shade | |
| Elevation (meters) | Mean: | 750 | 790 | 470 | 710 |
| | Range: | 380-960 | 630-1000 | 350-490 | 350-1000 |
| Rainfall ¹ (millimeters) | Mean: | 2220 | 2180 | 2230 | 2210 |
| | Range: | 1800-2700 | 1600-2400 | 2100-2300 | 1600-2700 |
| Slope ² (percent) | Mean: | 50 | 55 | 60 | 50 |
| | Range: | 20-90 | 20-80 | 20-80 | 20-90 |

¹Mean annual precipitation from isohyet map (Commonwealth of Puerto Rico 1979).²Average slope at each plot location.Table 3.-*Forest characteristics by forest class, Toro Negro public forest, 1983*

| Characteristic (units) | Statistic | Forest class | | | | | All classes |
|---|-----------|--------------|------------------|----------------|-------------|------------|------------------|
| | | Plantations | Other timberland | Upper mountain | Palm | Dwarf | |
| Basal area ¹ (m ² /ha) | Mean: | 29.5 | 26.1 | 31.8 | 34.5 | 20.6 | 29.3 |
| | Range: | 24.1-36.6 | 14.0-35.9 | 26.2-42.9 | 23.9-42.4 | 12.1-31.0 | 12.1-42.9 |
| Number of trees ¹ (stems/ha) | Mean: | 2039 | 2907 | 2926 | 2206 | 2869 | 2601 |
| | Range: | 1077-2878 | 1549-4775 | 2102-4406 | 1457-3506 | 2650-3136 | 1077-4775 |
| Mean diameter ² (centimeters) | Mean: | 14.2 | 10.8 | 12.1 | 14.1 | 9.4 | 12.3 |
| | Range: | 11.7-18.6 | 7.7-13.6 | 9.3-14.3 | 11.0-17.4 | 7.0-11.8 | 7.0-18.6 |
| Mean canopy height ³ (meters) | Mean: | 22.2 | 13.5 | 10.4 | 11.1 | 6.7 | 12.8 |
| | Range: | 15.7-26.8 | 8.5-18.4 | 8.0-13.5 | 8.6-14.7 | 5.6-7.9 | 5.6-26.8 |
| Total volume ⁴ (m ³ /ha) | Mean: | 321.4 | 174.9 | 176.2 | 200.1 | 73.9 | 192.3 |
| | Range: | 238.8-423.8 | 66.6-311.4 | 85.9-296.7 | 113.8-279.1 | 47.6-114.1 | 47.6-423.8 |
| Timber volume ⁵ (m ³ /ha) | Mean: | 184.5 | 124.6 | | | | 137.7 |
| | Range: | 160.0-213.2 | 50.2-245.9 | | | | 50.2-245.9 |

¹All trees 2.5 cm. d.b.h. and larger.²Quadratic mean at each plot location.³Based on dominant and codominant trees.⁴Total overbark volume of trees 12.5 cm. and larger using equation by Dawkins (1961).⁵All sound wood of trees 12.5 cm. and larger, from stump to a 10 cm. minimum diameter.

Table 4.-Forest characteristics of private timberland by **forest class**, Toro Negro region, 1983

| Characteristic (units) | Statistic | Forest class | | | All classes |
|--|-----------|------------------|------------------------|---------------------|----------------|
| | | Secondary forest | Abandoned coffee shade | Active coffee shade | |
| Basal area ¹ (m ² /ha) | Mean: | 13.5 | 17.6 | 7.8 | 13.5 |
| | Range: | 0.9–27.8 | 13.0–21.1 | 3.8–14.3 | 0.9–27.8 |
| Number of trees ² (stems/ha) | Mean: | 1672 | 2383 | 1840 | 1869 |
| | Range: | 16-5146 | 924-4596 | 697-2525 | 16-5146 |
| Mean diameter ³ (centimeters) | Mean: | 10.8 | 11.2 | 7.4 | 10.3 |
| | Range: | 4.8-17.4 | 6.0–15.9 | 5.4-8.5 | 4.8-17.4 |
| Mean canopy height ³ (meters) | Mean: | 12.0 | 15.0 | 12.2 | 12.7 |
| | Range: | 6.0-17.2 | 7.9-23.7 | 12.1-12.5 | 6.0–23.7 |
| Total volume ⁴ (m ³ /ha) | Mean: | 95.1 | 127.6 | 52.7 | 95.3 |
| | Range: | 0-245.9 | 27.9-167.6 | 21.8–111.0 | 0-245.9 |
| Timber volume ⁵ (m ³ /ha) | Mean: | 54.9 | 80.4 | 22.5 | 58.4 |
| | Range: | 0-240.7 | 17.7-115.9 | 6.8-43.4 | 0-240.7 |

¹All trees 2.5 cm. d.b.h. and larger.²Quadratic mean at each plot location.³Based on dominant and codominant trees.

*Total overbark volume of trees 12.5 cm. and larger using equation by Dawkins (1961).

⁵All sound wood of trees 12.5 cm. and larger, from stump to a 10 cm. minimum diameter.Table 5.-Average number **of** live trees by diameter class and forest class, Toro Negro region, 1983¹

| Diameter class (cm.) | Public forest class | | | | | Private timberland |
|-------------------------|--------------------------|------------------|----------------|-------|-------|-----------------------|
| | Plantations | Other timberland | Upper mountain | Palm | Dwarf | |
| | <i>trees per hectare</i> | | | | | |
| 5 | 1,405 | 1,963 | 1,400 | 722 | 1,747 | 1,479 |
| 10 | 245 | 414 | 698 | 533 | 491 | 173 |
| 15 | 124 | 206 | 434 | 287 | 401 | 66 |
| 20 | 73 | 177 | 238 | 500 | 180 | 68 |
| 25 | 44 | 74 | 93 | 130 | 37 | 35 |
| 30 | 44 | 37 | 40 | 19 | 12 | 22 |
| 35 | 32 | 16 | 11 | 7 | 0 | 10 |
| 40 | 31 | 10 | 9 | 4 | 0 | 8 |
| 45 | 12 | 5 | 2 | 2 | 0 | 4 |
| 50 | 8 | 2 | 0 | 0 | 0 | 1 |
| 55 | 7 | 1 | 1 | 0 | 0 | 1 |
| 60 | 8 | 1 | 1 | 0 | 0 | 0 |
| 65 and greater | 5 | 1 | 0 | 0 | 0 | |
| Total | 2,039 | 2,907 | 2,926 | 2,206 | 2,869 | 1,869 |

¹Totals may not add due to rounding.

Table 6.-Area by land class and owner, Toro Negro region, 1983

| Land class | Owner class | | | | All owners | |
|-------------------|-----------------------------|-----------------|----------------|-----------------|----------------|-----------------|
| | Public | | Private | | | |
| | <i>cuerdas</i> ² | <i>hectares</i> | <i>cuerdas</i> | <i>hectares</i> | <i>cuerdas</i> | <i>hectares</i> |
| Timberland | 2,603 | 1,024 | 48,542 | 19,111 | 51,145 | 20,135 |
| Other forest land | 3,854 | 1,518 | 2,080 | 819 | 5,934 | 2,337 |
| Nonforest land | 181 | 71 | 36,061 | 14,197 | 36,242 | 14,268 |
| Total land | 6,638 | 2,613 | 86,683 | 34,127 | 93,321 | 36,740 |

¹Includes the area within 2 USGS 7.5 minute quadrangles: Orocovis and Jayuya.²Local unit of measure. One cuerda=0.3937 hectare.

Table 7.—*Forest area by forest class and division, Toro Negro public forest, 1983*

| Forest class | Public forest division | | | Total public |
|-------------------------------|------------------------|------------|-----------|--------------|
| | El Guineo | Doña Juana | Matrullas | |
| | <i>hectares</i> | | | |
| Timberland | | | | |
| Plantations | 0 | 101 | 50 | 151 |
| Other timberland ¹ | 423 | 205 | 245 | a73 |
| Total | 423 | 306 | 295 | 1,024 |
| Other forest | | | | |
| Upper mountain | 221 | 4 | 0 | 225 |
| Palm | 652 | 99 | 53 | 804 |
| Dwarf | 489 | 0 | 0 | 489 |
| Total | 1,362 | 103 | 53 | 1,518 |
| All forest land | 1,785 | 409 | 348 | 2,542 |

¹Includes abandoned coffee shade and other successional forest types.

Table B.—*Forest area by forest class and life zone¹, Toro Negro public forest, 1983*

| Forest class | Life zone | | Life zones |
|-------------------------------|------------------------|--------------------------|------------|
| | Subtropical wet forest | Lower montane wet forest | |
| | <i>hectares</i> | | |
| Plantations | 151 | 0 | 151 |
| Other timberland ² | 450 | 0 | 450 |
| Upper mountain | 4 | 221 | 225 |
| Palm | 152 | 652 | 804 |
| Dwarf | 0 | 489 | 489 |
| Total | 757 | 1,362 | 2,119 |

¹Life zones defined by Holdridge (1967).

²Excluding 423 hectares of timberland in El Guineo division.

Table 9.—*Private timberland area by forest class and life zone¹, Toro Negro region, 1983*

| Forest class | Life zone | | | All life zones |
|------------------------|--------------------------|------------------------|--------------------------|----------------|
| | Subtropical moist forest | Subtropical wet forest | Lower montane wet forest | |
| | <i>hectares</i> | | | |
| Secondary forest | 2,248 | 6,746 | 2,248 | 11,242 |
| Abandoned coffee shade | 0 | 3,373 | 1,124 | 4,497 |
| Active coffee shade | 1,124 | 2,248 | 0 | 3,372 |
| Total | 3,372 | 12,367 | 3,372 | 19,111 |

¹Life zones defined by Holdridge (1967).

Table 10.—*Forest area by forest class and past disturbance¹, Toro Negro public forest, 1983*

| Forest class | Past land use | | | | Total |
|-------------------------------|-----------------|---------|-------|--------|-------|
| | Coffee shade | Pasture | Brush | Forest | |
| | <i>hectares</i> | | | | |
| Plantations | 50 | 0 | 34 | 67 | 151 |
| Other timberland ² | 110 | 90 | 54 | 196 | 450 |
| Upper mountain | 0 | 0 | 0 | 225 | 225 |
| Palm | 26 | 0 | 0 | 778 | 804 |
| Dwarf | 0 | 0 | 0 | 489 | 489 |
| Total | 186 | 90 | 88 | 1,755 | 2,119 |

¹From historical land use map (Gulick 1951).

²Excluding 423 hectares of timberland in El Guineo division.

Table 11.—Number of live trees by species and diameter class, ranked by basal area plurality, Toro Negro public plantations, 1983¹

| Species code | Scientific name | Total basal area (square meters) | Tree size class ² | | | All classes |
|--------------|-------------------------------------|----------------------------------|------------------------------|------------|-----------|-------------|
| | | | Sapling | Poletimber | Sawtimber | |
| | | | thousand trees | | | |
| 186 | <i>Eucalyptus robusta</i> | 2,810 | 3 | 8 | 18 | 29 |
| 211 | <i>Micropholis chrysophylloides</i> | 169 | 3 | 8 | 0 | 11 |
| 64 | <i>Inga vera</i> | 118 | 5 | 3 | * | 8 |
| 109 | <i>Guarea guidonia</i> | 112 | 0 | 3 | 1 | 3 |
| 20 | <i>Cecropia peltata</i> | 111 | 0 | 2 | 1 | 2 |
| 255 | <i>Nephelea portoricensis</i> | 105 | 14 | 0 | 0 | 14 |
| 188 | <i>Eugenia jambos</i> | 83 | 26 | 1 | 0 | 27 |
| 236 | <i>Tabebuia heterophylla</i> | 73 | 10 | 2 | 0 | 12 |
| 118 | <i>Alchornea latifolia</i> | 69 | 8 | 2 | 0 | 10 |
| 7 | <i>Prestoea montana</i> | 67 | 3 | 1 | 0 | 4 |
| 201 | <i>Didymopanax morototoni</i> | 62 | 0 | 2 | * | 2 |
| 62 | <i>Inga fagifolia</i> | 49 | 0 | 1 | * | 1 |
| 180 | <i>Buchenavia capitata</i> | 49 | 0 | 0 | * | * |
| 129 | <i>Sapium laurocerasus</i> | 48 | 6 | 0 | * | 6 |
| | Other species (33) | 534 | 172 | 4 | 1 | 177 |
| All species | | 4,460 | 249 | 36 | 23 | 308 |

¹Totals may not add due to rounding.

²Saplings are 2.5 to 12.5 cm. d.b.h.; poletimber trees are 12.5 to 27.5 cm. d.b.h.; sawtimber trees are larger than 27.5 cm. d.b.h.

*Less than 500 trees.

Table 12.—Number of live trees by species and diameter class, ranked by basal area plurality, Toro Negro other public timberland¹, 1983²

| Species code | Scientific name | Total basal area (square meters) | Tree size class ³ | | | All classes |
|--------------|-------------------------------------|----------------------------------|------------------------------|------------|-----------|-------------|
| | | | Sapling | Poletimber | Sawtimber | |
| | | | .. . thousand trees | | | |
| 7 | <i>Prestoea montana</i> | 1,245 | 4 | 44 | 0 | 48 |
| 20 | <i>Cecropia peltata</i> | 1,091 | 5 | 20 | 5 | 30 |
| 188 | <i>Eugenia jambos</i> | 834 | 133 | 13 | 4 | 150 |
| 109 | <i>Guarea guidonia</i> | 758 | 25 | 9 | 5 | 38 |
| 62 | <i>Inga fagifolia</i> | 735 | 42 | 14 | 2 | 58 |
| 211 | <i>Micropholis chrysophylloides</i> | 688 | 43 | 9 | 3 | 55 |
| 169 | <i>Casearia arborea</i> | 622 | 93 | 14 | 1 | 108 |
| 255 | <i>Nephelea portoricensis</i> | 580 | 109 | 0 | 0 | 109 |
| 180 | <i>Buchenavia capitata</i> | 400 | 0 | 0 | 2 | 2 |
| 224 | <i>Cordia sulcata</i> | 392 | 7 | 12 | * | 19 |
| 236 | <i>Tabebuia heterophylla</i> | 389 | 11 | 14 | 0 | 25 |
| 118 | <i>Alchornea latifolia</i> | 375 | 21 | 7 | 1 | 29 |
| 186 | <i>Eucalyptus robusta</i> | 293 | 0 | 0 | 2 | 2 |
| 111 | <i>Swietenia macrophylla</i> | 293 | 0 | 3 | 2 | 5 |
| 162 | <i>Clusia grisebachiana</i> | 204 | 0 | 7 | 0 | 7 |
| 64 | <i>Inga vera</i> | 172 | 12 | 2 | 1 | 14 |
| 106 | <i>Dacryodes excelsa</i> | 150 | 0 | * | 1 | 1 |
| 201 | <i>Didymopanax morototoni</i> | 148 | 7 | 4 | * | 11 |
| 87 | <i>Ormosia krugii</i> | 140 | 2 | 1 | 1 | 4 |
| 149 | <i>Sloanea berteriana</i> | 136 | 1 | 1 | 1 | 2 |
| 150 | <i>Hibiscus tiliaceus</i> | 121 | 53 | 0 | 0 | 53 |
| 192 | <i>Myrcia deflexa</i> | 113 | 31 | 3 | 0 | 34 |
| 173 | <i>Homalium racemosum</i> | 112 | 16 | 3 | 0 | 19 |
| | Other species (50) | 1,750 | 456 | 26 | 3 | 485 |
| All species | | 11,739 | 1,070 | 205 | 33 | 1,308 |

¹Excluding 423 hectares of timberland in El Guineo division.

²Totals may not add due to rounding.

³Saplings are 2.5 to 12.5 cm. d.b.h.; poletimber trees are 12.5 to 27.5 cm. d.b.h.; sawtimber trees are larger than 27.5 cm. d.b.h.

*Less than 500 trees.

Table 13.—Number of live trees by species and diameter class, ranked by basal area plurality, Toro Negro public upper mountain forest, 1983¹

| Specie5 code | Scientific name | Total basal area (square meters) | Tree size class" | | | All classes |
|----------------------------|-------------------------------------|--|------------------|------------|-----------|----------------|
| | | | Sapling | Poletimber | Sawtimber | |
| thousand trees | | | | | | |
| 7 | <i>Prestoea montana</i> | 1,999 | 6 | 78 | 0 | 84 |
| 21.1 | <i>Micropholis chrysophylloides</i> | 1,067 | 46 | 22 | 3 | 71 |
| 20 | <i>Cecropia peltata</i> | 593 | * | 7 | 4 | 11 |
| 619 | <i>Tetrazygia biflora</i> | 519 | 12 | 10 | 2 | 25 |
| 255 | <i>Nephelea portoricensis</i> | 342 | 57 | 2 | 0 | 59 |
| 139 | <i>Matayba domingensis</i> | 299 | 39 | 3 | 0 | 42 |
| 1 | <i>Cyathea arborea</i> | 269 | 30 | 5 | 0 | 35 |
| 196 | <i>Calycogonium squamulosum</i> | 242 | 24 | 4 | * | 29 |
| 162 | <i>Clusia grisebachiana</i> | 215 | 0 | 6 | 0 | 6 |
| 62 | <i>Inga fagifolia</i> | 194 | 0 | 3 | 1 | 4 |
| 136 | <i>Cyrilla racemiflora</i> | 187 | 3 | 7 | 1 | 11 |
| 169 | <i>Casearia arborea</i> | 140 | 15 | 5 | 0 | 20 |
| 248 | <i>Rondeletia portoricensis</i> | 126 | 12 | 2 | 0 | 14 |
| 64 | <i>Inga vera</i> | 125 | 3 | 1 | 1 | 5 |
| 709 | <i>Tabebuia schumanniana</i> | 94 | 3 | 2 | * | 5 |
| 118 | <i>Alchornea latifolia</i> | 94 | 3 | 4 | * | 8 |
| 121 | <i>Drypetes glauca</i> | 84 | 45 | 2 | 0 | 47 |
| | Other species (25) | 571 | 173 | 9 | * | 182 |
| All species | | 7,158 | 472 | 172 | 14 | 658 |

¹Totals may not add due to rounding.

²Saplings are 2.5 to 12.5 cm. d.b.h.; poletimber trees are 12.5 to 27.5 cm. d.b.h.; sawtimber trees are larger than 27.5 cm. d.b.h.

*Less than 500 trees.

Table 14.—Number of live trees by species and diameter class, ranked by basal area plurality, Toro Negro public palm forest, 1983¹

| Species code | Scientific name | Total basal area (square meters) | Tree size class ² | | | All classes |
|----------------------------|---------------------------------------|--|------------------------------|------------|-----------|----------------|
| | | | Sapling | Poletimber | Sawtimber | |
| thousand trees | | | | | | |
| 7 | <i>Prestoea montana</i> | 16,530 | 33 | 535 | 3 | 571 |
| 1 | <i>Cyathea arboreu</i> | 2,196 | 134 | 53 | 1 | 187 |
| 211 | <i>Micropholis chrysophylloides</i> | 1,989 | 99 | 40 | 7 | 146 |
| 20 | <i>Cecropia peltata</i> | 1,157 | 15 | 19 | 5 | 39 |
| 248 | <i>Rondeleii</i> <i>portoricensis</i> | 1,086 | 60 | 21 | 2 | 83 |
| 62 | <i>Inga fagifolia</i> | 632 | 5 | 7 | 3 | 16 |
| 196 | <i>Calycogonium squamulosum</i> | 529 | 56 | 13 | 0 | 69 |
| 139 | <i>Matayba domingensis</i> | 301 | 9 | 11 | 1 | 22 |
| 129 | <i>Sapium laurocerasus</i> | 299 | 0 | 2 | 2 | 5 |
| 255 | <i>Nepheba portoricensis</i> | 267 | 49 | 0 | 0 | 49 |
| | Other species (25) | 2,771 | 549 | 36 | 3 | 587 |
| | All species | 27,757 | 1,010 | 737 | 27 | 1,774 |

¹Totals may not add due to rounding.

²Saplings are 2.5 to 12.5 cm. d.b.h.; poletimber trees are 12.5 to 27.5 cm. d.b.h.; sawtimber trees are larger than 27.5 cm. d.b.h.

Table 15.—Number of live trees by species and diameter class, ranked by basal area plurality, Toro Negro public dwarf forest, 1983 ¹

| Species code | Scientific name | Total basal area (square meters) | Tree size class ² | | | All classes |
|--------------|---------------------------------|-------------------------------------|------------------------------|------------|-----------|-------------|
| | | | Sapling | Poletimber | Sawtimber | |
| | | | ----- thousand trees ----- | | | |
| 1 | <i>Cyathea arborea</i> | 2,034 | 187 | 36 | 0 | 223 |
| 162 | <i>Clusia grisebachiana</i> | 1,392 | 67 | 51 | 0 | 117 |
| 7 | <i>Prestoea montana</i> | 1,223 | 0 | 49 | 0 | 49 |
| 196 | <i>Calycogonium squamulosum</i> | 1,045 | 53 | 35 | 4 | 92 |
| 251 | <i>Cyathea aquilina</i> | 997 | 80 | 34 | 0 | 114 |
| 139 | <i>Matayba domingensis</i> | 697 | 27 | 25 | 0 | 52 |
| 255 | <i>Nephelea portoricensis</i> | 407 | 107 | 6 | 0 | 113 |
| 185 | <i>Calyptranthes krugii</i> | 353 | 40 | 18 | 0 | 58 |
| 136 | <i>Cyrilla racemiflora</i> | 310 | 40 | 18 | 0 | 58 |
| 709 | <i>Tabebuia schumanniana</i> | 270 | 27 | 11 | 0 | 37 |
| 4% | <i>Ocotea leucoxylon</i> | 234 | 27 | 11 | 0 | 38 |
| 625 | <i>Didymopanax gleasonii</i> | 188 | 67 | 0 | 0 | 67 |
| 20 | <i>Cecropia peltata</i> | 136 | 0 | 0 | 2 | 2 |
| 203 | <i>Rapanea coriacea</i> | 136 | 0 | a | 0 | 8 |
| 144 | <i>Meliosma herbertii</i> | 117 | 40 | 0 | 0 | 40 |
| 489 | <i>Rhamnus sphaerosperma</i> | 116 | 40 | 0 | 0 | 40 |
| 187 | <i>Eugenia domingensis</i> | 113 | 40 | 0 | 0 | 40 |
| | Other species (9) | 288 | 254 | 0 | 0 | 254 |
| | All species | 10,054 | 1,095 | 302 | 6 | 1,403 |

¹Totals may not add due to rounding.

²Saplings are 2.5 to 12.5 cm. d.b.h.; poletimber trees are 12.5 to 27.5 cm. d.b.h.; sawtimber trees are larger than 27.5 cm d.b.h.

Table 16.—Number of live trees by species and diameter class, ranked by basal area plurality, Toro Negro private timberland, 1983 ¹

| Species code | Scientific name | Total basal area (square meters) | Tree size class ² | | | All classes |
|--------------|---------------------------------|-------------------------------------|------------------------------|------------|-----------|-------------|
| | | | Sapling | Poletimber | Sawtimber | |
| | | | ----- thousand trees ----- | | | |
| 109 | <i>Guarea guidonia</i> | 28,671 | 2,946 | 178 | 135 | 3,258 |
| 64 | <i>Inga vera</i> | 28,091 | 736 | 286 | 166 | 1,188 |
| 7 | <i>Prestoea montana</i> | 21,545 | 0 | 682 | 14 | 696 |
| 20 | <i>Cecropia peltata</i> | 17,376 | 460 | 57 | 133 | 650 |
| 188 | <i>Eugenia jambos</i> | 15,221 | 3,867 | 110 | 22 | 3,999 |
| 200 | <i>Dendropanax arboreus</i> | 12,975 | 829 | 126 | 69 | 1,023 |
| 81 | <i>Andira inermis</i> | 9,642 | 276 | 252 | 12 | 540 |
| 118 | <i>Alchornea latifolia</i> | 9,145 | 184 | 205 | 29 | 418 |
| 62 | <i>Inga fagifolia</i> | 7,640 | 92 | 17 | 65 | 174 |
| 240 | <i>Coffea arabica</i> | 6,754 | 7,181 | 0 | 0 | 7,181 |
| 84 | <i>Erythrina poeppigiana</i> | 6,557 | 0 | 60 | 14 | 75 |
| 151 | <i>Montezuma speciosissima</i> | 6,557 | 0 | 95 | 33 | 128 |
| 133 | <i>Spondias dulcis</i> | 5,704 | 92 | 105 | 19 | 216 |
| 32 | <i>Pisonia subcordata</i> | 5,115 | 184 | 58 | 20 | 261 |
| 131 | <i>Mangifera indica</i> | 5,038 | 92 | 0 | 19 | 111 |
| 172 | <i>Casearia sylvestris</i> | 4,719 | 3,959 | 0 | 0 | 3,959 |
| 224 | <i>Cordia sulcata</i> | 4,055 | 276 | 101 | 0 | 377 |
| 51 | <i>Persea americana</i> | 3,747 | 0 | 71 | 25 | 95 |
| 100 | <i>Citrus sinensis</i> | 3,745 | 552 | 96 | 0 | 649 |
| 251 | <i>Cyathea aquilina</i> | 3,386 | 460 | 0 | 0 | 460 |
| 203 | <i>Rapanea coriacea</i> | 3,220 | 921 | 46 | 0 | 967 |
| 221 | <i>Cordia alliodora</i> | 2,994 | 184 | 18 | 21 | 223 |
| 24 | <i>Ficus perforata</i> | 2,810 | 0 | 48 | 3 | 52 |
| 16 | <i>Trema micrantha</i> | 2,655 | 92 | 31 | 15 | 138 |
| 255 | <i>Nephelea portoricensis</i> | 2,640 | 92 | 118 | 0 | 210 |
| 107 | <i>Tetragastris balsamifera</i> | 2,603 | 368 | 53 | 0 | 421 |
| | Other species (43) | 34,931 | 7,733 | 432 | 80 | 8,244 |
| | All species | 257,540 | 31,576 | 3,245 | 892 | 35,713 |

¹Totals may not add due to rounding.

²Saplings are 2.5 to 12.5 cm. d.b.h.; poletimber trees are 12.5 to 27.5 cm. d.b.h.; sawtimber trees are larger than 27.5 cm d.b.h.

Table 17.—Dominant seedlings on public and private forests by forest class and species, Toro Negro region, 1983

| Species code | Scientific name | Public forest class | | | | | Private forests |
|--------------|-------------------------------------|----------------------|------------------|----------------|------------|-----|-----------------|
| | | Plantations | Other timberland | Upper mountain | Palm Dwarf | | |
| | | percent ¹ | | | | | |
| 7 | <i>Prestoea montana</i> | 20 | 4 | 3 | 23 | 4 | 2 |
| 62 | <i>Inga fagifolia</i> | 0 | 4 | 4 | 3 | 0 | 0 |
| 63 | <i>Inga quaternata</i> | 0 | 0 | 0 | 0 | 0 | 5 |
| 109 | <i>Guarea guidonia</i> | 0 | 0 | 0 | 0 | 0 | 5 |
| 121 | <i>Drypetes glauca</i> | 8 | 0 | 1 | 0 | 0 | 3 |
| 169 | <i>Casearia arborea</i> | 3 | 6 | 0 | 1 | 0 | 0 |
| 172 | <i>Casearia sylvestris</i> | 5 | 2 | 0 | 3 | 0 | 8 |
| 177 | <i>Daphnopsis philippiana</i> | 0 | 3 | 22 | 15 | 0 | 2 |
| 188 | <i>Eugenia jumbos</i> | 8 | 11 | 1 | 0 | 0 | 0 |
| 191 | <i>Eugenia stahlia</i> | 3 | 4 | 6 | 0 | 0 | 1 |
| 192 | <i>Myrcia deflexa</i> | 1 | 8 | 3 | 3 | 19 | 4 |
| 193 | <i>Myrcia splendens</i> | 0 | 0 | 0 | 0 | 0 | 4 |
| 196 | <i>Calycogonium squamulosum</i> | 0 | 0 | 4 | 6 | 4 | 0 |
| 211 | <i>Micropholis chrysophylloides</i> | 0 | 3 | 3 | 7 | 0 | 2 |
| 240 | <i>Coffea arabica</i> | 0 | 11 | 1 | 1 | 0 | 32 |
| 255 | <i>Nephelea portoricensis</i> | 5 | 3 | 1 | 1 | 4 | 0 |
| 256 | <i>Alsophila bryophila</i> | 1 | 6 | 0 | 1 | 0 | 0 |
| 413 | <i>Guarea rameiflora</i> | 0 | 3 | 6 | 7 | 0 | 1 |
| 602 | <i>Miconia laevigata</i> | 5 | 6 | 5 | 4 | 0 | 2 |
| 612 | <i>Miconia subcorymbosa</i> | 0 | 3 | 5 | 2 | 4 | 0 |
| | Other species (43) | 41 | 23 | 35 | 23 | 65 | 29 |
| | All species | 100 | 100 | 100 | 100 | 100 | 100 |

¹Proportion of all seedlings tallied within each class.Table 18.—Volume of timber¹, growing stock², and sawtimber³ by species and tree size class⁴, Toro Negro public plantations, 1983⁵

| Species code | Scientificname | Timber volume | | | Growing-stock volume | | | Sawtimber volume Total |
|--------------------------|---|---------------|-----------|--------|----------------------|-----------|--------|---------------------------|
| | | Poletimber | Sawtimber | Total | Poletimber | Sawtimber | Total | |
| ----- cubic meters ----- | | | | | | | | |
| 186 | <i>Eucalyptus robusta</i> | 1,145 | 20,756 | 21,901 | 1,145 | 16,578 | 17,723 | 7,545 |
| 211 | <i>Micropholis chrysophylloides</i> | 841 | 0 | 841 | 605 | 0 | 605 | 0 |
| 20 | <i>Cecropia peltata</i> | 251 | 363 | 614 | 244 | 307 | 551 | 125 |
| 64 | <i>Inga vera</i> | 358 | 215 | 573 | 312 | 138 | 450 | 54 |
| 109 | <i>Guarea guidonia</i> | 205 | 344 | 549 | 205 | 206 | 411 | 51 |
| 7 | <i>Prestoea montana</i> | 461 | 0 | 461 | 0 | 0 | 0 | 0 |
| 180 | <i>Buchenavia capitata</i> | 0 | 454 | 454 | 0 | 325 | 325 | 126 |
| 84 | <i>Erythrina poeppigiana</i> | 0 | 311 | 311 | 0 | 0 | 0 | 0 |
| 161 | <i>Calophyllum calaba</i> | 0 | 287 | 287 | 0 | 162 | 162 | 0 |
| 62 | <i>Inga fagifolia</i> | 82 | 195 | 277 | 82 | 67 | 149 | 0 |
| 188 | <i>Eugenia jumbos</i> | 268 | 0 | 268 | 0 | 0 | 0 | 0 |
| | Other species (10) | 690 | 636 | 1,326 | 690 | 471 | 1,161 | 169 |
| | All species | 4,301 | 23,561 | 27,862 | 3,283 | 18,254 | 21,537 | 8,070 |

¹Volume of all sound wood in all live trees to a minimum 10 cm. diameter outside bark.²Volume of sound wood (less sound cull volume) in growing-stock trees of commercial species to a minimum 10 cm. diameter outside bark.³Net volume of the sawlog portion of sawtimber trees of commercial species, calculated according to the International rule.⁴Poletimber trees are between 12.5 and 27.5 cm. d.b.h., and sawtimber trees are greater than 27.5 cm. d.b.h.⁵Totals may not add due to rounding.

Table 19.-Volume of timber¹, growing stock², and sawtimber³ by species and tree size class ⁴, Toro Negro other public timberland⁵, 1983⁶

| Species code | Scientific name | Timber volume | | | Growing-stock volume | | | Sawtimber volume |
|--------------------------|---|---------------|-----------|--------|----------------------|-----------|--------|------------------|
| | | Poletimber | Sawtimber | Total | Poletimber | Sawtimber | Total | Total |
| ----- cubic meters ----- | | | | | | | | |
| 7 | <i>Prestoea montana</i> | 11,106 | 0 | 11,106 | 0 | 0 | 0 | 0 |
| 20 | <i>Cecropia peltata</i> | 2,469 | 2,988 | 5,457 | 2,336 | 2,347 | 4,683 | 1,028 |
| 188 | <i>Eugenia jumbos</i> | 2,860 | 1,722 | 4,582 | 0 | 0 | 0 | 0 |
| 109 | <i>Guarea guidonia</i> | 1,239 | 2,954 | 4,193 | 1,111 | 2,314 | 3,425 | 935 |
| 180 | <i>Buchenauiia capitata</i> | 0 | 3,432 | 3,432 | 0 | 2,418 | 2,418 | 785 |
| 211 | <i>Micropholis chrysophylloides</i> | 1,127 | 2,234 | 3,361 | 1,025 | 997 | 2,022 | 384 |
| 62 | <i>Inga fagifolia</i> | 1,766 | 1,211 | 2,977 | 1,519 | 789 | 2,308 | 330 |
| 186 | <i>Eucalyptus robusta</i> | 0 | 2,089 | 2,089 | 0 | 1,660 | 1,660 | 680 |
| 111 | <i>Swietenia macrophylla</i> | 530 | 1,312 | 1,842 | 530 | 968 | 1,498 | 406 |
| 118 | <i>Alchornea latifolia</i> | 779 | 987 | 1,766 | 767 | 603 | 1,370 | 213 |
| 224 | <i>Cordia sulcata</i> | 1,406 | 239 | 1,645 | 1,392 | 187 | 1,579 | 68 |
| 169 | <i>Casearia arborea</i> | 948 | 599 | 1,547 | 948 | 78 | 1,026 | 24 |
| 236 | <i>Tabebuia heterophylla</i> | 1,385 | 0 | 1,385 | 1,364 | 0 | 1,364 | 0 |
| 106 | <i>Dacryodes excelsea</i> | 30 | 1,174 | 1,204 | 30 | 839 | 869 | 286 |
| 87 | <i>Ormosia krugii</i> | 296 | 858 | 1,154 | 296 | 557 | 853 | 246 |
| 149 | <i>Sloanea berteriana</i> | 84 | 862 | 946 | 84 | 539 | 623 | 233 |
| 64 | <i>Zgavera</i> | 275 | 564 | 839 | 233 | 289 | 522 | 49 |
| 139 | <i>Matayba domingensis</i> | 394 | 370 | 764 | 394 | 242 | 636 | 100 |
| 201 | <i>Didymopanax morototoni</i> | 366 | 318 | 684 | 354 | 192 | 546 | 53 |
| 162 | <i>Clusia grisebachiana</i> | 588 | 0 | 588 | 491 | 0 | 491 | 0 |
| 242 | <i>Faramea occidentalis</i> | 174 | 386 | 560 | 174 | 280 | 454 | 137 |
| | Other species (23) | 2,393 | 1,534 | 3,927 | 1,953 | 951 | 2,904 | 368 |
| | All species | 30,215 | 25,833 | 56,048 | 15,001 | 16,250 | 31,251 | 6,325 |

¹Volume of all sound wood in all live trees to a minimum 10 cm. diameter outside bark.²Volume of sound wood (less sound cull volume) in growing-stock trees of commercial species to a minimum 10 cm. diameter outside bark.³Net volume of the sawlog portion of sawtimber trees of commercial species, calculated according to the International rule.⁴Poletimber trees are between 12.5 and 27.5 cm. d.b.h., and sawtimber trees are greater than 27.5 cm. d.b.h.⁵Excluding 423 hectares of timberland in El Guineo division.⁶Totals may not add due to rounding.

Table 20.—Volume of timber¹, growing stock², and sawtimber³ by species and tree size class⁴, Toro Negro private timberland, 1983⁵

| Species code | Scientific name | Timber volume | | | Growing stock volume | | | Sawtimber volume |
|--------------------------|-------------------------------------|---------------|-----------|-----------|----------------------|-----------|---------|------------------|
| | | Poletimber | Sawtimber | Total | Poletimber | Sawtimber | Total | Total |
| ----- cubic meters ----- | | | | | | | | |
| 7 | <i>Prestoea montana</i> | 183,300 | 13,200 | 196,600 | 0 | 0 | 0 | 0 |
| 109 | <i>Guarea guidonia</i> | 41,300 | 97,500 | 138,800 | 37,900 | 83,600 | 121,600 | 16,900 |
| 20 | <i>Cecropia peltata</i> | 19,900 | 106,200 | 126,100 | 19,900 | 86,400 | 106,300 | 34,700 |
| 64 | <i>Inga vera</i> | 45,100 | 70,000 | 115,100 | 37,600 | 37,066 | 74,800 | 14,100 |
| 200 | <i>Dendropanax arboreus</i> | 8,200 | 44,800 | 53,100 | 5,600 | 37,800 | 43,400 | 5,700 |
| 118 | <i>Alchornea latifolia</i> | 42,800 | 8,600 | 51,400 | 42,600 | 7,600 | 50,200 | 2,000 |
| 62 | <i>Inga fagifolia</i> | 7,000 | 39,300 | 46,300 | 6,000 | 24,900 | 30,900 | 7,400 |
| 84 | <i>Erythrina poeppigiana</i> | 15,800 | 24,700 | 40,600 | 0 | 0 | 0 | 0 |
| 32 | <i>Pisonia subcordata</i> | 12,500 | 27,100 | 39,700 | 12,500 | 15,300 | 27,800 | 3,100 |
| 81 | <i>Andira inermis</i> | 27,300 | 6,200 | 33,500 | 25,100 | 3,400 | 28,600 | 500 |
| 151 | <i>Montezuma speciosissima</i> | 7,600 | 22,900 | 30,500 | 1,600 | 18,400 | 20,100 | 3,200 |
| 188 | <i>Eugenia jambos</i> | 13,400 | 14,200 | 27,600 | 0 | 0 | 0 | 0 |
| 221 | <i>Cordia alliodora</i> | 5,500 | 17,700 | 23,200 | 5,500 | 10,600 | 16,100 | 3,800 |
| 133 | <i>Spondias dulcis</i> | 8,700 | 12,300 | 21,100 | 5,400 | 400 | 5,800 | 1,100 |
| 51 | <i>Persea americana</i> | 4,100 | 13,300 | 17,400 | 2,900 | 8,700 | 11,600 | 3,400 |
| 131 | <i>Mangifera indica</i> | 0 | 15,900 | 15,900 | 0 | 0 | 0 | 0 |
| 224 | <i>Cordia sulcata</i> | 15,400 | 0 | 15,400 | 14,600 | 0 | 14,700 | 0 |
| 86 | <i>Lonchocarpus pentaphyllus</i> | 0 | 12,000 | 12,000 | 0 | 11,900 | 11,900 | 5,100 |
| 34 | <i>Magnolia portoricensis</i> | 0 | 11,300 | 11,300 | 0 | 10,400 | 10,400 | 1,800 |
| 211 | <i>Micropholis chrysophylloides</i> | 1,600 | 9,600 | 11,300 | 0 | 7,800 | 7,800 | 2,800 |
| 100 | <i>Citrus sinensis</i> | 11,100 | 0 | 11,100 | 0 | 0 | 0 | 0 |
| | Other species (16) | 35,500 | 42,500 | 78,000 | 31,900 | 28,400 | 60,400 | 8,400 |
| | All species | 506,300 | 609,600 | 1,115,900 | 249,500 | 392,900 | 642,400 | 114,000 |

¹Volume of all sound wood in all live trees to a minimum 10 cm. diameter outside bark.²Volume of sound wood (less sound cull volume) in growing-stock trees of commercial species to a minimum 10 cm. diameter outside bark.³Net volume of the sawlog portion of sawtimber trees of commercial species, calculated according to the International rule.⁴Poletimber trees are between 12.5 and 27.5 cm. d.b.h., and sawtimber trees are greater than 27.5 cm. d.b.h.⁵Totals may not add due to rounding.Table 21.—Volume of timber by use category¹ and forest class, Toro Negro region, 1983²

| Species Use category | Forest class | | |
|--------------------------------------|--------------------|--------------------------------------|--------------------|
| | Public plantations | Other public timberland ³ | Private timberland |
| ----- cubic meters per hectare ----- | | | |
| High quality sawtimber | 15.9 | 40.9 | 13.0 |
| Utility poletimber and sawtimber | 152.9 | 32.4 | 22.2 |
| Unusable for timber product | 6.4 | 39.6 | 16.7 |
| Uncommon species ⁸ | 9.3 | 11.7 | 6.5 |
| Ail timber | 184.5 | 124.6 | 58.4 |

¹Use codes for each species are listed in table8 23, 24, and 25²Totals may not add due to rounding.³Excluding 423 hectares of timberland in El Guineo division.

Table 22.-Volume of timber by class of timber and forest class, Toro Negro region, 1983¹

| Class of timber | Forest class | | |
|------------------------|--------------------------------------|--------------------------------------|--------------------|
| | Public plantations | Other public timberland ² | Private timberland |
| | ----- cubic meters per hectare ----- | | |
| Growing-stock trees | | | |
| Sawtimber trees: | | | |
| Sawlog portion | 110.2 | 32.9 | 13.9 |
| Upper stem | 6.7 | 2.7 | 2.5 |
| Branches and forks | 23.4 | 10.7 | 4.1 |
| Sound cull | 8.7 | 5.6 | 2.8 |
| Timber volume | 148.9 | 51.8 | 23.4 |
| Poletimber trees: | | | |
| Bole volume | 20.3 | 33.3 | 11.2 |
| Branches and forks | 0.0 | 0.0 | 0.1 |
| Sound cull | 5.6 | 31.7 | 2.5 |
| Timber volume | 5.8 | 64.9 | 13.8 |
| Rough and rotten trees | | | |
| Bole volume | 5.5 | 0.5 | 6.0 |
| Branches and forks | 2.3 | 1.4 | 1.7 |
| Sound cull | 1.9 | 5.8 | 13.5 |
| Timber volume | 9.7 | 7.8 | 21.2 |
| All timber | 184.5 | 124.6 | 58.4 |

¹Totals may not add due to rounding.²Excluding 423 hectares in El Guineo division.

Table 23.-Average number of trees by tree class, species, and size class, ranked by basal area plurality, Toro Negro public plantations, 1983¹

| Tree class ² | Species code | Use code ³ | Scientific name | Tree size class ⁴ | | | All size classes |
|-------------------------------|---------------------|-----------------------|-------------------------------------|------------------------------|------------|-----------|------------------|
| | | | | Sapling | Poletimber | Sawtimber | |
| trees per hectare | | | | | | | |
| Growing stock | 186 | 2 | <i>Eucalyptus robusta</i> | 18 | 56 | 120 | 193 |
| | 211 | 1 | <i>Micropholis chrysophylloides</i> | 18 | 38 | 0 | 56 |
| | 64 | 2 | <i>Inga vera</i> | 32 | 17 | 2 | 51 |
| | 109 | 1 | <i>Guarea guidonia</i> | 0 | 17 | 3 | 20 |
| | 20 | 2 | <i>Cecropia peltata</i> | 0 | 10 | 4 | 15 |
| | 255 | 3 | <i>Nephelea portoricensis</i> | 73 | 0 | 0 | 73 |
| | 188 | 3 | <i>Eugenia jumbos</i> | 155 | 4 | 0 | 159 |
| | 236 | 1 | <i>Tabebuia heterophylla</i> | 68 | 10 | 0 | 78 |
| | 118 | 2 | <i>Alchornea latifolia</i> | 54 | 15 | 0 | 69 |
| | 7 | 3 | <i>Prestoea montana</i> | 18 | 10 | 0 | 28 |
| | 201 | 2 | <i>Didymopanax morototoni</i> | 0 | 12 | 2 | 15 |
| | 62 | 1 | <i>Inga fagifolia</i> | 0 | 7 | 0 | 7 |
| | 180 | 1 | <i>Buchenavia capitata</i> | 0 | 0 | 2 | 2 |
| | 129 | 3 | <i>Sapium laurocerasus</i> | 36 | 0 | 2 | 39 |
| | | | Other species | 786 | 25 | 5 | 816 |
| | Total growing stock | | | | 1,259 | 221 | 14.1 |
| Rough and rotten trees | | | | | | | |
| | All species | | | 391 | 20 | 7 | 419 |
| All live trees | | | | | | | |
| | Total | | | 1,650 | 241 | 148 | 2,039 |

¹Totals may not add due to rounding.

²Growing-stock trees are currently or prospectively merchantable based on form and soundness, regardless of species.

³High quality sawtimber is code I; utility poletimber and sawtimber is code 2; currently unusable timber is code 3.

*Saplings are 2.5 to 12.5 cm. d.b.h.; poletimber trees are 12.5 to 27.5 cm. d.b.h.; sawtimber trees are larger than 27.5 cm. d.b.h.

Table 24.—Average number of trees by tree class, species, and size class, ranked by basal area plurality, Toro Negro other public timberland¹, 1983²

| Tree class ³ | Species code | Use code ⁴ | Scientific name | Tree size class ⁵ | | | All size classes |
|-------------------------|--------------|-----------------------|-------------------------------------|------------------------------|------------|-----------|------------------|
| | | | | Sapling | Poletimber | Sawtimber | |
| | | | | | trees per | hectare | ----- |
| Growing stock | | | | | | | |
| | 7 | 3 | <i>Prestoea montana</i> | 8 | 99 | 0 | 107 |
| | 20 | 2 | <i>Cecropia peltata</i> | 12 | 45 | 11 | 67 |
| | 188 | 3 | <i>Eugenia jambos</i> | 271 | 24 | 3 | 298 |
| | 109 | 1 | <i>Guarea guidonia</i> | 54 | 18 | 10 | 83 |
| | 62 | 1 | <i>Inga fagifolia</i> | 75 | 29 | 4 | 109 |
| | 211 | 1 | <i>Micropholis chrysophylloides</i> | 95 | 21 | 4 | 119 |
| | 169 | 3 | <i>Casearia arborea</i> | 178 | 27 | 1 | 205 |
| | 255 | 3 | <i>Nephelea portoricensis</i> | 36 | 0 | 0 | 36 |
| | 180 | 1 | <i>Buchenavia capitata</i> | 0 | 0 | 4 | 5 |
| | 224 | 2 | <i>Cordia sulcata</i> | 15 | 27 | 1 | 43 |
| | 236 | 1 | <i>Tabebuia heterophylla</i> | 25 | 31 | 0 | 56 |
| | 118 | 2 | <i>Alchornea latifolia</i> | 46 | 15 | 3 | 64 |
| | 186 | 2 | <i>Eucalyptus robusta</i> | 0 | 0 | 3 | 4 |
| | 111 | 1 | <i>Swietenia macrophylla</i> | 0 | 6 | 5 | 10 |
| | 162 | 3 | <i>Clusia grisebachiana</i> | 0 | 14 | 0 | 14 |
| | 64 | 2 | <i>Inga vera</i> | 26 | 3 | 1 | 30 |
| | 106 | 1 | <i>Dacryodes excelsa</i> | 0 | 0 | 3 | 3 |
| | 201 | 2 | <i>Didymopanax morototoni</i> | 15 | 9 | 1 | 25 |
| | 87 | 2 | <i>Ormosia krugii</i> | 5 | 3 | 2 | 9 |
| | 149 | 2 | <i>Sloanea berteriana</i> | 2 | 1 | 3 | 6 |
| | 150 | 3 | <i>Hibiscus tiliaceus</i> | 89 | 0 | 0 | 89 |
| | 192 | 2 | <i>Myrcia deflexa</i> | 69 | 6 | 0 | 76 |
| | 173 | 2 | <i>Homalium racemosum</i> | 35 | 7 | 0 | 42 |
| | | | Other species | 787 | 57 | 6 | 849 |
| Total growing stock | | | | 1,842 | 442 | 64 | 2,348 |
| Rough and rotten trees | | | | | | | |
| All species | | | | 535 | 15 | 9 | 559 |
| All live trees | | | | | | | |
| Total | | | | 2,377 | 456 | 74 | 2,907 |

¹Excluding 423 hectares of timberland in El Guineo division.

²Totals may not add due to rounding.

³Growing-stock trees are currently or prospectively merchantable based on form and soundness, regardless of species.

⁴High quality sawtimber is code 1; utility poletimber and sawtimber is code 2; currently unusable timber is code 3.

⁵Saplings are 2.5 to 12.5 cm. d.b.h.; poletimber trees are 12.5 to 27.5 cm. d.b.h.; sawtimber trees are larger than 27.5 cm. d.b.h.

Table X5.-Average number of trees by tree class, species, and size class, ranked by basal area plurality, Toro Negro private timberland, 1983¹

| Tree class ² | Species code | Use code ³ | Scientific name | Tree size class ⁴ | | | All size classes | |
|-------------------------------|---------------------------|--------------------------|---------------------------------|------------------------------|------------|-----------|------------------------|--|
| | | | | Sapling | Poletimber | Sawtimber | | |
| trees per hectare | | | | | | | | |
| Growing stock | 109 | 1 | <i>Guarea guidonia</i> | 149 | 6 | 5 | 160 | |
| | 64 | 2 | <i>Inga vera</i> | 39 | 10 | 4 | 52 | |
| | 7 | 3 | <i>Prestoea montana</i> | 0 | 14 | 0 | 14 | |
| | 20 | 2 | <i>Cecropia peltata</i> | 24 | 2 | 6 | 33 | |
| | 188 | 3 | <i>Eugenia jambos</i> | 43 | 0 | 0 | 43 | |
| | 200 | 2 | <i>Dendropanax arboreus</i> | 34 | 3 | 1 | 39 | |
| | 81 | 1 | <i>Andira inermis</i> | 14 | 12 | 1 | 27 | |
| | 118 | 2 | <i>Alchornea latifolia</i> | 10 | 9 | 2 | 21 | |
| | 62 | 1 | <i>Inga fagifolia</i> | 5 | 1 | 2 | 8 | |
| | 240 | 3 | <i>Coffea arabica</i> | 39 | 0 | 0 | 39 | |
| | 84 | 3 | <i>Erythrina poeppigiana</i> | 0 | 1 | * | 1 | |
| | 151 | 1 | <i>Montezuma speciosissima</i> | 0 | 0 | 1 | 1 | |
| | 133 | 3 | <i>Spondias dulcis</i> | 5 | 6 | 1 | 11 | |
| | 32 | 2 | <i>Pisonia subcordata</i> | 5 | 3 | 1 | 9 | |
| | 131 | 3 | <i>Mangiferu indica</i> | 5 | 0 | * | 5 | |
| | 172 | 3 | <i>Casearia sylvestris</i> | 149 | 0 | 0 | 149 | |
| | 224 | 2 | <i>Cordia sulcata</i> | 14 | 5 | 0 | 20 | |
| | 51 | 3 | <i>Persea americana</i> | 0 | 4 | 1 | 5 | |
| | 100 | 3 | <i>Citrus sinensis</i> | 0 | 0 | 0 | 0 | |
| | 251 | 3 | <i>Cyathea aquilina</i> | 0 | 0 | 0 | 0 | |
| | 203 | 3 | <i>Rapanea coriacea</i> | 43 | 2 | 0 | 46 | |
| | 221 | 1 | <i>Cordia alliodora</i> | 10 | 1 | 1 | 12 | |
| | 24 | 3 | <i>Ficus perforata</i> | 0 | 3 | * | 3 | |
| | 16 | 3 | <i>Trema micrantha</i> | 5 | 2 | 1 | 7 | |
| | 255 | 3 | <i>Nephelea portoricensis</i> | 0 | 0 | 0 | 0 | |
| | 107 | 1 | <i>Tetragastris balsamifera</i> | 19 | 0 | 0 | 19 | |
| | | | Other species | 318 | 16 | 4 | 338 | |
| | | | Total growing stock | 930 | 100 | 31 | 1,061 | |
| | | | | | | | | |
| | Rough and rotten trees | | All species | 723 | 70 | 15 | 808 | |
| | | | | | | | | |
| | | | | | | | | |
| All live trees | | Total | 1,652 | 170 | 47 | 1,869 | | |

¹Excluding 423 hectares of timberland in El Guineo division

²Totals may not add due to rounding.

³High quality sawtimber is code 1; utility poletimber and sawtimber is code 2; currently unusable timber is code 3.

*Growing-stock trees are currently or prospectively merchantable based on form and soundness, regardless of species.

*Less than one tree per hectare.

Table 26.—*Basal area by size class, tree class, and forest class, Toro Negro region 1983¹*

| Size class and tree class | Public forest class | | All public timberland | All private timberland |
|---------------------------------|---------------------------------------|------------------|--------------------------|---------------------------|
| | Plantations | Other timberland | | |
| | ----- square meters per hectare ----- | | | |
| Saplings: | | | | |
| Growing stock | 3.0 | 4.2 | 3.9 | 2.1 |
| Rough and rotten | .9 | 1.8 | 1.5 | 1.3 |
| Total | 3.9 | 6.0 | 5.5 | 3.4 |
| | | | | |
| Poletimber trees: | | | | |
| Growing stock | 5.7 | 12.0 | 10.5 | 2.8 |
| Rough and rotten | .7 | .5 | .5 | 2.2 |
| Total | 6.4 | 12.5 | 11.0 | 5.0 |
| | | | | |
| Sawtimber trees: | | | | |
| Growing stock | 18.2 | 6.7 | 9.6 | 3.2 |
| Rough and rotten | .9 | .9 | .7 | 1.9 |
| Total | 19.1 | 7.6 | 10.5 | 5.1 |
| | | | | |
| All growing stock | 27.0 | 22.9 | 24.0 | 8.2 |
| All rough and rotten | 2.5 | 3.1 | 3.0 | 5.3 |
| All live trees | 29.5 | 26.1 | 27.0 | 13.5 |

¹Totals may not add due to rounding.

Birdsey, R. A.; Jiménez, D. The forests of Toro Negro. Res. Pap. SO-222. New Orleans, LA: U.S. Department of Agriculture, Forest Service, Southern Forest Experiment Station; 1985. 29 p.

The Toro Negro region of Puerto Rico is 61 percent forested with 20,100 hectares of timberland and 2,300 hectares of other forest land. *Eucalyptus robusta* accounts for 37 percent of the growing stock volume in the public forest segment. Most eucalyptus plantations in the public forest are ready for harvest and regeneration. Private timberland has adequate sapling stocking which could be released.

Additional keywords: forest inventory, Puerto Rico, timber volume, forest area, tropical forest management.