Forestry Department
Food and Agriculture Organization of the United Nations

GLOBAL FOREST RESOURCES ASSESSMENT 2010

COUNTRY REPORT

PUERTO RICO

FRA2010/168
Rome, 2010

The Forest Resources Assessment Programme

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

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

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

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

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Introduction

(The following introduction is excerpted from Brandeis, T. J., E. H. Helmer, and S. N. Oswalt. 2007. The Status of Puerto Rico's Forests, 2003. Resource Bulletin SRS-119, USDA Forest Service Southern Research Station, Asheville, NC, p. 75.)

The Commonwealth of Puerto Rico consists of the islands of Puerto Rico, Vieques, Culebra, Mona, and a number of smaller islands centered on the geographic coordinates 18° 15' N by 66° 30' W. Many researchers have pointed out the relationships between the islands' rugged topography, climatic gradients, and forest vegetation. Forest vegetation reflects the marked environmental and climatic gradients brought about by the interaction between Trade Winds and abrupt elevation changes. Birdsey and Weaver (1982) and Ewel and Whitmore (1973) give excellent descriptions of the forest associations found on Puerto Rico. Their descriptions follow the Holdridge life zone model, which defines ecological life zones using mean annual precipitation and mean annual bio-temperature (Ewel and Whitmore 1973). Holdridge life zone associations are commonly used in Puerto Rico and have been the basis for reporting forest categories in the previous forest inventories.

The forested life zones found on mainland Puerto Rico are subtropical dry forest, subtropical moist forest, subtropical wet forest, subtropical rain forest, subtropical lower montane wet forest and subtropical lower montane rain forest (Ewel and Whitmore 1973, Birdsey and Weaver 1982). Subtropical dry forest conditions predominate on the outlying islands of Vieques, Culebra, and Mona with some subtropical moist forest found at higher elevations on Vieques. Mangrove forests are found on Puerto Rico, Vieques and Culebra.

The value of the islands' forests extends far beyond any direct monetary benefits coming from the harvest of forest products. A well-forested watershed will retain more freshwater, speeding aquifer recharge, which is a critical issue throughout the Caribbean. Forest cover stabilizes soils on the frequently steep, erodable slopes, keeping sediments from damaging coastal coral reefs and regulating freshwater run-off that affects estuarine and coastal marine ecosystems. Through these hydrological mechanisms, forests directly affect many island economic activities such as fishing and tourism that depend on healthy coastal marine ecosystems. Despite the widespread, serious deforestation and human-impacts, Caribbean forests are recognized as global biodiversity "hot spots" due to their diversity and concentrations of endemic species (Myers et al. 2000, Helmer et al. 2002). Puerto Rico's public forest system protects relatively large areas with examples of most of the major Caribbean forest types, making them not only a locally valuable resource, but a globally valuable one as well. These public forests also provide recreational and ecotourism resources for an increasingly urbanized population and a growing international tourism sector of the economy.

Population growth over the past two decades has meant that, despite their ecological significance and importance to the sustainable development of the islands, Puerto Rican forests are currently being cleared for urban development at increasing rates (López et al. 2001, Ramos-Gonzalez et al. 2003, 2005). With a population of 3.9 million people, an average km^2 holds 443 people and 2.9 km of road (Central Intelligence Agency 2006).

Past forest inventories have shown an overall forest area increase on mainland Puerto Rico due to natural regeneration on abandoned agricultural land. Most of the abandonment has been in rugged mountainous areas (60 percent of the stocked timberland in 1980 occurred in areas with slopes greater than 45 percent) where agriculture was difficult to sustain and in most cases this resulted in severe soil erosion (Birdsey and Weaver 1982). Franco et al. (1997) attributed the increase of forest cover between the 1980 and 1990 inventories to continued reversion on abandoned cropland and pastures, which still exceeded the losses of forest cover from conversion to non-forest land uses. Coffee shade declined by about one half as abandoned stands were reclassified as secondary forest or were converted to other agricultural uses such as full-sun coffee production (Franco et al. 1997).

Forest structure also reflected the young, recovering nature of Puerto Rico's forests. Overall, stands were characterized as understocked, with low basal areas and relatively little volume in commercially valuable trees with good form. Younger, smaller trees predominated in the many pole and sapling-size stands found on abandoned cropland and pasture that had recently (< 30 years) reverted to secondary forest. Larger, older trees that provide sawtimber were most frequently found in stands managed for coffee shade. These stands were categorized as understocked, consisting of sapling-size natural regeneration beneath an overstory of relatively few large, open-grown, rough trees (Anderson et al. 1982, Birdsey and Weaver 1982). The inventories clearly illustrated the development and maturing of Puerto Rico's forests over that 10 year period. Franco et al. (1997)

highlight the substantial increases in basal areas, improved stocking, doubling of average volume per hectare, and decreased losses due to poor form as stands previously classified as poletimber-size advanced to sawtimber-size.

Puerto Rico's tree species richness stands out even when considering that the previous forest inventories encountered only a portion of the total tree species native or introduced to the island (Little et al. 1974 lists 750 tree species in Puerto Rico and the U.S. Virgin Islands). The 1980 inventory tallied 189 species and the 1990 inventory tallied 199 species. Despite the overall species richness of the forests, only 10 species accounted for approximately one-half of the basal area recorded in both 1980 and 1990 (Birdsey and Weaver 1982, Franco et al. 1997). The vast majority of the trees species found by inventory crews were encountered infrequently.
The tree species mix found in Puerto Rico's secondary forests as described by the previous inventories clearly reflected their relatively young age and past land uses. Fast-growing species commonly found in the early stages of tropical forest succession such as pumpwood (*Cecropia schreberiana* Miq.), yuquilla (S*chefflera morototonii* (Aubl.) Maguire, Steyermark & Frodin), and loblolly sweetwood (*Ocotea leucoxylon* (Sw.) Mez.) are frequently encountered. The importance of species introduced for coffee shade, fruit production, or as ornamentals is demonstrated by the high frequency and high basal areas of Malabar plum (*Syzygium jambos* (L.) Alston), African tuliptree (*Spathodea campanulata* Beauv.), and mango (*Mangifera indica* L.). African tuliptree shows a notable increase in frequency and basal area over the 10-year period between the two inventories (Franco et al. 1997). The decreasing frequency and basal areas from 1980 to 1990 of shade coffee tree species, particularly river koko (*Inga vera* Willd.), sacky sac bean (*Inga laurina* (Sw.) Willd.) and coffee (*Coffea* spp.), reflects the abandonment of this agroforestry and senescence of older coffee shade trees.

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1 Table T1 – Extent of Forest and Other wooded land

1.1 FRA 2010 Categories and definitions

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

1.2 National data

1.2.1 Data sources

References to sources of information	Quality (H/M/L)	Variable(s)	Year(s)	Additional comments
Birdsey, R. A., and P. L. Weaver. 1982. The forest resources of Puerto Rico. Resource Bulletin SO-85, USDA Forest Service Southern Forest Experiment Station, New Orleans, Louisiana. pp. 56	H	Forest cover Volume	1980	Forest inventory report
Franco, P. A., P. L. Weaver, and S. Eggen-McIntosh. 1997. Forest resources of Puerto Rico, 1990. Southern Resource Bulletin SRS-22, USDA Forest Service Southern Research Station, Asheville, North Carolina. pp. 45	H	Forest cover Volume	1990	Forest inventory report
Brandeis, T. J., E. H. Helmer, and S. N. Oswalt. 2007. The Status of Puerto Rico's Forests, 2003. Resource Bulletin SRS-119, USDA Forest Service Southern Research Station, Asheville, NC. pp. 75	H	Forest cover Volume Biomass	2003	Forest inventory report
FAOSTAT	H	Inland water	All	

1.2.2 Classification and definitions

The forest inventory definition used is the same as that for FRA 2010. Below are additional forest type and land cover class definitions that have been used in the forest inventories of 1980, 1990 and 2003. The forest inventories do not measure other forested land or trees on other land uses.

National class	Definition
Subtropical lower montane wet and rain forest	Found in areas with elevations between 700 and 1000 meters. Forest types and their typical species include the palo colorado forest type (*Cyrilla racemiflora* L., *Ocotea spathulata* Mez., *Micropholis chrysophylloides* Pierre, and *Micropholis garciniifolia* Pierre), the elfin forest type (*Eugenia borinquensis* Britton, *Tabebuia rigida* Urban, *Weinmannia pinnata* L., and *Calycogonium squamulosum* Cogn.), and the palm brake forest type (*Prestoea montana* (Graham) Nichols.).
Subtropical dry forest	Found in areas with 600 to 1100 mm of annual precipitation. *Bursera simaruba* (L.) Sarg., *Bucida buceras* L., *Cephalocereus royenii* (L.) Britton, and *Guaiacum officinale* L. are species typical of Puerto Rican dry forest. The more heavily-disturbed dry forest areas have numerous, smaller stemmed *Leucaena leucocephala* (Lam.) deWit, *Prosopis juliflora* (Sw.) DC., *Acacia macracantha* Humb. & Bonpl., and *Acacia farnesiana* (L.) Willd. individuals.
Subtropical moist forest	Found in areas with 1000 to 2200 mm of annual precipitation. The subtropical moist life zone is the most extensive on Puerto Rico and covers a wide variety of soil parent materials, topographic classes, and land uses that give rise to highly diverse species mixtures that typically include *Tabebuia heterophylla* (DC.) Britton, *Spathodea campanulata* Beauv., *Guarea guidonia* (L.) Sleumer, *Andira inermis* (W. Wright) Kunth ex DC., *Roystonea borinquena* O.F. Cook, *Mangifera indica* L., *Cecropia peltata* L., *Schefflera morototonii* (Aubl.) Maguire, Steyermark & Frodin, and species of the *Nectandra*, *Ocotea*, and *Coccoloba* genera.
Subtropical wet and rain forest	Found in areas with 2000 to 4000 mm of annual precipitation. *Dacryodes excelsa* Vahl., *Sloanea berteriana* Choisy, and *Manilkara bidentata* (A.DC.) are species indicative of the tabonuco forest type. *Cecropia peltata* L., *Schefflera morototonii* (Aubl.) Maguire, Steyermark & Frodin, and *Ochroma lagopus* Sw. are also common in wet forest stands in early stages of succession or recovery from disturbance. Wet forest shade coffee plantations hold species such as *Guarea guidonia* (L.) Sleumer, *Inga laurina* (Sw.) Willd., Inga vera Willd., and *Erythrina poeppigiana* (Walp.) O.F. Cook. Palm forest characterized by *Prestoea montana* (Graham) (Nichols.) occupies higher elevations falling in the subtropical rain forest zone.
Mangrove	Mangrove forests comprised of *Rhizophora mangle* L., *Avicennia nitidia* Jacq., *Laguncularia racemosa* (L.) Gaertn. f., and *Conocarpus erectus* L. are found along the coastlines and estuaries.
Secondary	Forest land resulting from the abandonment of cropland or pasture, and forest resulting from regeneration of previously cutover or disturbed forest land
Abandoned coffee shade	Secondary forest land resulting from the abandonment of coffee production under shade trees.
Active coffee shade	A multi-story, multi-crop system used principally for the production of coffee. An upper story of shade trees is characteristic.
Upper mountain	This is the local "colorado" forest type with *Cyrilla racemiflora* usually, but not necessarily, dominant. Found in the subtropical lower montane wet forest life zone.
Palm	Nearly pure stands of *Prestoea montana* which form in upper mountain regions.
Dwarf	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 then 7 meters tall.
Xeric scrub	Fine woody vegetation generally less then 10 meters tall at maturity, found under dry conditions typical of the subtropical dry life zone and certain serpentine and limestone soils.

1.2.3 Original data

Original forest area data comes from the USDA Forest Service inventories of Puerto Rico done in 1980 (Birdsey and Weaver 1982), 1990 (Franco et al. 1997) and 2003 (Brandeis et al. 2007). The forest definition used by the forest inventories at all three points in time was the same as that for FRA 2010 for all forest types and land cover classes. Forest types and land cover classes categories in 1990 were different from those used in 1980 and 2003, however.

The 1990 forest inventory used land cover classes instead of the Holdridge forest life zones and forest types used in 1980 and 2003. These land cover classes and associated forest areas appear in the original data table below.

Land cover class	1990 (ha)
Secondary	197,500
Abandoned coffee shade	39,700
Active coffee shade	13,800
Upper mountain	2,300
Palm	1,800
Dwarf	1,800
Xeric scrub	25,900
Mangrove	4,700
Total	**287,500**

Only the 1990 mangrove land cover class and mangrove forest type of 2003 are directly comparable. The original data below show forest area trends over the 23 year period covered by the 3 forest inventories.

	Measured forest areas (ha)		
Forest type	1980	1990	2003
Subtropical dry	40,500	n.a.	50,346
Subtropical moist	122,400	n.a.	258,861
Subtropical wet/rain	105,000	n.a.	161,503
Lower montane wet/rain	10,800	n.a.	11,722
Mangrove	n.a.	4,700	7,920
Total	**278,700**	**287,400**	**490,352**

1.3 Analysis and processing of national data

1.3.1 Calibration

Although there is a slight difference (4 ha) in the USDA Forest Service (886,996 ha) and FAOSTAT (887,000 ha) total land areas for Puerto Rico and outlying islands, a correction factor (1.00000451) was not applied to the estimates.

1.3.2 Estimation and forecasting

The following annual change per hectare by forest type figures were applied to the most current forest cover estimate (2003) to estimate forest area for year 2000 and project forest area to the 2005 and 2010 reporting years. For 1990, original data were used directly.

Survey unit	Annual change (ha/yr)	Projected forest areas (ha) 2000	2005	2010
Subtropical dry	428	49,062	51,202	53,343
Subtropical moist	5,933	241,062	270,727	300,393
Subtropical wet/rain	2,457	154,133	166,416	178,700
Lower montane wet/rain	40	11,602	11,802	12,003
Mangrove	0	7,920	7,920	7,920
Total	**9,202**	**463,778**	**508,068**	**552,357**

1.3.3 Reclassification into FRA 2010 categories

All of the national forest classes, (which are based on Holdridge life zones), fully correspond to the FRA forest category. The area of Other land was derived from total land area less area of forest.

1.4 Data for Table T1

FRA 2010 categories	Area (1000 hectares) 1990	2000	2005	2010
Forest	287	464	508	552
Other wooded land	0	0	0	0
Other land	600	423	379	335
...of which with tree cover	n.a.	n.a.	n.a.	n.a.
Inland water bodies	8	8	8	8
TOTAL	**895**	**895**	**895**	**895**

1.5 Comments to Table T1

Variable / category	Comments related to data, definitions, etc.	Comments on the reported trend
Forest	All of the national forest classes, (which are based on Holdridge life zones), correspond to the FRA forest category. The 1990 inventory used another set of classes and data for 1990 could therefore not be fully harmonized with the other reporting years.	The jump in the trend between 1990 and 2000 are likely due to the different classification systems for the data sets and does not necessarily reflect a real trend. Instead, the annual change in forest area from 1980 to 2003 was used to estimate an annual rate of change as the classification system was the same in both data sets. Although there is some information on change by forest type, the forest inventories have not consistently reported forest area on the same forest types. Therefore, only the total annual change will be used for estimation and forecasting. Mangrove forest cover, in particular, has not been estimated separately in all inventory years.
Other wooded land	The forest inventories did not quantify other wooded land, an unknown area of Other wooded land may be reported under the category Other land.	

Other land	All land that did not meet the definition of forest was considered non-forest, or according the FRA terminology, other land. The reported area of Other land may contain an unknown area of Other wooded land.	
Other land with tree cover	Again, no data available for other land with tree cover because these lands were not included in the forest inventories.	
Inland water bodies	FAOSTAT figure reported.	

Other general comments to the table
Note that the forest area estimates of 1980 and 1990 do not include the Puerto Rican islands of Vieques, Culebra, Mona and other smaller islands. These smaller islands were included in the 2003 forest inventory, however. Because we do not have information on these smaller islands prior to 2003, for this report only the mainland Puerto Rico forest area estimates will be presented. The FRA 2010 report for Puerto Rico uses substantially different forest area data than that used in 2005. The current report uses data entirely taken from the USDA Forest Service's Forest Inventory and Analysis (FIA) forest inventories of the islands. The 2003 forest area estimates were not ready at the time of FRA 2005, so the FRA 2005 forest area estimates came from Landsat ETM+ satellite image classifications done on imagery taken in 1991 and 2004 by Kennaway and Helmer. The 1991 forest area satellite image estimates (403,969 ha) differs from the FIA forest area estimates published in Franco et al. 1997 (287,000 ha) and used in FRA 2000. However, the 2000 satellite estimates of 406,846 ha of forest also differ from the 2003 FIA estimates of 490,352 ha. For FRA 2010, I have chosen to use only the FIA data for forest area estimation and forecasting. The methodology has been relatively consistent since 1980, and although there have been doubts expressed about the accuracy of the 1990 forest area estimate, the 23 year trend (1980 to 2003) should be relatively reliable.

Expected year for completion of ongoing/planned <u>national</u> forest inventory and/or RS survey / mapping	
Field inventory	2010
Remote sensing survey / mapping	2010

2 Table T4 – Forest characteristics

2.1 FRA 2010 Categories and definitions

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

2.2 National data

2.2.1 Data sources

References to sources of information	Quality (H/M/L)	Variable(s)	Year(s)	Additional comments
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Active coffee shade	A multi-story, multi-crop system used principally for the production of coffee. An upper story of shade trees is characteristic.
Upper mountain	This is the local "colorado" forest type with *Cyrilla racemiflora* usually, but not necessarily, dominant. Found in the subtropical lower montane wet forest life zone.
Palm	Nearly pure stands of *Prestoea montana* which form in upper mountain regions.
Dwarf	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 then 7 meters tall.
Xeric scrub	Fine woody vegetation generally less then 10 meters tall at maturity, found under dry conditions typical of the subtropical dry life zone and certain serpentine and limestone soils.

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Subtropical dry	40,500	n.a.	50,346
Subtropical moist	122,400	n.a.	258,861
Subtropical wet/rain	105,000	n.a.	161,503
Lower montane wet/rain	10,800	n.a.	11,722
Mangrove	n.a.	4,700	7,920
Total	**278,700**	**287,400**	**490,352**

2.3 Analysis and processing of national data

2.3.1 Calibration

Although there is a slight difference (4 ha) in the USDA Forest Service (886,996 ha) and FAO STAT (887,000 ha) total land areas for Puerto Rico and outlying islands, a correction factor (1.00000451) was not applied to the estimates.

2.3.2 Estimation and forecasting

The following annual change per hectare by forest type figures were applied to the most current forest cover estimate (2003) to estimate past forest area and project forest area into the future.

Survey unit	Annual change (ha/yr)	Projected forest areas (ha) 2000	2005	2010
Subtropical dry	428	49,062	51,202	53,343
Subtropical moist	5,933	241,062	270,727	300,393
Subtropical wet/rain	2,457	154,133	166,416	178,700
Lower montane wet/rain	40	11,602	11,802	12,003
Mangrove	0	7,920	7,920	7,920
Total	**9,202**	**463,778**	**508,068**	**552,357**

2.3.3 Reclassification into FRA 2010 categories

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

2.4 Data for Table T4

Table 4a

FRA 2010 Categories	Forest area (1000 hectares) 1990	2000	2005	2010
Primary forest	0	0	0	0
Other naturally regenerated forest	287	464	508	552
...of which of introduced species	n.a.	n.a.	n.a.	n.a.
Planted forest	0	0	0	0
...of which of introduced species	0	0	0	0
TOTAL	287	464	508	552

Table 4b

FRA 2010 Categories	Area (1000 hectares) 1990	2000	2005	2010
Rubber plantations (Forest)	0	0	0	0
Mangroves (Forest and OWL)	n.a.	7.920	7.920	7.920
Bamboo (Forest and OWL)	n.a.	n.a.	n.a.	n.a.

2.5 Comments to Table T4

Variable / category	Comments related to data, definitions, etc.	Comments on the reported trend
Primary forest	Although there is some forest in Puerto Rico that could be considered primary forest, we cannot quantify it due to its fragmentation and unknown history.	Comments on the general forest area trends apply.
Other naturally regenerating forest	Almost all forest in Puerto Rico is naturally regenerated secondary forest that has been impacted by human activities. The reported area may contain an unknown area of Planted forest. Note that the forest area estimates of 1980 and 1990 do not include the Puerto Rican islands of Vieques, Culebra, Mona and other smaller islands. These smaller islands were included in the 2003 forest inventory. Therefore, for this report only the mainland Puerto Rico forest area estimates will be presented.	Comments on the general forest area trends apply. The annual change in forest area from 1980 to 2003 was used to estimate an annual rate of change. Although there is some information on change by forest type, the forest inventories have not consistently reported forest area on the same forest types. Therefore, only the total annual change will be used for estimation and forecasting. Mangrove forest cover, in particular, has not been estimated separately in all inventory years.
Planted forest	There are planted forests in Puerto Rico, but they are of such a minor extent that they are not captured as separate quantities by the forest inventory.	
Rubber plantations	There are no rubber plantations in Puerto Rico.	
Mangroves	Mangrove forest is found along the coast of mainland Puerto Rico.	The 2003 forest inventory results show 7,920 ha of mangrove forest on mainland Puerto Rico, while the 1990 forest shows 4,700 ha. There is reason to doubt the accuracy of the 1990 mangrove forest estimates, therefore I have chosen to not project an increase in mangrove forest and have used the 2003 estimate only.
Bamboo	There are bamboo stands in Puerto Rico, but they are not considered forest by the forest inventory and therefore not quantified. In any case, they are of limited extent, primarily along riparian areas.	

Other general comments to the table

3 Table T6 – Growing stock

3.1 FRA 2010 Categories and definitions

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

3.2 National data

3.2.1 Data sources

References to sources of information	Quality (H/M/L)	Variable(s)	Year(s)	Additional comments
Birdsey, R. A., and P. L. Weaver. 1982. The forest resources of Puerto Rico. Resource Bulletin SO-85, USDA Forest Service Southern Forest Experiment Station, New Orleans, Louisiana. pp. 56	H	Forest cover Volume	1980	Forest inventory report
Franco, P. A., P. L. Weaver, and S. Eggen-McIntosh. 1997. Forest resources of Puerto Rico, 1990. Southern Resource Bulletin SRS-22, USDA Forest Service Southern Research Station, Asheville, North Carolina. pp. 45	H	Forest cover Volume	1990	Forest inventory report
Brandeis, T. J., E. H. Helmer, and S. N. Oswalt. 2007. The Status of Puerto Rico's Forests, 2003. Resource Bulletin SRS-119, USDA Forest Service Southern Research Station, Asheville, NC. pp. 75	H	Forest cover Volume Biomass	2003	Forest inventory report

3.2.2 Classification and definitions

The USDA Forest Service's FIA program uses the following definitions for growing stock ad growing stock volume.

National class	Definition
Growing stock	Living trees of commercial species classified as sawtimber, poletimber, saplings, and seedlings. For a tree to be considered growing stock, one-third or more of the gross volume in its saw-log section must meet grade, soundness, and size requirements for commercial logs, or the tree must have the potential to meet these requirements if it is poletimber size with 12.5 cm ≤ d.b.h. ≤ 27.5 cm.
Growing stock volume	The m^3 volume of sound wood in growing-stock trees at least 12.5 cm d.b.h. from a 30-cm stump to a minimum 10-cm top d.o.b. of the central stem, measured outside of bark.

3.2.3 Original data

Data from the 2003 forest inventory for mean merchantable growing stock volume, outside bark in cubic meters, per hectare by forest type is presented below.

Forest type	Volume/ha
Subtropical dry	2.576
Subtropical moist	30.136
Subtropical wet/rain	53.656
Lower montane wet/rain	46.482
Mangrove	0.525
All groups	**33.852**

Using the measured forest area in 2003 and the per hectare growing stock volume values in cubic meters, total growing stock volume was calculated as presented below.

	Measured forest area (ha)	Measured GS volume (m^3)
Survey unit	**2003**	**2003**
Puerto Rico		
Subtropical dry	50,346	129,691
Subtropical moist	258,861	7,801,035
Subtropical wet/rain	161,503	8,665,605
Lower montane wet/rain	11,722	544,862
Mangrove	7,920	4,158
Grand total	**490,352**	**17,145,351**

3.3 Analysis and processing of national data

3.3.1 Calibration

Although there is a slight difference (4 ha) in the USDA Forest Service (886,996 ha) and FAO STAT (887,000 ha) total land areas for Puerto Rico and outlying islands, a correction factor (1.00000451) was not applied to the estimates.

3.3.2 Estimation and forecasting

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

	Projected GS volume (m^3)			
Survey unit	**1990**	**2000**	**2005**	**2010**
Puerto Rico				
Subtropical dry	n.a.	126,383	131,897	137,411
Subtropical moist	n.a.	7,264,637	8,158,634	9,052,632
Subtropical wet/rain	n.a.	8,270,163	8,929,233	9,588,304
Lower montane wet/rain	n.a.	539,272	548,589	557,905
Mangrove	n.a.	4,158	4,158	4,158
Grand total	**9,729,065**	**16,204,612**	**17,772,511**	**19,340,409**

3.3.3 Reclassification into FRA 2010 categories

The total volume figures above are equivalent to total growing stock as defined in the FRA 2010 categories.

3.4 Data for Table T6

Table 6a – Growing stock

FRA 2010 category	Volume (million cubic meters over bark)							
	Forest				Other wooded land			
	1990	2000	2005	2010	1990	2000	2005	2010
Total growing stock	9.729	16.205	17.773	19.340	n.a.	n.a.	n.a.	n.a.
... of which coniferous	0.000	0.000	0.000	0.000	n.a.	n.a.	n.a.	n.a.
... of which broadleaved	9.729	16.205	17.773	19.340	n.a.	n.a.	n.a.	n.a.
Growing stock of commercial species	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.

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

FRA 2010 category / Species name			Growing stock in forest (million cubic meters)			
Rank	Scientific name	Common name	1990	2000	2005	2010
1st	*Spathodea campanulata*	African tuliptree	3.075	5.122	5.618	6.113
2nd	*Guarea guidonia*	American muskwood	0.712	1.186	1.301	1.416
3rd	*Cecropia schreberiana*	pumpwood	0.705	1.175	1.288	1.402
4th	*Dacryodes excelsa*	candletree	0.450	0.750	0.823	0.895
5th	*Calophyllum antillanum*	Antilles calophyllum	0.315	0.525	0.576	0.627
6th	*Andira inermis*	cabbagebark tree	0.312	0.520	0.571	0.621
7th	*Eucalyptus robusta*	swampmahogany	0.295	0.492	0.539	0.587
8th	*Erythrina poeppigiana*	mountain immortelle	0.265	0.442	0.485	0.528
9th	*Inga laurina*	sacky sac bean	0.240	0.399	0.438	0.477
10th	*Schefflera morototonii*	matchwood	0.195	0.324	0.355	0.387
Remaining			3.163	5.269	5.778	6.288
TOTAL			**9.729**	**16.205**	**17.773**	**19.340**

Table 6c – Specification of threshold values

Item	Value	Complementary information
Minimum diameter (cm) at breast height[1] of trees included in growing stock (X)	12.5 cm	
Minimum diameter (cm) at the top end of stem for calculation of growing stock (Y)	10.0 cm	
Minimum diameter (cm) of branches included in growing stock (W)	n.a.	
Volume refers to "above ground" (AG) or "above stump" (AS)	AS	

3.5 Comments to Table T6

Variable / category	Comments related to data, definitions, etc.	Comments on the reported trend
Total growing stock	Growing stock represents all species of trees with DBH ≥ 12.5 cm except for palms and tree ferns. Diameter at breast height (DBH) refers to diameter over bark measured at a height of 1.30 m above ground level or 30 cm above buttresses if these are higher than 1 m. Mean per hectare growing stock outer bark volume was estimated for dry, moist, wet, lower montane and mangrove forest types. Mean per hectare volume values for each forest type were then multiplied by the number of hectares of each respective forest type for the years 1990, 2000, 2005 and 2010. Forest area for each forest type was estimated and forecast as described in the documentation for table T1. Projection was not done by life zone for 1990 because that forest inventory did not present values for these forest types See table 1 documentation for more details.	Rather than use the growing stock volume figures presented in the 1990 forest inventory report of Franco et al. (1997), I have chosen to back-project the 1990 growing stock volume using the 2003 forest inventory per hectare growing stock volume values. (That is, I multiplied the total 1990 forest acreage by the 2003 average growing stock volume per hectare value.) This was done because the 1990 forest inventory did not measure forest that was considered "non-productive" like subtropical dry forest, so field data was skewed toward forests with greater growing stock volume. The 2003 inventory results included all lands and therefore the growing stock volume per hectare values from 2003 more accurately reflect island-wide volume levels. This estimation and forecasting assumes no change in per hectare values over the time periods. It also assumes there has been no change in mangrove areas or mangrove forest per hectare growing stock volumes.
Growing stock of broadleaved / coniferous	Essentially all growing stock in Puerto Rico is broadleaved.	
Growing stock of commercial species	Commercial growing stock is not defined due to the lack of comprehensively defined commercial markets for wood products in Puerto Rico.	
Growing stock composition		

Other general comments to the table

4 Table T7 – Biomass stock

4.1 FRA 2010 Categories and definitions

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

4.2 National data

4.2.1 Data sources

References to sources of information	Quality (H/M/L)	Variable(s)	Year(s)	Additional comments
Birdsey, R. A., and P. L. Weaver. 1982. The forest resources of Puerto Rico. Resource Bulletin SO-85, USDA Forest Service Southern Forest Experiment Station, New Orleans, Louisiana. pp. 56	H	Forest cover Volume	1980	Forest inventory report
Franco, P. A., P. L. Weaver, and S. Eggen-McIntosh. 1997. Forest resources of Puerto Rico, 1990. Southern Resource Bulletin SRS-22, USDA Forest Service Southern Research Station, Asheville, North Carolina. pp. 45	H	Forest cover Volume	1990	Forest inventory report
Brandeis, T. J., E. H. Helmer, and S. N. Oswalt. 2007. The Status of Puerto Rico's Forests, 2003. Resource Bulletin SRS-119, USDA Forest Service Southern Research Station, Asheville, NC. pp. 75	H	Forest cover Volume Biomass	2003	Forest inventory report

4.2.2 Classification and definitions

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

4.2.3 Original data

The original data for above and below ground live tree biomass per hectare as measured by the 2003 forest inventory appears below.

Per hectare above-ground biomass of live trees by forest type

Forest type	Biomass (Mg/ha)
Subtropical dry	35.18
Subtropical moist	87.75
Subtropical wet/rain	104.09
Lower montane wet/rain	142.91
Mangrove	44.75
All groups	86.41

Per hectare below-ground biomass of live trees by forest type

Forest type	Biomass (Mg/ha)
Subtropical dry	6.16
Subtropical moist	13.52
Subtropical wet/rain	14.08
Lower montane wet/rain	19.07
Mangrove	6.29
All groups	12.68

For dead wood, which includes standing dead trees and down woody material on the forest floor, the original data from the 2003 forest inventory appears below. Note that the down woody material original data was a carbon estimate that was multiplied by 2 to convert to a biomass estimate.

Per hectare dead woody biomass by forest type

Forest type	Biomass (Mg/ha)
Subtropical dry	8.040
Subtropical moist	23.060
Subtropical wet/rain	26.823
Lower montane wet/rain	2.820
Mangrove	40.880
All groups	23.800

4.3 Analysis and processing of national data

4.3.1 Calibration

Although there is a slight difference (4 ha) in the USDA Forest Service (886,996 ha) and FAO STAT (887,000 ha) total land areas for Puerto Rico and outlying islands, a correction factor (1.00000451) was not applied to the estimates.

4.3.2 Estimation and forecasting

The per hectare values from the original data (2003 forest inventory) were multiplied by the forest area for each of the projected years for aboveground live, belowground live and dead woody biomass.

Aboveground live tree biomass								
	Projected forest areas				Estimated population values			
Survey unit	**1990**	**2000**	**2005**	**2010**	**1990**	**2000**	**2005**	**2010**
Puerto Rico								
Subtropical dry	n.a.	49,062	51,202	53,343	n.a.	1,725,992	1,801,292	1,876,593
Subtropical moist	n.a.	241,062	270,727	300,393	n.a.	21,153,168	23,756,310	26,359,451
Subtropical wet/rain	n.a.	154,133	166,416	178,700	n.a.	16,043,708	17,322,273	18,600,838
Lower montane wet/rain	n.a.	11,602	11,802	12,003	n.a.	1,658,005	1,686,649	1,715,293
Mangrove	n.a.	7,920	7,920	7,920	n.a.	354,420	354,420	354,420
Grand total	**287,400**	**463,778**	**508,068**	**552,357**	**24,834,234**	**40,935,293**	**44,920,944**	**48,906,595**

Belowground live tree biomass								
	Projected forest areas				Estimated population values			
Survey unit	**1990**	**2000**	**2005**	**2010**	**1990**	**2000**	**2005**	**2010**
Puerto Rico								
Subtropical dry	n.a.	49,062	51,202	53,343	n.a.	302,220	315,405	328,590
Subtropical moist	n.a.	241,062	270,727	300,393	n.a.	3,259,155	3,660,231	4,061,308
Subtropical wet/rain	n.a.	154,133	166,416	178,700	n.a.	2,170,193	2,343,142	2,516,090
Lower montane wet/rain	n.a.	11,602	11,802	12,003	n.a.	221,245	225,067	228,890
Mangrove	n.a.	7,920	7,920	7,920	n.a.	49,817	49,817	49,817
Grand total	**287,400**	**463,778**	**508,068**	**552,357**	**3,644,232**	**6,002,630**	**6,593,663**	**7,184,695**

Standing and down woody dead material biomass								
	Projected forest areas				Estimated population values			
Survey unit	**1990**	**2000**	**2005**	**2010**	**1990**	**2000**	**2005**	**2010**
Puerto Rico								
Subtropical dry	n.a.	49,062	51,202	53,343	n.a.	394,456	411,665	428,875
Subtropical moist	n.a.	241,062	270,727	300,393	n.a.	5,558,884	6,242,969	6,927,054
Subtropical wet/rain	n.a.	154,133	166,416	178,700	n.a.	4,134,289	4,463,761	4,793,233
Lower montane wet/rain	n.a.	11,602	11,802	12,003	n.a.	32,717	33,282	33,847
Mangrove	n.a.	7,920	7,920	7,920	n.a.	323,770	323,770	323,770
Grand total	**287,400**	**463,778**	**508,068**	**552,357**	**6,840,120**	**10,444,115**	**11,475,447**	**12,506,778**

4.3.3 Reclassification into FRA 2010 categories

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

4.4 Data for Table T7

FRA 2010 category	Biomass (million metric tonnes oven-dry weight)							
	Forest				Other wooded land			
	1990	2000	2005	2010	1990	2000	2005	2010
Above-ground biomass	24.834	40.935	44.921	48.907	n.a.	n.a.	n.a.	n.a.
Below-ground biomass	3.644	6.003	6.594	7.185	n.a.	n.a.	n.a.	n.a.
Dead wood	6.840	10.444	11.475	12.507	n.a.	n.a.	n.a.	n.a.
TOTAL	**35.319**	**57.382**	**62.990**	**68.598**	n.a.	n.a.	n.a.	n.a.

4.5 Comments to Table T7

Variable / category	Comments related to data, definitions, etc.	Comments on the reported trend
Above-ground biomass	Aboveground live tree biomass was estimated using several regression equations that can be found in Brandeis, T. J., E. Helmer and S. N. Oswalt. 2007. The Status of Puerto Rico's Forests, 2003. Resource Bulletin SRS-119, USDA Forest Service Southern Research Station, Asheville, NC. pp. 75	
Below-ground biomass	Total oven-dry biomass in kilograms of all live belowground tree parts was estimated using a regression equation that models the relationship between aboveground biomass and belowground biomass from Cairns, M. A., S. Brown, E. H. Helmer, and G. A. Baumgardner. 1997. Root biomass allocation in the world's upland forests. Oecologia 111:1-11.	
Dead wood	Standing dead tree biomass was estimated using the same allometric equations used for live trees. Down woody biomass estimates were calculated by multiplying the carbon estimates by 2. Carbon estimates were derived from methods that appear in Woodall, C., and M. S. Williams. 2005. Sampling protocol, estimation and analysis procedures for down woody materials indicator of the FIA program. General Technical Report NC-256, USDA Forest Service, North Central Research Station, St. Paul, MN. These methods adjust carbon content for degree of decay.	

Other general comments to the table

5 Table T8 – Carbon stock

5.1 FRA 2010 Categories and definitions

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

5.2 National data

5.2.1 Data sources

References to sources of information	Quality (H/M/L)	Variable(s)	Year(s)	Additional comments
Birdsey, R. A., and P. L. Weaver. 1982. The forest resources of Puerto Rico. Resource Bulletin SO-85, USDA Forest Service Southern Forest Experiment Station, New Orleans, Louisiana. pp. 56	H	Forest cover Volume	1980	Forest inventory report
Franco, P. A., P. L. Weaver, and S. Eggen-McIntosh. 1997. Forest resources of Puerto Rico, 1990. Southern Resource Bulletin SRS-22, USDA Forest Service Southern Research Station, Asheville, North Carolina. pp. 45	H	Forest cover Volume	1990	Forest inventory report
Brandeis, T. J., E. H. Helmer, and S. N. Oswalt. 2007. The Status of Puerto Rico's Forests, 2003. Resource Bulletin SRS-119, USDA Forest Service Southern Research Station, Asheville, NC. pp. 75	H	Forest cover Volume Biomass	2003	Forest inventory report

5.2.2 Classification and definitions

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

	for all trees with d.b.h. ≥ 2.5 cm.
Down woody material	Woody pieces of trees and shrubs that have been uprooted (roots no longer support growth) or severed from their root system, are not self-supporting, and are lying on the ground.
Coarse woody debris	Down pieces of wood with a minimum small-end diameter of at least 8 cm and a length of at least 0.9 m (excluding decay class 5). Coarse woody material pieces must be detached from a bole and/or not be self-supported by a root system, and must have a lean angle of more than 45 degrees from vertical. These pieces of down wood comprise the 1,000+ fuel-hour class, also.
Fine woody debris	Down pieces of wood with a diameter ≤8 cm, not including foliage or bark fragments. These pieces of down wood comprise the medium (0.7-8 cm diameter) and small fuel-hour classes (0-0.6 cm diameter), also.

5.2.3 Original data

Original data on forest carbon in live and dead standing trees on a per hectare basis as measured by the 2003 forest inventory is as follows.

Carbon in live and dead standing trees by forest type

Forest life zone	Live tree	Standing dead	Total
Subtropical dry	20.67	0.02	20.69
Subtropical moist	50.63	1.12	51.75
Subtropical wet/rain	59.09	1.08	60.17
Lower montane wet/rain	80.99	1.41	82.40
Mangrove	25.52	4.29	29.81
All groups	49.55	1.01	50.56

Original data on per hectare carbon in down woody materials and the forest floor from the 2003 forest inventory appears below. Carbon content in fine and coarse woody debris is corrected for degree of decay and forest floor carbon estimates come from laboratory analysis of samples collected in the 2003 forest inventory.

Mean carbon (Mg/ha) in down woody materials and forest floor for Puerto Rico by forest-type.

Forest life zone	Fine woody debris	Coarse woody debris	Forest Floor	Total Carbon
Subtropical dry	3.56	0.44	7.69	11.69
Subtropical moist	5.86	4.55	12.55	22.96
Subtropical wet/rain	6.13	6.20	13.12	25.45
Lower montane wet/rain	n.a.	n.a.	n.a.	n.a.
Mangrove	10.64	5.51	15.08	31.23
All groups	6.13	4.76	12.52	23.41

5.3 Analysis and processing of national data

5.3.1 Calibration

Although there is a slight difference (4 ha) in the USDA Forest Service (886,996 ha) and FAO STAT (887,000 ha) total land areas for Puerto Rico and outlying islands, a correction factor (1.00000451) was not applied to the estimates.

5.3.2 Estimation and forecasting

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

Forest floor carbon								
	Projected forest areas				Estimated population values			
Survey unit	**1990**	**2000**	**2005**	**2010**	**1990**	**2000**	**2005**	**2010**
Puerto Rico								
Subtropical dry	n.a.	49,062	51,202	53,343	n.a.	377,285	393,745	410,205
Subtropical moist	n.a.	241,062	270,727	300,393	n.a.	3,025,325	3,397,626	3,769,927
Subtropical wet/rain	n.a.	154,133	166,416	178,700	n.a.	2,021,565	2,182,669	2,343,772
Lower montane wet/rain	n.a.	11,602	11,802	12,003	n.a.	n.a.	n.a.	n.a.
Mangrove	n.a.	7,920	7,920	7,920	n.a.	119,394	119,394	119,394
Grand total	**287,400**	**463,778**	**508,068**	**552,357**	**3,598,248**	**5,543,569**	**6,093,433**	**6,643,298**

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

5.3.3 Reclassification into FRA 2010 categories

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

5.4 Data for Table T8

FRA 2010 Category	Carbon (Million metric tonnes)							
	Forest				Other wooded land			
	1990	**2000**	**2005**	**2010**	**1990**	**2000**	**2005**	**2010**
Carbon in above-ground biomass	12.417	20.468	22.460	24.453	n.a.	n.a.	n.a.	n.a.
Carbon in below-ground biomass	1.822	3.001	3.297	3.592	n.a.	n.a.	n.a.	n.a.
Sub-total: Living biomass	***14.239***	***23.469***	***25.757***	***28.046***	n.a.	n.a.	n.a.	n.a.
Carbon in dead wood	3.420	5.222	5.738	6.253	n.a.	n.a.	n.a.	n.a.
Carbon in litter	3.598	5.544	6.093	6.643	n.a.	n.a.	n.a.	n.a.
Sub-total: Dead wood and litter	***7.018***	***10.766***	***11.831***	***12.897***	n.a.	n.a.	n.a.	n.a.
Soil carbon	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
TOTAL	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.

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

5.5 Comments to Table T8

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

Other general comments to the table