Forestry Department
Food and Agriculture Organization of the United Nations

GLOBAL FOREST RESOURCES ASSESSMENT

COUNTRY REPORTS

NORTHERN MARIANA ISLANDS

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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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Contents

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Introduction

The Commonwealth of the Northern Mariana Islands (CNMI) is a 480 km long archipelago composed of 14 islands that lie in the north Pacific ocean, approximately 2600 km east of Manila. The climate is warm, with little annual variation in temperature, but a distinct dry season extending from January to June. The archipelago lies in a typhoon track and tends to average at least one major storm per year. Owing to this high frequency of disturbance, forests are composed primarily of small-diameter, young trees. Additionally, there has been much human-caused disturbance on the islands of Rota, Tinian, and Saipan, the three largest islands in the commonwealth. In conjunction with the high levels of disturbance, invasive species continue to establish, outcompeting native forest vegetation and changing the composition and structure of forests. Major efforts are under way to restore native forests and eliminate the most damaging invasive species.

Inventory data in this report were derived from a forest inventory conducted January to March, 2004 by a multinational crew that included foresters from the CNMI, American Samoa, and the U.S. Department of Agriculture, Forest Service.

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
Liu, Z., Fischer, L. 2006. Commonwealth of the Northern Mariana Islands Vegetation Mapping Using Very High Resolution Imagery: Methodology. U.S. Department of Agriculture, Forest Service, Pacific Southwest Region, Forest Health Protection. URL: http://www.fs.fed.us/r5/spf/fhp /fhm/landcover/islands/index.shtml	H	Land cover	2005	Data and methods available on the web site. Imagery from two satellite datasets spans 2003-2004. Ground and low altitude aerial attributing and verification conducted in 2005.
Falanruw, M. C., T. G. Cole, and A. H. Ambacher. 1989. Vegetation Survey of Rota, Tinian, and Saipan, Commonwealth of the Northern Mariana Islands. Resource Bulletin PSW-RB-27, USDA Forest Service, Pacific Southwest Forest and Range Experiment Station, Berkeley, CA.	H	Land cover	1976	Maps derived from interpretation of 1976, 1:8,000 black and white aerial photography. Maps were partially field verified in 1984. Data are considered to be from 1976.

1.2.2 Classification and definitions

National class	Definition
Forest land	Land spanning more than 0.5 hectares and a tree canopy cover of more than 10 percent.
Unreserved forest land	Forest land available for wood removals.
Protected forest land	Forest land that is not available for wood removals.
Nonforest urban	Land used primarily for urban purposes.
Nonforest vegetation	Land characterized primarily by non-tree species or <10% canopy cover of trees.
Barren lands	Lands with exposed soil, rock, or sand, devoid of vegetation.
Unknown	Further work is needed to determine land cover.
Water	Inland water bodies generally include major rivers, lakes and water reservoirs.

1.2.3 Original data

1976 **Land class and type**	**Total for Rota, Tinian, Saipan** *Hectares*
Forest:	
Limestone forest	6088
Introduced trees	4313
Casuarina thickets	1403
Atoll forest	37
Mangrove forest	7
Total forest	11848
Secondary vegetation	10111
Agroforest:	
Agroforest	7
Agroforest (w/coconuts)	48
Coconut plantations	1755
Total agroforest	1810
Subtotal forest/agroforest/2ndary veg	**23769**
Nonforest:	
Marsh, fresh	164
Savanna/grassland	3737
Strand	1217
Cropland	332
Urban	915
Barren	293
Water	20
Total Nonforest	6678
Total area	**30447**

2005 **Area by landcover**	Saipan	Rota	Tinian	Total
FOREST		*hectares*		
Native Limestone Forest	103	4428	548	5078
Mixed Introduced Forest	5123	741	2841	8705
Ravine Forest	0	83	0	83
Casuarina Thicket (Forest)	30	0	148	179
Leucaena leucocephala	2091	132	3441	5664
Strand forest	83	101	227	410
Agroforest	34	97	17	148
Agroforest -- coconut	123	231	22	376
Subtotal forested	7587	5812	7244	20643
NONFOREST	0	0	0	0
Barren/Sandy Beach/Bare Rocks	105	37	81	222
Cropland	93	142	134	370
Savanna Complex	515	0	0	515
Other Shrub and Grass	938	1948	2006	4892
Urban Vegetation	1536	303	214	2054
Urban and Built-up	1088	265	407	1759
Wetland	12	0	26	38
Water	78	3	0	80
Subtotal nonforest	4365	2697	2868	9930
Grand Total	11951	8509	10112	30572

	1976 ha	**2005 ha**
Total Forest/Agroforest/Secondary vegetation	23769	20642
Other Land	6678	9849
Inland Water	0	80
Total	**30447**	**30572**

1.3 Analysis and processing of national data

1.3.1 Calibration

FAOSTAT area for the Northern Mariana Islands: 46000 ha
Area in sample from satellite 2005: 30572 ha (includes 80 ha inland water)
Calibration factor 1976 = (46000/30447) = 1.51082
Calibration factor 2005 = (46000/30491) = 1.50864

1.3.2 Estimation and forecasting

	FAO Calibrated Data 1976 (ha)	FAO Calibrated Data 2005 (ha)	Total change in 29 years	Area Δ per year
All forest land	35911	31142	-4769	-164
Other land	10089	14858	4769	164
Inland water	0	0	0	0
	46000	46000		

1.3.3 Reclassification into FRA 2010 categories

1.4 Data for Table T1

FRA 2010 categories	Area (1000 hectares)			
	1990	2000	2005	2010
Forest	33.609	31.964	31.142	30.319
Other wooded land	0	0	0	0
Other land	12.391	14.036	14.858	15.681
...of which with tree cover	n.a.	n.a.	n.a.	n.a.
Inland water bodies	0	0	0	0
TOTAL	46.000	46.000	46.000	46.000

1.5 Comments to Table T1

Variable / category	Comments related to data, definitions, etc.	Comments on the reported trend
Forest	Includes agroforest and secondary vegetation. Secondary vegetation is a post-disturbance land cover that is reverting to forest and may include invasive/non-native tree species.	Figures differ from FRA 2005 owing to availability of newer, more refined land cover map.
Other wooded land	No data available. Other wooded land may occur in the other land category.	
Other land		Figures differ from FRA 2005 owing to availability of newer, more refined land cover map.
Other land with tree cover		
Inland water bodies		Inland water was not reported in FAOSTAT but was mapped in the 2005 satellite interpretation.

Other general comments to the table
Agroforest and secondary forest are included in the totals. FRA 2000 reported 13978 ha of closed forest, 20430 ha of shrubs/trees (secondary vegetation and low growth of summit) and 55 ha of forest fallow (Agroforest). These last two categories were reclassifed as other wooded land for FRA 2000, while secondary vegetation and agroforests were included in the total forest area in this report.

Expected year for completion of ongoing/planned national forest inventory and/or RS survey / mapping	
Field inventory	2003, 2013…
Remote sensing survey / mapping	2005, 2015…

2 Table T3 – Forest designation and management

2.1 FRA 2010 Categories and definitions

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

2.2 National data

2.2.1 Data sources

References to sources of information	Quality (H/M/L)	Variable(s)	Year(s)	Additional comments
Liu, Z., Fischer, L. 2006. Commonwealth of the Northern Mariana Islands Vegetation Mapping Using Very High Resolution Imagery: Methodology. U.S. Department of Agriculture, Forest Service, Pacific Southwest Region, Forest Health Protection. URL: http://www.fs.fed.us/r5/spf/fhp	H	Land cover	2005	Data and methods available on the web site. Imagery from two satellite datasets spans 2003-2004. Ground and low altitude aerial attributing and verification conducted in 2005.

/fhm/landcover/islands/index.shtml				
Falanruw, M. C., T. G. Cole, and A. H. Ambacher. 1989. Vegetation Survey of Rota, Tinian, and Saipan, Commonwealth of the Northern Mariana Islands. Resource Bulletin PSW-RB-27, USDA Forest Service, Pacific Southwest Forest and Range Experiment Station, Berkeley, CA.	H	Land cover	1976	Maps derived from interpretation of 1976, 1:8,000 black and white aerial photography. Maps were partially field verified in 1984. Data are considered to be from 1976.

2.2.2 Classification and definitions

Not available.

2.2.3 Original data

Data from T1 used as input.

2.3 Analysis and processing of national data

No national quantitative data on designated functions are available. Data on forest area were taken from table T1 and assumes all forest land is multiple use.

2.3.1 Reclassification into FRA 2010 categories

Forests on CNMI serve the multiple purposes of protection of soil and water, conservation of biodiversity, and social services, such as recreation and aesthetics. Additionally, some fruits, nuts, and medicines are collected within the forests.

2.4 Data for Table T3

Table 3a – Primary designated function

FRA 2010 Categories	Forest area (1000 hectares)			
	1990	2000	2005	2010
Production	0	0	0	0
Protection of soil and water	0	0	0	0
Conservation of biodiversity	0	0	0	0
Social services	0	0	0	0
Multiple use	33.609	31.964	31.142	30.319
Other (please specify in comments below the table)	0	0	0	0
No / unknown	0	0	0	0
TOTAL	33.609	31.964	31.142	30.319

Table 3b – Special designation and management categories

FRA 2010 Categories	Forest area (1000 hectares)

	1990	2000	2005	2010
Area of permanent forest estate				
Forest area within protected areas				
Forest area under sustainable forest management				
Forest area with management plan				

2.5 Comments to Table T3

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

Other general comments to the table
Agroforest and secondary forest are included in the totals. Forests on CNMI serve the multiple purposes of protection of soil and water, conservation of biodiversity, and social services, such as recreation and aesthetics. Additionally, some fruits, nuts, and medicines are collected within the forests.

3 Table T4 – Forest characteristics

3.1 FRA 2010 Categories and definitions

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

3.2 National data

3.2.1 Data sources

References to sources of information	Quality (H/M/L)	Variable(s)	Year(s)	Additional comments
Liu, Z., Fischer, L. 2006. Commonwealth of the Northern Mariana Islands Vegetation Mapping Using Very High Resolution Imagery: Methodology. U.S. Department of Agriculture, Forest Service, Pacific Southwest Region, Forest Health Protection. URL: http://www.fs.fed.us/r5/spf/fhp /fhm/landcover/islands/index.shtml	H	Land cover	2005	Data and methods available on the web site. Imagery from two satellite datasets spans 2003-2004. Ground and low altitude aerial attributing and verification conducted in 2005.
Falanruw, M. C., T. G. Cole, and A. H. Ambacher. 1989. Vegetation Survey of Rota, Tinian, and Saipan, Commonwealth of the Northern Mariana Islands. Resource Bulletin PSW-RB-27, USDA Forest Service, Pacific Southwest Forest and Range Experiment Station, Berkeley, CA.	H	Land cover	1976	Maps derived from interpretation of 1976, 1:8,000 black and white aerial photography. Maps were partially field verified in 1984. Data are considered to be from 1976.

3.2.2 Original data

1976		2005	
Limestone forest	6088	Native Limestone Forest	5078
		Ravine Forest	83
Mangrove forest	7		
Atoll forest	37		
Casuarina thickets	1403	Casuarina thicket (forest)	179
		Strand forest	410
Native/naturalized subtotal	7535	*Native/naturalized subtotal*	5750
Introduced trees	4313	Mixed Introduced Forest	8705
Agroforest	7	Agroforest	148
Agroforest (w/coconuts)	48	Agroforest -- coconut	376
Coconut plantations	1755		
Secondary vegetation	10111		
		Leucaena leucocephala	5664
Non-native & agroforest subtotal	16234	*Non-native & agroforest subtotal*	14893
Total Forest	23769	Total Forest	20643

3.3 Analysis and processing of national data

3.3.1 Calibration

FAOSTAT area for the Northern Mariana Islands: 46000 ha
Area in sample for forest inventory 2004: 30572 ha (includes 80 ha water)
Calibration factor 1976 = (46000/30447) = 1.51082
Calibration factor 2005 = (46000/30491) = 1.50864

3.3.2 Estimation and forecasting

1976 Forest type	FAO Calibrated Data 1976	2005 Forest type	FAO Calibrated Data 2005	Change in 29 years	Area Δ per year
		hectares			
Limestone forest	9198	Native Limestone Forest	7662		
		Ravine Forest	125		
Mangrove forest	11				
Atoll forest	56				
Casuarina	2120	Casuarina	269		
		Strand forest	619		
Native/naturalized subtotal	11384	*Native/naturalized subtotal*	8674	-2710	-93
Introduced trees	6516	Mixed Introduced Forest	13132		
Agroforest	11	Agroforest	223		
Agroforest (coconuts)	73	Agroforest (coconut)	568		
Coconut plantations	2651				
Secondary vegetation	15276				
		Leucaena leucocephala	8545		
Non-native & agroforest subtotal	24527	*Non-native & agroforest subtotal*	22468	-2059	-71
Total Forest	35911	Total Forest	31142	-4769	-164

3.3.3 Reclassification into FRA 2010 categories

Native/naturalized subtotal = Primary forest
Non-native/agroforest = Planted forest

3.4 Data for Table T4

Table 4a

FRA 2010 Categories	Forest area (1000 hectares)			
	1990	2000	2005	2010
Primary forest	10.075	9.141	8.674	8.207
Other naturally regenerated forest	0	0	0	0
...of which of introduced species	0	0	0	0
Planted forest	23.533	22.823	22.468	22.113
...of which of introduced species	n.a.	n.a.	n.a.	n.a.
TOTAL	**33.609**	**31.964**	**31.142**	**30.319**

Table 4b

FRA 2010 Categories	Area (1000 hectares)			
	1990	2000	2005	2010
Rubber plantations (Forest)	0	0	0	0
Mangroves (Forest and OWL)	0.01	0.01	0.01	0.01
Bamboo (Forest and OWL)	0	0	0	0

3.5 Comments to Table T4

Variable / category	Comments related to data, definitions, etc.	Comments on the reported trend
Primary forest	Contains an unknown area of Other naturally regenerated forest.	Classification methods, definitions, and base imagery have changed between 1976 and 2005. Primary forest losses are real, but error in the estimates is unknown.
Other naturally regenerating forest		
Planted forest		Classification methods, definitions and base imagery have changed between 1976 and 2005. Planted forest losses are real, but error in the estimates is unknown.
Rubber plantations		
Mangroves		
Bamboo		

Other general comments to the table
Agroforest is included in the Planted forest category. Agroforest is an ad-hoc mixture of native, introduced, and naturalized tree species, with a higher proportion of the species mix commonly used for sustenance. Agroforest is a gradation between Plantation and Primary forest.

4 Table T6 – Growing stock

4.1 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.

4.2 National data

4.2.1 Data sources

References to sources of information	Quality (H/M/L)	Variable(s)	Year(s)	Additional comments
Donnegan, J. A., K. Waddell, O. Kuegler, and B. A. Hiserote. 2008. Forest Inventory and Analysis: The Pacific Islands Database for American Samoa, Guam, Palau, the Northern Mariana's, Micronesia, and the Marshall Islands. Database version 2008-1. U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station, Portland, OR.	H	Forest land volume	2003	Data are collected on 0.067 ha plots spaced at approximately 3 km intervals across the forested landscape.

4.2.2 Classification and definitions

National class	Definition
Net growing stock volume	Volume over bark of all living trees more than 12.5 cm in diameter at breast height (or above buttress and stilted roots if these are higher) minus rotten cull. Includes the stem from ground level to a top diameter of 1 cm. Does not include branches off of the main stem.

4.2.3 Original data

Scientific Name	Total	Standard Error
	cubic meters	
Ficus prolixa	151642	130760
Premna obtusifolia	95210	39148
Pandanus tectorius	87178	33937
Casuarina equisetifolia	78928	70757
Cocos nucifera	62672	37130
Hernandia sonora	60951	44720
Leucaena leucocephala	48801	18342
Albizia lebbeck	47623	32423
Pandanus dubius	42459	29664
Cynometra ramiflora	35268	20290
Remaining	282112	90282
Total	992844	237374

4.3 Analysis and processing of national data

4.3.1 Calibration

FAO area for the Northern Mariana Islands: 46000 ha
Area in sample for forest inventory 2004: 30572 ha
Calibration factor 2005 = (46000/30491) = 1.50864

4.3.2 Estimation and forecasting

The estimation for 1990, 2002 and 2010 is based on the growing stock per hectare for 2005 multiplied with the forest area reported in table T1.

4.4 Data for Table T6

Table 6a – Growing stock

FRA 2010 category	Volume (million cubic meters over bark)							
	Forest				Other wooded land			
	1990	2000	2005	2010	1990	2000	2005	2010
Total growing stock	1.616	1.537	1.497	1.458				
... of which coniferous	0	0	0	0				
... of which broadleaved	1.616	1.537	1.497	1.458				
Growing stock of commercial species	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
1st	*Ficus prolixa*	nunu, banyan	n.a.	n.a.	0.229
2nd	*Premna obtusifolia*	ahgao	n.a.	n.a.	0.144
3rd	*Pandanus tectorius*	kafu or aggag	n.a.	n.a.	0.132
4th	*Casuarina equisetifolia*	ironwood	n.a.	n.a.	0.119
5th	*Cocos nucifera*	niyok or coconut palm	n.a.	n.a.	0.095
6th	*Hernandia sonora*	nonak	n.a.	n.a.	0.092
7th	*Leucaena leucocephala*	tangantangan	n.a.	n.a.	0.074
8th	*Albizia lebbeck*	mamis	n.a.	n.a.	0.072
9th	*Pandanus dubius*	pahong	n.a.	n.a.	0.064
10th	*Cynometra ramiflora*	gulos	n.a.	n.a.	0.053
Remaining			n.a.	n.a.	0.426
TOTAL					1.498

Note: Rank refers to the order of importance in terms of growing stock, i.e. 1st is the species with the highest growing stock. Year 2000 is the reference year for defining the species list and the order of the species.

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	
Minimum diameter (cm) at the top end of stem for calculation of growing stock (Y)	1	
Minimum diameter (cm) of branches included in growing stock (W)		No branch volume is included in estimates
Volume refers to "above ground" (AG) or "above stump" (AS)	AG	No branch volume is included in estimates

4.5 Comments to Table T6

Variable / category	Comments related to data, definitions, etc.	Comments on the reported trend
Total growing stock	Stem volume was estimated for each tree using conic equations and inputs of two tree diameters and tree height. No branch or root volume is included in estimates. Origninal inventory data is for the islands of Rota, Tinian, and Saipan. Only 67 percent of the FAO reported area was measured in the forest inventory of 2003. Calibrated numbers may not reflect non-inventoried areas.	
Growing stock of broadleaved / coniferous	No conifer species are included.	
Growing stock of commercial species		
Growing stock composition		

Other general comments to the table

[1] 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.

5 Table T7 – Biomass stock

5.1 FRA 2010 Categories and definitions

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

5.2 National data

5.2.1 Data sources

References to sources of information	Quality (H/M/L)	Variable(s)	Year(s)	Additional comments
Donnegan, J. A., K. Waddell, O. Kuegler, and B. A. Hiserote. 2008. Forest Inventory and Analysis: The Pacific Islands Database for American Samoa, Guam, Palau, the Northern Mariana's, Micronesia, and the Marshall Islands. Database version 2008-1. U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station, Portland, OR.	H	Biomass.	2004	Data are collected on 0.067 ha plots spaced at approximately 3 km intervals across the forested landscape. Sample was further intensified in the Marshall Islands to account for high edge to interior forest ratios along narrow atolls..
Penman, J., M. Gytarsky, T. Hiraishi, T. Krug, D. Kruger, R. Pipatti, L. Buendia, K. Miwa, T. Ngara, K. Tanabe, and F. Wagner, editors. 2003. Good Practice Guidance for Land Use, Land-Use Change and Forestry. Intergovernmental Panel on Climate Change, National Greenhouse Gas Inventories Programme, Institute for Global Environmental Strategies (IGES), Hayama, Kanagawa, Japan,.	M	Carbon mass conversion factors, biomass expansion factors and ratio of aboveground to belowground biomass.	2003	

5.2.2 Classification and definitions

National class	Definition
Live above-ground stem biomass	Biomass of live standing tree stems ≥2.5 cm at breast height from ground to 1 cm top. Does not include branch, leaf, or root biomass.
Dead above-ground stem biomass	Biomass of dead standing tree stems ≥2.5 cm at breast height from ground to 1 cm top. Does not include branch, leaf, or root biomass.
Total above-ground stem biomass	Biomass of live and dead standing tree stems ≥2.5 cm at breast height from ground to 1 cm top. Does not include branch, leaf, or root biomass.

5.2.3 Original data

2004 stem biomass, CNMI

	Live		Dead		Total	
	Total	**SE[1]**	**Total**	**SE**	**Total**	**SE**
			bone-dry tons[2]			
Leucaena leucocephala	282,692	53,160	760	591	283,451	53,089
Pandanus tectorius	105,870	38,477	6,232	6,494	112,102	43,266
Ficus prolixa	95,857	78,385	--	--	95,857	78,385
Casuarina equisetifolia	72,600	65,115	4,660	4,708	77,260	65,285
Premna obtusifolia	60,082	22,835	11,145	10,382	71,227	25,815
Cynometra ramiflora	43,110	20,289	--	--	43,110	20,289
Albizia lebbeck	38,302	19,668	3,605	3,544	41,907	20,618
Cocos nucifera	34,543	20,465	--	--	34,543	20,465
Pandanus dubius	23,402	16,350	1,552	1,673	24,954	16,932
Hernandia sonora	21,615	15,951	711	564	22,326	16,494
Remaining	278,722	60,225	5,331	2,410	284,052	61,229
Total	1,056,795	145,358	33,995	13,737	1,090,791	148,760

[1]SE = Standard error; [2]Original units are in bone-dry U.S. tons, NOT metric tonnes.

5.3 Analysis and processing of national data

5.3.1 Calibration

FAOSTAT area for the Northern Mariana Islands: 46000 ha
Area in sample for forest inventory 2004: 30572 ha
Calibration factor 2005 = (46000/30491) = 1.50864
1 U.S. ton = 0.90718474 metric tons
Biomass was calculated using total stem volume and wood density, a biomass expansion factor to estimate branches, leaves, and seeds (3.4; tropical broadleaf), and an aboveground to belowground ratio estimator (0.27; tropical/sub-tropical dry forest).

5.3.2 Estimation and forecasting

The proportion of forest area (T-1) at different time periods was used for estimation and forecasting.

5.3.3 Reclassification into FRA 2010 categories

5.4 Data for Table T7

FRA 2010 category	**Biomass (million metric tonnes oven-dry weight)**							
	Forest				**Other wooded land**			
	1990	**2000**	**2005**	**2010**	**1990**	**2000**	**2005**	**2010**
Above-ground biomass	5.307	5.047	4.918	4.788				
Below-ground biomass	1.433	1.363	1.328	1.293				
Dead wood	0.050	0.048	0.047	0.045				
TOTAL	**6.790**	**6.458**	**6.292**	**6.126**				

5.5 Comments to Table T7

Variable / category	Comments related to data, definitions, etc.	Comments on the reported trend
Above-ground biomass		
Below-ground biomass		
Dead wood	Does not include branch or root biomass.	

Other general comments to the table

6 Table T8 – Carbon stock

6.1 FRA 2010 Categories and definitions

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

6.2 National data

6.2.1 Data sources

References to sources of information	Quality (H/M/L)	Variable(s)	Year(s)	Additional comments
Donnegan, J. A., K. Waddell, O. Kuegler, and B. A. Hiserote. 2008. Forest Inventory and Analysis: The Pacific Islands Database for American Samoa, Guam, Palau, the Northern Mariana's, Micronesia, and the Marshall Islands. Database version 2008-1. U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station, Portland, OR.	H	Carbon	2003	Data are collected on 0.067 ha plots spaced at approximately 3 km intervals across the forested landscape..
Penman, J., M. Gytarsky, T. Hiraishi, T. Krug, D. Kruger, R. Pipatti, L. Buendia, K. Miwa, T. Ngara, K. Tanabe, and F. Wagner, editors. 2003. Good Practice Guidance for Land Use, Land-Use Change and Forestry. Intergovernmental Panel on Climate Change, National Greenhouse Gas Inventories Programme, Institute for Global Environmental Strategies (IGES), Hayama, Kanagawa, Japan,.	M	Carbon mass conversion factors, biomass expansion factors and ratio of aboveground to belowground biomass.	2003	

6.2.2 Classification and definitions

National class	Definition
Carbon in above-ground tree stem biomass	Carbon in living tree stems ≥ 2.5 cm in diameter at breat height from ground to 1 cm top. Does not include branches, bark, seeds, and foliage.
Carbon in dead tree stem biomass	Carbon in standing dead tree stems ≥ 2.5 cm in diameter at breat height from ground to 1 cm top. Does not include branches, bark, seeds, and foliage.

6.2.3 Original data

	Live		Dead		Total	
	Total	SE[1]	Total	SE	Total	SE
			U.S. tons[2]			
Leucaena leucocephala	141,346	26,580	380	296	141,726	26,544
Pandanus tectorius	52,935	19,239	3,116	3,247	56,051	21,633
Ficus prolixa	47,928	39,193	--	--	47,928	39,193
Casuarina equisetifolia	36,300	32,557	2,330	2,354	38,630	32,642
Premna obtusifolia	30,041	11,418	5,573	5,191	35,614	12,908
Cynometra ramiflora	21,555	10,145	--	--	21,555	10,145
Albizia lebbeck	19,151	9,834	1,802	1,772	20,954	10,309
Cocos nucifera	17,271	10,232	--	--	17,271	10,232
Pandanus dubius	11,701	8,175	776	837	12,477	8,466
Hernandia sonora	10,807	7,975	356	282	11,163	8,247
Remaining	139,361	30,112	2,665	1,205	142,026	30,615
Total	528,398	72,679	16,998	6,868	545,395	74,380

[1]SE = Standard error; [2]Original units are in bone-dry U.S. tons, NOT metric tonnes.

6.3 Analysis and processing of national data

6.3.1 Calibration

FAOSTAT area for the Northern Mariana Islands: 46000 ha
Area in sample for forest inventory 2003: 30572 ha
Calibration factor 2005 = (46000/30491) = 1.50864
1 U.S. ton = 0.90718474 metric tons
Carbon mass was estimated as ½ biomass.

6.3.2 Reclassification into FRA 2010 categories

Carbon in above-ground tree stem biomass = Carbon in above-ground biomass
Carbon in dead tree stem biomass = Carbon in dead wood

6.4 Data for Table T8

FRA 2010 Category	Carbon (Million metric tonnes)							
	Forest				Other wooded land			
	1990	2000	2005	2010	1990	2000	2005	2010
Carbon in above-ground biomass	2.654	2.524	2.459	2.394				

Carbon in below-ground biomass	0.716	0.681	0.664	0.646				
Sub-total: Living biomass	3.370	3.205	3.123	3.040				
Carbon in dead wood	0.025	0.024	0.023	0.023				
Carbon in litter	n.a.	n.a.	n.a.	n.a.				
Sub-total: Dead wood and litter	n.a.	n.a.	n.a.	n.a.				
Soil carbon	n.a.	n.a.	n.a.	n.a.				
TOTAL	n.a.	n.a.	n.a.	n.a.				

Soil depth (cm) used for soil carbon estimates	

6.5 Comments to Table T8

Variable / category	Comments related to data, definitions, etc.	Comments on the reported trend
Carbon in above-ground biomass		
Carbon in below-ground biomass		
Carbon in dead wood		
Carbon in litter		
Soil carbon		

Other general comments to the table

7 Table T10 – Other disturbances affecting forest health and vitality

7.1 FRA 2010 Categories and definitions

Term	Definition
Disturbance	Damage caused by any factor (biotic or abiotic) that adversely affects the vigour and productivity of the forest and which is not a direct result of human activities.
Invasive species	Species that are non-native to a particular ecosystem and whose introduction and spread cause, or are likely to cause, socio-cultural, economic or environmental harm or harm to human health.
Category	**Definition**
Disturbance by insects	Disturbance caused by insect pests.
Disturbance by diseases	Disturbance caused by diseases attributable to pathogens, such as bacteria, fungi, phytoplasma or virus.
Disturbance by other biotic agents	Disturbance caused by biotic agents other than insects or diseases, such as wildlife browsing, grazing, physical damage by animals, etc.
Disturbance caused by abiotic factors	Disturbances caused by abiotic factors, such as air pollution, snow, storm, drought, etc.

7.2 National data

7.2.1 Data sources

References to sources of information	Quality (H/M/L)	Variable(s)	Year(s)	Additional comments
Donnegan, J. A., K. Waddell, O. Kuegler, and B. A. Hiserote. 2008. Forest Inventory and Analysis: The Pacific Islands Database for American Samoa, Guam, Palau, the Northern Mariana's, Micronesia, and the Marshall Islands. Database version 2008-1. U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station, Portland, OR.	H	Damages on trees, presence/absence	2003	Data are collected on 0.067 ha plots spaced at approximately 3 km intervals across the forested landscape.

7.2.2 Classification and definitions

National class	Definition
Insect	Disturbance caused by insect pests.
Disease	Disturbance caused by diseases attributable to pathogens, such as bacteria, fungi, phytoplasma or virus.
Fire	Damage to a tree from fire.
Animal	Damage caused by grazing, browsing, rooting, or toppling.
Weather	Damage related to storms, e.g., wind, flood, lightning.
Vegetation (e.g., competition or vines)	Damage caused by other vegetation.
Unknown	Unknown damage agent.
Silvicultural or cutting	Damage caused by humans.
Physical	Damage caused by one tree hitting another or from undermining of roots.

7.2.3 Original data

Number of Trees by Species by Damaging Agent, 2003

	Insects		Disease		Weather		Vegetation		Unknown	
	Total	SE	Total	SE	Total	SE	Total	SE	Total	SE
Species	*thousand trees*									
Acacia confusa	--	--	--	--	--	--	--	--	--	--
Adenanthera pavonina	--	--	--	--	--	--	--	--	11	12
Aglaia mariannensis	--	--	--	--	--	--	264	194	--	--
Aidia cochinchinensis	--	--	--	--	--	--	--	--	--	--
Albizia lebbeck	26	26	--	--	--	--	1071	696	142	153
Allophylus timorensis	--	--	--	--	--	--	132	148	--	--
Annona spp.	--	--	--	--	--	--	--	--	--	--
Artocarpus altilis	--	--	--	--	--	--	--	--	--	--
Barringtonia asiatica	--	--	--	--	32	36	--	--	--	--
Barringtonia racemosa	--	--	--	--	11	12	--	--	143	160
Bruguiera gymnorrhiza	--	--	--	--	--	--	--	--	--	--
Carica papaya	--	--	--	--	11	12	--	--	--	--
Cassia fistula	--	--	--	--	--	--	--	--	--	--
Casuarina equisetifolia	--	--	--	--	13	13	26	26	52	51
Cerbera dilatata	--	--	--	--	--	--	--	--	--	--
Citrus aurantifolia	--	--	--	--	--	--	--	--	--	--
Citrus hystrix	--	--	--	--	529	592	2513	2814	397	444
Claoxylon marianum	--	--	--	--	132	148	--	--	--	--
Cocos nucifera	--	--	--	--	--	--	23	25	11	12
Cynometra ramiflora	426	459	--	--	13	13	318	343	613	480
Delonix regia	--	--	--	--	--	--	--	--	--	--
Discocalyx ponapensis	--	--	--	--	132	148	--	--	--	--
Drypetes spp.	--	--	--	--	--	--	--	--	--	--
Elaeocarpus joga	--	--	--	--	32	36	--	--	--	--
Erythrina variegata	--	--	--	--	--	--	23	25	--	--
Eugenia palumbis	--	--	--	--	397	444	529	448	--	--
Eugenia stelechantha	--	--	--	--	--	--	647	636	--	--
Ficus prolixa	--	--	--	--	179	149	310	268	458	460
Ficus spp.	--	--	--	--	--	--	--	--	--	--
Ficus tinctoria	--	--	--	--	11	12	142	153	--	--

Guamia mariannae	--	--	--	--	823	757	1127	636	--	--
Guettarda speciosa	--	--	--	--	11	12	53	47	32	36
Hernandia sonora	--	--	--	--	85	95	132	148	64	47
Heterospathe elata	--	--	--	--	--	--	--	--	--	--
Hibiscus tiliaceus	--	--	--	--	--	--	144	149	--	--
Intsia bijuga	--	--	--	--	65	64	113	67	45	38
Leucaena leucocephala	769	519	301	222	1268	636	6207	1879	5449	2068
Mammea odorata	--	--	--	--	--	--	--	--	--	--
Mangifera indica	--	--	--	--	--	--	--	--	11	12
Melanolepis multiglandulosa	--	--	--	--	--	--	1112	721	37	29
Morinda citrifolia	--	--	--	--	--	--	--	--	11	12
Morus alba	--	--	--	--	--	--	--	--	--	--
Neisosperma oppositifolia	--	--	--	--	11	12	--	--	11	12
Pandanus dubius	--	--	--	--	32	36	--	--	22	17
Pandanus tectorius	--	--	--	--	249	149	32	17	64	39
Pipturus argenteus	--	--	--	--	--	--	162	159	--	--
Pisonia grandis	--	--	--	--	--	--	142	153	--	--
Pithecellobium dulce	--	--	--	--	--	--	--	--	--	--
Pouteria obovata	--	--	--	--	--	--	--	--	--	--
Premna obtusifolia	--	--	--	--	142	54	608	355	215	74
Psychotria mariana	--	--	--	--	--	--	159	161	13	13
Spathodea campanulata	--	--	--	--	--	--	23	25	11	12
Unknown	--	--	--	--	540	604	264	296	132	148
Unknown 0	11	12	--	--	--	--	--	--	--	--
Unknown 1	--	--	--	--	--	--	--	--	142	153
Unknown, other	--	--	--	--	--	--	323	318	--	--
Total	1233	687	301	222	4715	1904	16601	3978	8085	2263

Continued—Number of Trees by Species by Damaging Agent, 2003

	Human caused		Physical		All damaged trees		All trees	
	Total	SE	Total	SE	Total	SE	Total	SE
Species	*thousand trees*							
Acacia confusa	--	--	--	--	--	--	132	148
Adenanthera pavonina	--	--	--	--	11	12	34	37
Aglaia mariannensis	--	--	--	--	264	194	1012	550
Aidia cochinchinensis	--	--	--	--	--	--	142	153
Albizia lebbeck	--	--	--	--	1213	712	1929	1073
Allophylus timorensis	--	--	--	--	132	148	132	148
Annona spp.	--	--	--	--	--	--	142	153
Artocarpus altilis	--	--	--	--	--	--	32	36
Barringtonia asiatica	--	--	--	--	32	36	32	36
Barringtonia racemosa	--	--	--	--	143	160	143	160
Bruguiera gymnorrhiza	--	--	11	12	11	12	23	25
Carica papaya	--	--	--	--	11	12	2522	1102
Cassia fistula	--	--	--	--	--	--	11	12
Casuarina equisetifolia	--	--	--	--	65	64	375	231
Cerbera dilatata	--	--	--	--	--	--	11	12
Citrus aurantifolia	--	--	--	--	--	--	323	318
Citrus hystrix	--	--	--	--	3438	3851	6215	6961
Claoxylon marianum	--	--	--	--	132	148	132	148
Cocos nucifera	--	--	--	--	33	27	177	102
Cynometra ramiflora	--	--	--	--	1228	806	6900	3451
Delonix regia	--	--	--	--	--	--	733	790
Discocalyx ponapensis	--	--	--	--	132	148	1907	1266

Drypetes spp.	--	--	--	--	--	--	529	592
Elaeocarpus joga	--	--	--	--	32	36	53	47
Erythrina variegata	--	--	--	--	23	25	114	123
Eugenia palumbis	--	--	--	--	793	734	1587	1185
Eugenia stelechantha	--	--	--	--	647	636	1617	1590
Ficus prolixa	--	--	142	153	1068	890	3803	2294
Ficus spp.	--	--	--	--	--	--	21	24
Ficus tinctoria	--	--	--	--	153	154	732	778
Guamia mariannae	--	--	--	--	1788	976	5075	2859
Guettarda speciosa	--	--	--	--	53	47	76	53
Hernandia sonora	--	--	--	--	260	199	366	274
Heterospathe elata	--	--	--	--	--	--	11	12
Hibiscus tiliaceus	--	--	--	--	144	149	1058	842
Intsia bijuga	--	--	--	--	163	100	564	463
Leucaena leucocephala	11	12	--	--	12605	2722	39384	10858
Mammea odorata	--	--	--	--	--	--	13	13
Mangifera indica	--	--	--	--	11	12	11	12
Melanolepis multiglandulosa	--	--	--	--	1124	721	1449	762
Morinda citrifolia	--	--	--	--	11	12	840	582
Morus alba	--	--	--	--	--	--	323	318
Neisosperma oppositifolia	--	--	--	--	11	12	192	148
Pandanus dubius	--	--	--	--	54	49	327	218
Pandanus tectorius	--	--	--	--	313	160	4626	1742
Pipturus argenteus	--	--	--	--	162	159	294	217
Pisonia grandis	--	--	--	--	142	153	364	392
Pithecellobium dulce	--	--	--	--	--	--	47	39
Pouteria obovata	--	--	--	--	--	--	11	12
Premna obtusifolia	--	--	11	12	876	369	1073	396
Psychotria mariana	--	--	--	--	172	174	545	404
Spathodea campanulata	11	12	11	12	46	49	137	147
Unknown	--	--	--	--	672	752	1730	1937
Unknown 0	--	--	--	--	11	12	11	12
Unknown 1	--	--	--	--	142	153	142	153
Unknown, other	--	--	--	--	323	318	323	318
Total	23	25	176	177	28644	5298	90648	13948

7.3 Analysis and processing of national data

7.3.1 Calibration

National data is recorded as presence/absence on individual trees. Presence/absence point count cannot be expanded to area estimates.

7.3.2 Estimation and forecasting

7.3.3 Reclassification into FRA 2010 categories

Insect = Disturbance by insects
Disease = Disturbance by diseases
Fire = Disturbance caused by abiotic factors
Animal = Disturbance by other biotic agents
Weather = Disturbance caused by abiotic factors
Vegetation (e.g., competition or vines) = Disturbance by other biotic agents
Unknown = Unknown

Silvicultural or cutting = Disturbance by other biotic agents

7.4 Data for Table T10

Table 10a – Disturbances

FRA 2010 category	Affected forest area (1000 hectares)		
	1990	2000	2005
Disturbance by insects			
Disturbance by diseases			
Disturbance by other biotic agents			
Disturbance caused by abiotic factors			
Total area affected by disturbances			

Notes: The figures for the reporting years refer to the averages of annually affected areas for the 5-year periods 1988-1992, 1998-2002 and 2003-2007 respectively.

The total area affected by disturbances is not necessarily the sum of the individual disturbances as these may be overlapping.

Table 10b – Major outbreaks of insects and diseases affecting forest health and vitality

Description / name	Tree species or genera affected (scientific name)	Year(s) of latest outbreak	Area affected (1000 hectares)	If cyclic, approx. cycle (years)

Note: Area affected refers to the total area affected during the outbreak.

Table 10c – Area of forest affected by woody invasive species

Scientific name of woody invasive species	Forest area affected 2005 (1000 hectares)

Total forest area affected by woody invasive species	

Note: The total forest area affected by woody invasive species is not necessary the sum of the values above, as these may be overlapping.

7.5 Comments to Table T10

Variable / category	Comments related to data, definitions, etc.	Comments on the reported trend
Disturbance by insects		
Disturbance by diseases		
Disturbance by other biotic agents		
Disturbance caused by abiotic factors		
Major outbreaks		
Invasive species		

Other general comments to the table
National numbers are recorded on an individual tree basis and expanded to the population as an estimated number of trees affected by damaging agent.