



Forest Area and Change	Asia (excl.)		
	Singapore	Middle East	World
Total forest area, 2000 (000 ha)	2	504,180	3,869,455
Natural forest area, 2000 (000 ha)	X	375,824	3,682,722
Plantations area, 2000 (000 ha)	X	110,953	186,733
Total dryland area, 1950-1981 (000 ha) {a}	0	1,078,121	5,059,984
Change in forest area:			
Total, 1990-2000	0%	-1%	-2%
Natural, 1990-2000	X	-1%	-4%
Plantations, 1990-2000	X	5%	3%
Original forest {b} as a percent of total land area {c}	79%	X	48%
Forest area in 2000 as a percent of total land area {c}	3%	20%	29%

## Forest Area by Crown Cover (000 ha), 2000

*Note: Crown cover data are gathered using different methodologies than the forest area calculated above. The two estimates may differ substantially.*

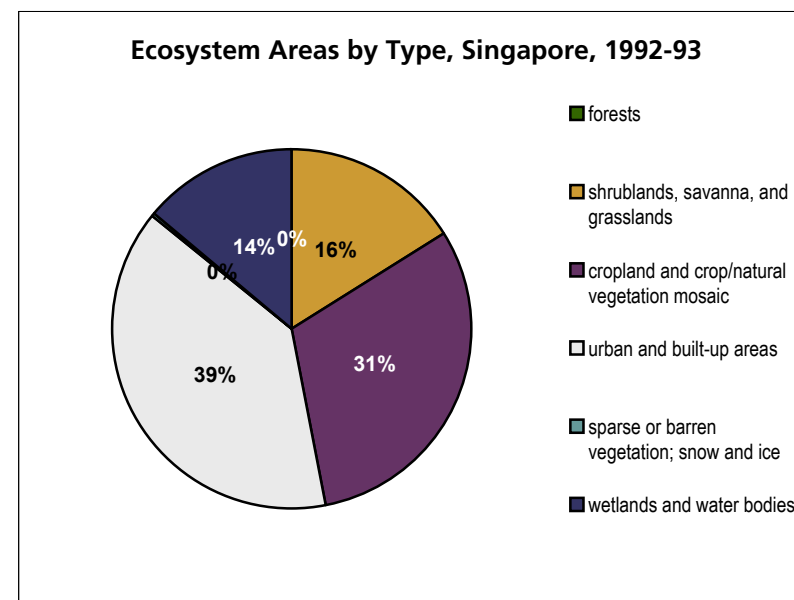
Area of forest with crown cover:	Singapore	Asia (excl. Middle East)	World
Greater than 10%	19	920,164	6,537,209
Greater than 25%	11	699,058	4,842,071
Greater than 50%	7	509,247	3,143,720
Greater than 75%	3	336,266	1,945,916

## Ecosystem Areas by Type

Total land area	Singapore	Asia (excl. Middle East)	World
Total land area	62	2,494,475	13,328,979
Percent of total land area covered by:			
Forests	0%	17%	24%
Shrublands, savanna, and grasslands	16%	37%	37%
Cropland and crop/natural vegetation mosaic	31%	34%	20%
Urban and built-up areas	38.7%	0.2%	0.2%
Sparse or barren vegetation; snow and ice	0%	10%	16%
Wetlands and water bodies	14%	2%	3%

## Forests certified through the Forest Stewardship Council

	Singapore	Asia (excl. Middle East)	World
Natural forests, 2002 (hectares)	0	145,323	11,457,393
Plantations, 2002 (hectares)	0	61,936	3,324,996
Mixed forests, 2002 (hectares)	0	25,702	11,461,154



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## Forests, Grasslands, and Drylands-- Singapore

	Singapore	Asia (excl. Middle East)	World
<b>Forest Protection</b>			
Percent of forests protected:			
Tropical forest, 1990s	X	16.4%	9.0%
Nontropical forest, 1990s	X	5.3%	6.0%
Sparse trees and parkland, 1990s	X	7.0%	5.5%
Number of tree species threatened, 1990s	61	X	5,904
<b>Wood Production and Trade</b>			
Annual roundwood production:			
Total, 1996-1998 (000 meters <sup>3</sup> )	X	1,111,958	3,261,621
Fuel, 1996-1998 (000 meters <sup>3</sup> )	X	863,316	1,739,504
Industrial, 1996-1998 (000 meters <sup>3</sup> )	X	268,470	1,522,116
Wood-based panels, 1996-1998 (000 meters <sup>3</sup> )	355	39,057	151,390
Paper and paperboard, 1996-1998 (thousand metric tons)	87	88,859	313,206
Recovered paper, 1996-1998 (thousand metric tons)	275	36,539	126,404
Average value of trade in forest products {d}:			
Imports, 1996-1998 (thousand US\$)	1,109,950	37,114,499	142,932,629
Exports, 1996-1998 (thousand US\$)	607,884	16,434,017	135,313,009
Forest product exports as a percent of the total value of all exports, 1997	X	2.1%	2.0%

### Other Resources:

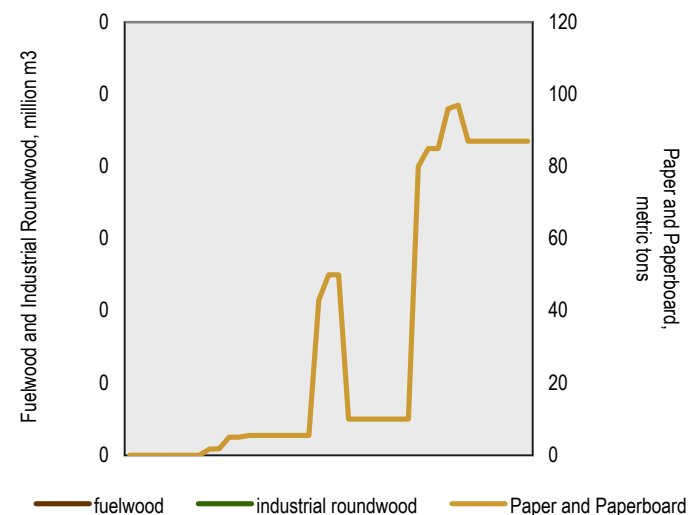
Country Profiles of the Food and Agriculture Organization of the United Nations, Forestry Sector:

<http://www.fao.org/countryprofiles/index.asp?subj=5&iso3=SGP>

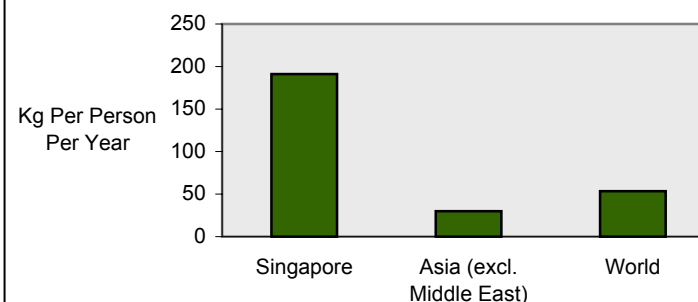
### Footnotes:

- Areas are presented as long-term average covering the years from 1950 to 1981.
- Original forest refers to estimated forest cover about 8,000 years ago assuming current climatic conditions.
- "Forest area in 2000 as a percent of total land area" and "Original forest as a percent of total land area" are not directly comparable; data are from two different sources.
- Includes trade in industrial roundwood, wood fuel, sawnwood, wood-based panels, pulp, paper and paperboard, recovered paper, chips, particles, & wood residues.

Forest Products Production, Singapore, 1961-2001



Average Paper Consumption per Capita, 2000



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## Forests, Grasslands, and Drylands—Sources and Definitions

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### Forest Area and Change

**Total forest area** includes both natural forests and plantations. Total Forest is defined as land with tree crown cover of more than 10 percent of the ground and area of more than 0.5 hectares. Tree height at maturity should exceed 5 meters. These forest statistics are based primarily on forest inventory information provided by national governments. In the case of the tropical region, inventory information is supplemented by a remote sensing survey. If only limited or out-dated inventory data are available, combination of linear projections and expert opinion techniques were applied to fill in data gaps. View full technical notes on-line at [http://earthtrends.wri.org/searchable\\_db/variablenotes\\_static.cfm?varid=296&theme=9](http://earthtrends.wri.org/searchable_db/variablenotes_static.cfm?varid=296&theme=9)

**Natural forest area** is the total area of forest composed primarily of indigenous (native) tree species. Natural forests include closed forest, where trees cover a high proportion of the ground and where grass does not form a continuous layer on the forest floor (e.g., broadleaved forests, coniferous forests, and bamboo forests), and open forest, which the Food and Agriculture Organization of the United Nations (FAO) defines as mixed forest/grasslands with at least 10 percent tree cover and a continuous grass layer on the forest floor. Tree height at maturity should exceed 5 meters. Natural forest is estimated by subtracting plantation area from total forest areas.

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**Plantations area** describes forest stands established artificially by afforestation and reforestation for industrial and non-industrial usage. Reforestation does not include regeneration of old tree crops (through either natural regeneration or forest management), although some countries may report regeneration as reforestation. Many trees are also planted for non-industrial uses, such as village wood lots. Non-industrial plantations include those established for fuelwood production, soil protection, amenity or other purposes. They do not include plantations of agro-forestry crops, such as rubber and oil palm. The data presented here reflect plantation survival rate as estimated by FAO. Tree height at maturity should exceed 5 meters.

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**Total dryland land area** is the total terrestrial area falling within three of the world's six aridity zones—the arid, semi-arid, and dry sub-humid zones. These areas are especially vulnerable to land degradation. In drylands, the ratio of average precipitation to average evapotranspiration, called the aridity index, is between .05 and .65 (excluding polar and sub-polar regions). The East Anglica University Climatic Research Centre used climate surfaces to define aridity zone boundaries for the globe.

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**Change in forest area** is the total percent change in both natural forests and plantations between 1990 and 2000. Total forest is defined as land with tree crown cover of more than 10 percent of the ground and area of more than 0.5 hectares. Tree height at maturity should exceed 5 meters. In many cases, FAO projected forward or backward in time to estimate forest area in the two reference years and calculate change in area over the decade.

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**Original forest as a percent of land area** refers to the estimate of the percent of land that would have been covered by closed forest about 8,000 years ago assuming current climatic conditions, before large-scale disturbance by human society began. Figures are based on a map of estimated forest cover developed by the World Conservation Monitoring Centre (WCMC). This map was developed by WCMC based on numerous global and regional biogeographic maps.

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**Forest area in 2000 as a percent of total land area** is calculated by dividing total forest area (see above) by total land area.

### Sources

Food and Agriculture Organization of the United Nations (FAO). 2001. Global Forest Resources Assessment 2000--main Report. *FAO Forestry Paper No. 140*. Rome: FAO. Data available on-line at <http://www.fao.org/forestry/foris/webview/forestry2/index.jsp?siteId=101&langId=1>

UNEP/GRID. United Nations Environment Program/Global Resource Information Database. 1991. Global digital data sets for land degradation studies: a GIS approach. Prepared by U. Deichmann and L. Eklundh. GRID Case Study Series No. 4. UNEP/GEMS and GRID. Nairobi, Kenya.

Bryant, D., D. Nielsen and L. Tangle, "The Last Frontier Forests: Ecosystems and Economies on the Edge", (World Resources Institute, Washington, DC, 1997).

## Forest Area by Canopy Cover

**Area of forest with canopy cover greater than 10%** shows the amount of a country's land area that is at least 10% covered by the crown of a woody species. **Area of forest with canopy cover greater than 25%, 50%, and 75%** shows the amount of a country's land area that is at least 25, 50, or 75% covered by the crown of a woody species. Canopy cover is the vertical projection of a tree's outermost perimeter, including small openings in the crown. Areas reported here are gathered via satellite data by the Moderate Resolution Imaging Spectroradiometer (MODIS) instrument over several months in 2000. The percent tree cover data are derived from an automated algorithm depicting percent tree crown cover for each 500 meter pixel based on a year of MODIS data inputs.

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### Sources

University of Maryland (UMd) Global Land Cover Facility (GLCF). 2002. *MODIS 500m Vegetation Continuous Fields Percent Tree Cover*. Available online at <http://glcf.umiaccs.umd.edu/data/>. Data by country were processed by UMD for the World Resources Institute.

## Ecosystem Areas By Type

**Total land area** is the total area of the country, including area under inland water bodies, obtained mainly from the United Nations Statistical Division.

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**Ecosystem areas by type** were measured by the Global Land Cover Characteristics (GLCC) project using satellite images in conjunction with ancillary data. The satellite data were measured by a Advanced Very High Resolution Radiometer (AVHRR), with a resolution of 1 X 1 km. Ancillary data include (1) a digital elevation model of the ecological factors that govern natural vegetation distribution; (2) ecoregions data to stratify vegetation by seasonal impacts; and (3) maps of soils, vegetation, and land cover enabling post-classification refinement. The GLCC study classified vegetation and other land cover types into one of 18 categories, originally defined by the International Geosphere-Biosphere Programme (IGBP) (please see <http://www.igbp.kva.se/> for details). WRI's country profiles have combined these 18 original categories into the 6 larger classifications described below:

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**Forests** include all areas dominated by evergreen or deciduous trees with a canopy cover of greater than 60% and a height exceeding 2 meters. Both broadleaf and needleleaf trees are included.

**Shrublands, savannah and grasslands** include lands dominated by woody vegetation less than 2 meters tall and with shrub canopy cover greater than 10%. The shrub foliage can be either evergreen or deciduous. This category also includes savannas and grasslands with herbaceous and other understory systems. These lands may have a tree or shrub cover of less than 60%.

**Cropland and crop/natural vegetation mosaic.** Croplands are lands covered with temporary crops followed by harvest and a bare soil period (e.g., single and multiple cropping systems). Perennial woody crops are classified as forest or shrub land cover. Cropland/natural vegetation mosaics are lands with a mosaic of croplands, forests, shrublands, and grasslands in which no one component comprises more than 60% of the landscape.

**Urban and built-up areas** are covered by buildings and other man-made structures. This class was developed from the the Digital Chart of the World's "populated places layer" (Defense Mapping Agency, 1992).

**Sparse or barren vegetation; snow and ice.** Barren and sparsely vegetated areas are lands of exposed soil, sand, rocks, or snow and never has more than 10% vegetated cover during any time of the year. Snow and ice covered areas are lands under snow and/or ice cover throughout the year.

**Wetlands and water bodies.** Permanent wetlands are lands with a permanent mixture of water and herbaceous or woody vegetation that cover extensive areas. The vegetation can be present in either salt, brackish, or fresh water. Water bodies are oceans, seas, lakes, reservoirs, and rivers. They can be either fresh or salt water bodies.

#### **Sources**

Loveland, T.R., Reed, B.C., J.F., Brown, J.F., Ohlen, D.O., Zhu, Z., Yang, L. Merchant. J. 2000. *Global Land Cover Characteristics Database (GLCCD) Version 2.0*. Available online at: [http://edcdaac.usgs.gov/glcc/globdoc2\\_0.html](http://edcdaac.usgs.gov/glcc/globdoc2_0.html).

#### **Forest Certification and Protection**

The Forest Stewardship Council (FSC) certifies forests and plantations in accordance with the ten FSC principles and criteria. Groups around the world are accredited by the FSC to act as independent certification bodies.

Full certification of forest products involves two steps. First, an assessment of forest management is made at the site to ensure that management practices will sustain the resource and provide environmental goods and services. Second, chain of custody is traced from forest, to processor, to distributors, to the final consumer to ensure that only wood from the certified forests are being sold and delivered as FSC-certified. Many companies that have certified forests also possess certified mills and are distributors of certified wood as well. According to the FSC, all forest products carrying their logo have been independently certified as coming from forests that meet the FSC Principles and Criteria of Forest Stewardship.

Certified forests are categorized as natural forests, plantations, or mixed.

**Natural forests** are those where most of the principal characteristics and key elements of the native ecosystems, such as complexity, structure and diversity are present.

**Plantations** are areas which result from the human activities of planting, sowing or intensive silvicultural treatments, and lack most of the principal characteristics and key elements of native ecosystems. According to FSC, certified plantations should decrease the pressures on natural forests, have diversity in composition in species and age classes, preferentially choose native over exotic species, serve to improve soil function, fertility and structure, and have some proportion of their area managed for the restoration of natural forest cover.

**Mixed natural forest and plantations** include large areas certified as one block that contains both natural forests and plantations. Semi-natural areas are forests that have some elements of both natural forests and plantations.

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**Percent of forests protected.** Forest estimates were calculated by WCMC by compiling many national and regional data showing forest extent. The legends of these maps were harmonized into 15 different tropical and 11 non-tropical forest types for the globe, defined specifically for this study. Percent protected includes forest areas that fall within the protected areas in the world that are listed by IUCN - World Conservation Union as being within their management categories I-VI.

The forest type categories were split between "tropical" and non-tropical." Tropical forests included all forests located between the Tropics of Cancer and Capricorn. All other forests were put into the non-tropical categories. Sparse trees and parkland are natural forests in which the tree canopy cover is between 10-30%, such as in the savannah and steppe regions of the world.

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**Number of tree species threatened** includes full species that are categorized by IUCN as being critically endangered, endangered, or vulnerable. Data are from The World List of Threatened Trees, presenting the results of the first survey of the conservation status of trees species worldwide. Figures are not necessarily comparable among countries because taxonomic concepts and the extent of knowledge vary. Some taxonomic groups of trees were not evaluated, including tree ferns in the families Cyatheaceae and Dicksoniaceae, tree species in the cycad families Cycadaceae and Zamiaceae, and arborescent members of the Cactaceae family.

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### Sources

Forest Stewardship Council (FSC). 1998, 1999, 2000, 2002. Forests Certified by FSC-Accredited Certification Bodies. Document 5.3.3. Oaxaca, Mexico, FSC. Available online at: <http://www.fscoax.org/principal.htm>.

Iremonger, S., C. Ravilious, T. Quinton. 1997 "A statistical analysis of global forest conservation." In *A Global Overview of Forest Conservation CD-ROM*. Cambridge, U.K.: World Conservation Monitoring Centre (WCMC) and Centre for International Forestry Research.

S. Oldfield, C. Lusty and A. MacKinven (eds.). 1998. Tree Conservation Database. From *The World List of Threatened Trees*. Cambridge, U.K.: World Conservation Monitoring Centre (WCMC) and The World Conservation Union (IUCN). Available on-line at [http://www.wcmc.org.uk/trees/Background/country\\_stats.htm](http://www.wcmc.org.uk/trees/Background/country_stats.htm)

## Wood Production and Trade

FAO compiles forest products data from responses to annual questionnaires sent to national governments. Data from other sources, such as national statistical yearbooks, are also used. In some cases, FAO prepares its own estimates.

**Roundwood production** refers to all wood in the rough, whether destined for industrial or fuelwood uses. All wood felled or harvested from forests and trees outside the forest, with or without bark, round, split, roughly squared, or in other forms such as roots and stumps, is included. Wood that is harvested for charcoal production is also included. All wood production data refer to both coniferous and nonconiferous species.

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**Wood fuel production** refers to all roundwood used as fuel for purposes such as cooking, heating, or power production. It includes wood harvested from main stems, branches and other parts of trees. It also includes wood intended for charcoal production (e.g., pit kilns, and portable ovens). FAO data include only wood from direct sources such as natural forests, plantations, and other wooded land, such as homesteads and roadsides. FAO data do not currently include wood fuel from indirect sources such as industrial by-products derived from primary and secondary wood industries, recovered sources (wood waste from construction sites demolition, packaging etc.), and black liquor (derived from by-products of the pulp industry). FAO wood fuel estimates are partly based on household consumption surveys dating from the 1960s and per capita consumption estimates from the 1980s. Estimates are updated in line with population growth.

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**Industrial roundwood production** comprises all roundwood products other than fuelwood and charcoal. It includes sawlogs or veneer logs, posts, pitprops, pulpwood, and other roundwood industrial products. All wood production data refer to both coniferous and nonconiferous species..

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**Wood-based panel production** includes the following commodities: veneer sheets, plywood, particle board, and compressed or non-compressed fiberboard. All wood production data refer to both coniferous and nonconiferous species.

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**Paper and paperboard production** is the amount of primary paper and paperboard produced, even though a portion of it may immediately be consumed in the production of another product. Paper and paperboard includes newsprint, printing and writing paper, packaging paper, household and sanitary paper, and other paper and paperboard. All production data refer to both coniferous and non-coniferous species.

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**Recovered paper production** describes the amount of waste and scrap of paper or paperboard produced in a given country in a given year. This commodity includes paper and paperboard which has been used for its original purpose and residues from paper conversion, including waste and scrap collected for re-use as a raw material for the manufacture of paper and related products. These definitions follow those contained in *Classification and Definitions of Forest Products*, FAO, Rome, 1982.

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**Average value of trade in forest products** include imports and exports in industrial roundwood, wood fuel, sawnwood, wood-based panels, pulp, paper and paperboard, recovered paper, chips and particles, and wood residues. Figures are national totals in millions of US dollars. Imports and exports are usually on a cost, insurance, and freight basis (c.f.i.) (i.e., insurance and freight costs added in). "In-transit" shipments are excluded wherever possible.

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**Forest products exports as a percent of the total value of all exports** is calculated by dividing the total value of forest products exports by a country's total exports of goods and services. Exports of goods and services represent the value of all goods and other market services provided to the rest of the world. They include the value of merchandise, freight, insurance, transport, travel, royalties, license fees, and other services, such as communication, construction, financial, information, business, personal, and government services. They exclude labor and property income (formerly called factor services) as well as transfer payments.

### Sources

Development Data Group, The World Bank. 2002. *World Development Indicators 2002 online* (see [http://publications.worldbank.org/ecommerce/catalog/product?item\\_id=631625](http://publications.worldbank.org/ecommerce/catalog/product?item_id=631625)) Washington, D.C.: The World Bank.

Food and Agriculture Organization of the United Nations (FAO). 2002. *FAOSTAT on-line statistical service*. Available on-line at <http://apps.fao.org>. Rome: FAO.