

APPENDIX: Technical Notes

Map 1: Coarse-Scale Estimation of Central Africa's Low-Access Forest Tracts and Map 2: Status of Low-Access Forest Tracts

The base vegetation layer used was the latest TREES 2000 land cover map for central Africa (Mayaux and Malingreau 2000), updated from the original, approximately 1-km² resolution dataset (Mayaux et al. 1997).

- A forest/ non-forest map was created to separate natural closed-canopy forest from other vegetation. The “forest” category included lowland rainforest, mangroves, and swamp forest (classes 1, 6, and 9). “Non-forest” included secondary forest and rural complex, forest-savanna mosaic, nonforest, water bodies, swamp grasslands, and plantations (classes 2-5, 7-8, and 10).
- Updated roads datasets were prepared:
 - National-level roads data were updated.
 - The CARPE roads dataset (Central African Regional Program for the Environment/World Resources Institute) was used as the base layer.
 - Roads data missing from the CARPE dataset were supplemented with available data from the National Imagery and Mapping Agency (NIMA) Vector Map Level 0 dataset. VMAP (1997) is an update of the Digital Chart of the World, which was used as the base layer for the CARPE roads datasets.
 - Additional roads were digitized at WRI using recent (1993 to 2000) national maps at various scales (1:1,000,000 to 1:3,300,000).

These coarse-scale maps were used to digitize newer roads not depicted by other sources. No finer-scale (e.g., 1:200,000) maps created within the last decade were available for any countries in the region.

- The Gabon roads dataset was updated with roads data provided by WWF-Gabon that were digitized from local topographic maps (1:200,000) and Landsat satellite imagery.
 - Foot paths, ferry crossings, and other non-pertinent transport routes were removed prior to the forest fragmentation analysis.
 - No information was available on degraded or impassable roads (especially prevalent in the Democratic Republic of Congo).
 - These roads datasets were not verified in the field.
- Roads were buffered to a distance of 2 km, and converted to a 100-meter (m) grid. The TREES landcover map was also resampled to 100 m, to prevent the buffers from removing excess forest due to the coarseness of the forest cover map.
- Rivers are important access routes throughout central Africa. They were not, however, considered access routes for the purposes of this study, due to the difficulty in determining with consistent accuracy across the region which rivers are used as access routes. The region's largest rivers are considered indirectly in the analysis; they appear on the TREES land cover dataset as “non-forest” and therefore divide large forest areas into smaller blocks.

- Railroads were not considered access routes for the purposes of this analysis, even though they are important means of transporting timber and bushmeat in many forest areas.
- The buffered roads grid was used to segregate forest within 2 km of roads from the TREES forest cover map.
- Remaining forest areas were grouped into contiguous blocks, and sorted by size:
 - Over 10,000 km²
 - 1,000 to 10,000 km²
 - Under 1,000 km²
- Contiguous forest areas of at least 1,000 km² were defined as “large tracts of low-access forest.”
- Logging concessions and protected areas GIS datasets were overlaid on the low-access forest tracts and the portion of these tracts in concessions or protected areas was calculated. All calculations were made using datasets in an Albers equal-area projection.
 - Protected areas information was obtained from CARPE, based on datasets from the World Conservation Monitoring Centre (WCMC). Protected areas datasets for Cameroon and Gabon have been reviewed and updated by Global Forest Watch, with input from WWF and Wildlife Conservation Society (WCS); GFW also updated the boundaries for Odzala National Park in the Republic of Congo (ECOFAC). Protected areas datasets

Table A Log Exports out of Central Africa¹ (million cubic meters)

	1993	1994	1995	1996	1997	1998	1999	
Total	2,429	3,212	3,472	3,030	5,019	4,083	3,913	
Europe ²	1,019	1,478	1,674	756	1,253	2,041	1,610	
Asia ³	667	945	732	1,101	2,216	1,116	1,320	
Other ⁴	743	789	1,066	1,173	1,550	927	983	
								<i>Average</i>
% Europe	41.9	46	48.2	25	25	50	41.1	39.6
% Asia	27.5	29.4	21.1	36.3	44.2	27.3	33.7	31.4
% Other	30.6	24.6	30.7	38.7	30.9	22.7	25.1	29

Source: International Tropical Timber Organization Annual Review from <http://www.itto.or.jp/sitemap/sitemap.html>.

Notes:

¹Central Africa includes Cameroon, Republic of Congo, Democratic Republic of Congo, and Gabon, (DR Congo did not report 1999 figures).

²Europe includes Belgium, France, Germany, Greece, Italy, Luxembourg, Netherlands, Portugal, and Spain.

³Asia includes China, India, Japan, Korea, Malaysia, Philippines, Taiwan, and Thailand.

⁴"Other" category was calculated by subtracting the regional figures from Total Exports figures reported by either the exporting country or estimated by the ITTO.

outside Cameroon and Gabon have not been extensively reviewed.

- Logging concessions data were provided by: MINEF (Cameroon); Projet d'Aménagement Ressources Naturelles (Central African Republic); SPIAF and WRI (Democratic Republic of Congo); GFW and local partners (Equatorial Guinea); Ministère des Eaux et Forêts, Journal Officiel du Gabon,

WCMC, and WWF (Gabon); and WRI and WWF (Republic of Congo).

- Concessions data for Cameroon and Gabon have been reviewed by in-country partners and local experts. Datasets for the Republic of Congo, Equatorial Guinea, Central African Republic, and the Democratic Republic of Congo have not been reviewed for accuracy or completeness. In the Democratic Republic of

Congo, the current status of concessions is unknown, including whether mapped concessions remain valid and whether there are additional unmapped concessions.

- Country boundaries used for this analysis are from National Imagery and Mapping Agency (NIMA) VMAP Level 0.

Table B Central African¹ timber², production and exports (million cubic meters)

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Production	5,265	5,395	6,552	7,631	7,514	7,780	8,743	8,560	9,166	9,664
Exports	2,874	2,572	2,941	3,805	4,285	4,407	5,682	4,953	5,117	5,627
% Exported	55%	48%	45%	50%	57%	57%	65%	58%	56%	58%

Source: ITTO Annual Reviews from <http://www.itto.or.jp/sitemap/sitemap.html>

Notes

¹Central Africa includes Cameroon, Gabon, Republic of Congo, Democratic Republic of Congo and the Central African Republic, except in 1991 and 1992 for which Central African Republic data were not available. Note that data for Equatorial Guinea data were not available through ITTO, and thus not included here.

²Timber includes the following categories from the International Tropical Timber Organization: Logs, Sawnwood, Veneer and Plywood.

Map 3: Finer-Scale Analysis of Cameroon's Low-Access Forest Tracts

- Logging roads within Cameroon were digitized from 1999-2001 Landsat 7 ETM+ satellite imagery. The Landsat scenes provided full coverage of Cameroon's forested areas, though in some cases clouds prevented road mapping. The logging roads data layer includes main logging roads, secondary logging roads, and some new primary transportation routes through forest used to reach logging concessions.
- Logging roads were buffered twice: first by 1 km, to estimate the area accessed for logging and deepest penetration of vehicles into the forest; and second by 10 km, to estimate the area accessed for bushmeat hunting. The areas accessed for logging and hunting were calculated as a percentage of the total area of Cameroon's large (at least 1,000 km²), low-access forest tracts.

- Buffered road areas for the Cameroon map were not removed from the low-access forest tracts because these are not permanent roads. Also, a calculation of the portion accessed allows an indication of the extent of forest accessed in concessions across the region.

Table 1. Results of Access Analysis and Status of Low-Access Forest Tracts

Calculations of forest areas were based on the TREES 2000 central African vegetation map (Mayaux and Malingreau 2000). The 1-km-resolution TREES map was derived from 2000 NOAA AVHRR and SPOT VEGETATION satellite imagery, as well as ERS and JERS radar imagery. Landcover types included are: lowland rainforest, secondary forest and rural complex, forest-savannah mosaic, nonforest, mangrove, water bodies, swamp grasslands, swamp forest, and plantations. The

coarse-scale TREES vegetation map is suitable for regional analyses where the dataset can be compared to data from other sources. TREES data are much less accurate locally, as the coarseness of the sensor creates spatial aggregation errors (Mayaux et al. 1998).

The area of forest cover in central Africa has been reported in several global forest-resource assessments, including from TREES 1997 (E.C. Joint Research Centre), FAO (United Nations Food and Agriculture Organization, and IUCN (The World Conservation Union). Another estimate is available from the Central African Regional Program for the Environment (CARPE) (LaPorte et al. 1998). The extent of forest cover varies according to forest definition, date of the analysis, and methods used to develop land cover classifications, among other factors. Our estimate of 1,863,000 km², derived from the TREES 2000 data, compares with

1,839,670 km² estimated by TREES 1997 (“ever-green and semi-deciduous forest”); 1,583,000 km² by FAO-FORIS (“closed broadleaf forest”); 1,858,020 km² by IUCN (“closed forest”); and 1,815,753 km² by CARPE (LaPorte et al. 1998). For a discussion and detailed comparison of the TREES 1997, FAO, and IUCN datasets, see Mayaux et al. 1998.

Box 3, Figure A: Destination of Central African Timber Exports, 1993-1999

Regional totals are based on figures reported by International Tropical Timber Organization (ITTO) members, generally those reported by major importing countries.

- Estimates of log export underestimate the volume of timber felled, since logs are a subset of forest products produced and exported by central African countries. In addition, this estimate does not account for illegal logging.

Cameroon and Gabon are rapidly developing a wood processing industry to complement log production and exports with value-added products, such as sawnwood, plywood, and veneer sheets.

- Accurate data on the volume and direction of trade of processed products are difficult to obtain due to overlapping definitions used by international reporting agencies (Food and Agriculture Organization, International Tropical Timber Organization), and conflicting authority within the exporting countries’ forestry and customs services. Therefore, the direction of trade for all timber products (logs and processed products) may differ from the direction of log trade. Overall, export figures presented here are to be interpreted with caution due to discrepancies both within a single data source (e.g., ITTO) and between data sources (e.g., ITTO and FAO). However, these numbers give an indication of trends in trade and the associated order of magnitude.

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