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Global forest land-use change 1990–2005

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Cover photos:
Left: Western hemlock, Tsuga heterophylla natural forest, Alaska (B. Ciesla)
Centre: RGB composition (Band 5, 4 and 3) from Landsat 7, over a 20km by 20 km tile located at 72° West and 38° South, Chile (U.S geological survey)
Right: Forest cleared for agriculture, Thailand (FAO/14639/K. Boldt)

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Foreword

The world's forests are critical for human livelihoods. Increasingly they are being recognized for the wide range of products and essential ecosystem services they provide. Accurate and up-to-date information on the extent of the world's forests, and the way they are changing, has never been more important.

The Food and Agriculture Organization of the United Nations (FAO) has been collecting data and reporting on the world's forests for more than 60 years. Its Global Forest Resources Assessment (FRA) collates, analyses and tabulates data supplied to FAO by countries on a wide range of forest-related variables and reports its results every five years. Of particular interest are change in forest area and the dynamics of forest losses (deforestation and, to a lesser extent, loss through natural causes) and gains (afforestation and natural expansion of forests, for example into abandoned agricultural land). Many countries, however, lack sufficient data or repeated, comparable measurements with which to make reliable assessments of forest change.

With the rapid development, in the last 40 years, of global, satellite-based monitoring, such as the long time-series of data generated by Landsat, better data than ever before are available with which to carry out a comprehensive global study on change in forest area. It is vital that we look at forest area – and the way it has changed in recent years – in more detail.

This report on the FRA 2010 Remote Sensing Survey is the first of its kind to present systematic estimates of global forest land use and change. It is the result of many years of planning and three years of detailed work by staff at FAO and the European Commission Joint Research Centre (JRC), with inputs from technical experts from more than 100 countries. From its outset, the ambitious goal of the FRA 2010 Remote Sensing Survey has been to use remote sensing data to obtain globally consistent estimates of forest area and changes in tree cover and forest land use between 1990 and 2005.

It has been said that "we can't manage what we can't measure". We are delighted at the partnership that has developed between FAO, the JRC and countries with the aim of ensuring that future decisions on forests are based on reliable information. This report is a firm step in that direction. We thank the authors and all contributors and recommend this report to all those who want to know how the world's forests are changing.

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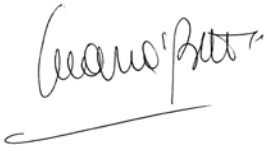

Maria Betti
Director
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and Sustainability
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Acronyms and abbreviations

ANOVA	analysis of variance
EOSD	Earth Observation for Sustainable Development of Forests (Canada)
FAO	Food and Agriculture Organization of the United Nations
FRA	Global Forest Resources Assessment (FAO)
GLS	Landsat Global Land Survey (United States Geological Survey)
ha	hectare(s)
IPCC	Intergovernmental Panel on Climate Change
JRC	European Commission Joint Research Centre
km	kilometre(s)
µm	micrometre(s)
MMU	minimum mapping unit
MODIS	Moderate Resolution Imaging Spectroradiometer
NFI	National Forest Inventory (Canada)
NLCD	National Land Cover Dataset (United States of America)
REML	restricted maximum likelihood
RSS	FRA Remote Sensing Survey
VCF	Vegetation Continuous Fields
WRS	Worldwide Reference System

Executive summary

This report presents the key findings on forest land use and land-use change between 1990 and 2005 from FAO's 2010 Global Forest Resources Assessment (FRA 2010) Remote Sensing Survey. This survey was the result of a partnership between FAO, countries and the European Commission Joint Research Centre (JRC). It is the first report of its kind to present systematic estimates of global forest land use and change.

A SYSTEMATIC SAMPLE FOR GLOBALLY CONSISTENT, STATISTICALLY RELIABLE RESULTS

The survey is based on a systematic sample of Landsat satellite imagery for the years 1990, 2000 and 2005 located at the intersection of each degree of longitude and latitude. Globally, 15 779 sample sites were processed for land cover and land use. The final number of sample sites analysed was 13 066 after accounting for sites with no data, statistical outliers and nation-specific review and revision (see Annex 1). The area surveyed at each sample site was 10 km × 10 km, providing a sampling intensity of about 1 percent of the global land surface.

FOREST LAND USE IS REPORTED

This report focuses on forest land use, not land cover. Forest land use is defined as areas with tree cover, or where management or natural processes will ultimately restore tree cover, and the predominant use is forestry. In some cases, forest land use may include land temporarily without tree cover, for example during cycles of shifting cultivation, forest plantations and even-age forest management. This approach is consistent with the forest definition used in FRA country reports and similar to the classes used in national reports under the United Nations Framework Convention on Climate Change.

FOREST AREA

The survey estimates the total area of the world's forests in 2005 at 3.8 billion hectares, or 30 percent of the global land area.

ANNUAL GLOBAL FOREST AREA LOSSES WERE GREATER IN 2000–2005 THAN IN 1990–2000

Overall, there was a net decrease in global forest area of 1.7 percent between 1990 and 2005, at an annual rate of change of 0.11 percent. This equates to an annual shift from forest land use to other land uses of 3 million hectares per year between 1990 and 2000 and of 6 million hectares per year between 2000 and 2005.

THERE WERE REGIONAL DIFFERENCES IN FOREST LOSS AND GAIN

Major regional differences were found in the net rates of forest area change; only Asia and North America experienced gains in forest area and all other regions saw net losses. South America had the highest net forest loss, losing some 3.3 million hectares annually between 1990 and 2005. Africa had the second highest net forest loss – 1.6 million hectares annually – during the same period. Europe, including the Russian Federation, had a net loss of 0.5 million hectares annually and Oceania lost just under 0.1 million hectares annually. North America experienced a net gain in forest area of 0.2 million hectares annually, while Asia had a net gain of 1.4 million hectares annually between 1990 and 2005.

FOREST LOSS WAS HIGHEST IN THE TROPICS

For this survey, forests were categorized according to four climatic domains: boreal, subtropical, temperate and tropical. There were significant gains in forest area in the boreal (0.9 million hectares annually) and subtropical (1.1 million hectares annually) between 1990 and 2005. There was also a net gain in forest area in the temperate domain of 0.9 million hectares annually over the same period.

In contrast, the tropical domain had a net loss of forest area of 6.8 million hectares annually between 1990 and 2005. This net reduction in forest land use was nearly 2.5 times the net forest area gained in the other three domains combined.