Project brief

Thünen Institute of Forestry 2022/19a

How 'good' are forest maps in the tropics?

Ruben Weber[1,2], Melvin Lippe[1], Fabián Tamayo[3], Tiza Mfuni[4], Renz Come[5], Cecilia Mangabat[6], Thomas Schneider[2] and Sven Günter[1,2]

- **An extraordinarily intensive ground verification effort allowed us to create highly accurate (92%) pantropical forest maps and to better estimate accuracies of seven relevant alternative datasets.**
- **The compared maps showed large areas of disagreement (from 17% to 24% of the total 15 million ha analyzed), mostly related to recurrent overestimations of forest cover by the global maps.**
- **Errors increased in regions prone to host reforestation or restoration activities; there ground verification methods combined with the critical use of forest maps are especially pertinent.**

Background

Obtaining reliable information on forest extent and condition is a prerequisite to design and implement effective environmental programs in tropical landscapes. Despite recent advances in remote sensing and the development of national forest monitoring agencies, the accurate mapping of tropical forests still faces operational challenges, such as: (1) errors at local level, with lack of cloud-free and reference data; (2) overcoming geographical variability; and (3) distinguishing forest condition regimes related to functionality or disturbance history.

Approach

Between 2016 and 2019, we collected over 16,000 ground control points and digitized over 18,000 ha with details on land use and forest disturbance across 36 landscapes in nine regions of Zambia, Ecuador and the Philippines. The selected areas of analysis represent a gradient of pantropical deforestation contexts, based on current forest cover and historical deforestation rates. Such an unusual effort to collect ground information allowed us to produce 30m-resolution forest maps covering ~15 million ha, using optical (Landsat-8) and radar (Sentinel-1) remote sensing data. To allow direct comparison, we followed a consistent methodology for the three countries. Our ground verification dataset also allowed us to better estimate the quality of our outputs and seven relevant global and national forest maps.

Key findings

We generated highly accurate (92%) forest maps for the studied regions (Table), slightly better than the maps of the national agencies, but with a consistent classification method across countries. Global datasets recurrently overestimated forest cover, with 10% worse overall accuracies than our maps. The spatial disagreements between all the analyzed sources ranged from 17% to 24% of the total 15 million ha assessed (Table), increasing in regions at advanced stages of deforestation (21% to 41%). Most of the errors affected regrowth forests, non-forest tree-based systems (e.g. perennials, palms, or agroforestry), shrub- and grasslands.

Table. Overall accuracies of the compared maps and spatial disagreements in the total sample (TOT), countries [a] and deforestation contexts [b].

Map sources	TOT	Country			Defor. Context		
		ZMB	ECU	PHL	INI	MID	ADV
Overall accuracies (%)							
Own production	92	96	79	96	96	89	90
Global maps (avg.)*	82	93	65	85	88	73	83
National maps (avg.)**	91	88	90	95	93	93	88
Spatial disagreements (%)	17-24	15-21	12-33	11-37	10-17	17-26	21-41

Source: Thünen Institute. a: Zambia, Ecuador, Philippines; b: Initial, Middle, Advanced; *: GFC, CGLS, JAXA FNF, TanDEM-X FNF; **: ILUA-II, MAE, NAMRIA.

Advice for policy-makers

Our findings show that the uncertainties of the maps currently employed for international forest policy actions can be very high in certain tropical areas. Relying uncritically on global and even on national maps can easily bias the estimations for climate change mitigation or forest protection measures, especially when assessing areas where most of the current environmental initiatives with focus on reforestation and forest restoration (e.g. Bonn challenge) take place. We highlight the role of ground verification as accompanying tool to monitor forests accurately and to reduce such uncertainties.

Further Information

Contact

[1] Thünen Institute of Forestry
ruben.weber@thuenen.de
www.thuenen.de/en/wf

Project-ID & Duration

1688 & 2497

01.2015-12.2020 & 01.2020-12.2023

DOI:10.3220/PB1652856131000

Partners

[2] Technical University of Munich.
[3] Universidad Estatal Amazónica, Universidad Técnica Luis Vargas Torres Esmeraldas (Ecuador); Copperbelt University, [4] CIFOR (Zambia); University Los Baños, ERDB-DENR, [5] Visayas State University, [6] Isabela State University (Philippines).

Publication

Ferrer Velasco R, Lippe M, Tamayo F, Mfuni T, Sales-Come R, Mangabat C, Schneider T, Günter S (2022). Towards accurate mapping of forest in tropical landscapes: a comparison of datasets on how forest transition matters. Remote Sens Environ 274: 112997. doi.org/10.1016/j.rse.2022.112997

Support

With support from
Federal Ministry of Food and Agriculture
by decision of the German Bundestag
Federal Office for Agriculture and Food