The Intact Forest Landscapes 2000/2013/2016/2020

The IFL Mapping Team, 2021

www.intactforests.org

The Intact Forest Landscape Definition

An Intact Forest Landscape (IFL) is an unbroken expanse of natural ecosystems within the current forest extent, with no remotely detected signs of human activity, and large enough that all native biodiversity, including viable populations of wide-ranging species, could be maintained. For our global assessment, an IFL is defined as a territory that contains forest and non-forest ecosystems minimally influenced by human activity, with (i) an area of at least 500 km^2 (50,000 ha), (ii) a minimum width of 10 km (measured as the diameter of a circle that could be entirely inscribed within the boundaries of the territory), and (iii) a minimum corridor/appendage width of 2 km. Areas with evidence of certain types of human influence are considered disturbed or fragmented and consequently not eligible for inclusion in the IFL. Specifically, we excluded from the IFL areas which in the last 30-70 years were affected by industrial activities (e.g. logging, mining, oil and gas exploration and extraction) or by stand-replacement fires in the vicinity of transport infrastructure or resource extraction sites, or which were cleared for agriculture or transformed into tree plantations. Settlements and infrastructure (including roads, navigable rivers, power lines, and pipelines) are excluded with a buffer zone of 1 km. Low-intensity and old (> 70 years) disturbances are treated as a "background" influence and don't lead to exclusion of the area from the IFL. Sources of background influence include historic (abandoned) shifting cultivation activities, diffuse grazing by domestic animals, low-intensity selective logging (without road infrastructure), and hunting. Although all IFLs are located within the forest zone (present-day extent of forest ecosystem distribution), some may contain extensive naturally tree-less areas, including grasslands, wetlands, lakes, alpine areas, and ice, if they are surrounded by forests.

IFL mapping and monitoring rely on freely available medium spatial resolution satellite imagery (Landsat and Sentinel-2), high spatial resolution imagery (available through Google Earth(TM) platform and through NICFI Program), and open access infrastructure and settlement maps. The IFL concept and mapping method were developed by a group of research and environmental organizations (Greenpeace, University of Maryland, World Resources Institute, and Transparent World) and have been used both in regional and global forest monitoring and research projects. For a detailed methodology overview please refer to *Potapov et al., 2008*; *Potapov et al., 2017,* and the IFL project website www.intactforests.org

Product history

The first global IFL map was prepared in 2005-2006 under the leadership of Greenpeace, with contributions from Biodiversity Conservation Center, International Socio-Ecological Union, and Transparent World (Russia), Luonto Liitto (Finnish Nature League), Forest Watch Indonesia, and Global Forest Watch, a network initiated by the World Resources Institute. The year 2000 map (***ifl_ 2000.shp***) was updated by Greenpeace Russia and the University of Maryland in 2012 using the year 2000 global cloud-free Landsat data composites that were produced following the methodology developed by *Hansen et al. (2013)*. During the 2020 update, the year 2000 IFL map was corrected in a few instances where the available high-resolution satellite data from Google Earth(TM) revealed pre-2000 infrastructure that were not visible on the year 2000 Landsat data.

The year 2013 global IFL map update was performed in 2014-2015 by Greenpeace, the University of Maryland, and Transparent World, with support from the World Resources Institute and WWF Russia. The map shows the extent of the IFL by the end of the year 2013 (***ifl_ 2013.shp***), and their degradation since the year 2000. The IFL map update for the year 2013 was based on the same data sources and methodology as the year 2000 mapping to ensure consistency. In our work, we leveraged annual cloud-free Landsat composites and the 2001-2013 gross tree cover loss map produced by the University of Maryland. During the IFL update, all human-induced forest clearing, new infrastructure, and burned areas adjacent to actively used infrastructure (permanent roads, rivers, pipelines, and power lines) were excluded from the year 2000 IFL, and the remaining areas were attributed as the year 2013 IFL if they passed our size criteria. The year 2013 IFL map was partially updated during the 2020 update.

At the end of 2017 – early 2018, the University of Maryland, Wildlife Conservation Society, Greenpeace, and Transparent World completed the update of the global IFL map for the year 2016 (***ifl_ 2016.shp***). The project was funded by the Wildlife Conservation Society and Greenpeace. The update employed Landsat data and annual forest cover change products produced by the Global Land Analysis and Discovery (GLAD) team (https://glad.umd.edu/). We used the latest available cloud-free Landsat observation composites for visual IFL change assessment using the same methodology as was used for the year 2013 update. The updated map represents IFL boundaries for the end for the year 2016 and the beginning of the year 2017. The map can be used in the framework of Forest Stewardship Council responsible forest management certification that requires the IFL extent for January 1, 2017. The 2016 map was partly updated in 2020 for the areas where newly available high-resolution data revealed older disturbances or infrastructure.

The latest year 2020 IFL map update was performed by the IFL Mapping Team, which includes satellite data interpretation specialists from the Global Land Analysis and Discovery team (at the University of Maryland) and Greenpeace. The analysis followed the same IFL mapping methodology. The GLAD analysis-ready Landsat data (GLAD ARD, https://glad.umd.edu/ard/home) supported the global IFL conversion and fragmentation detection. We also employed Sentinel-2 imagery and high resolution data from Google Earth(TM) and Planet (supported by the NICFI Program). The latest IFL map (***ifl_2020.shp***) provides information on the IFL extent for the end of the year 2020. In a few cases, we were not able to determine the exact date of the disturbance or fragmenting infrastructure that was detected using the newly available high resolution data. In such cases, the change of the IFL boundary from 2013/2016 to 2020 may represent an earlier disturbance.

References

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Product availability and licensing

All up-to-date IFL maps and IFL monitoring results are available from the project website **www.intactforests.org** in formats suitable for use in GIS software and as the Google Earth Engine datasets. The IFL Mapping Team is continuing to improve the IFL base map and to provide periodical updates as new data, technologies, and more sophisticated sources of information become available. Please check News & Updates for information about the latest map releases.

We suggest referencing the IFL maps as follows:

Potapov, P., Hansen, M. C., Laestadius L., Turubanova S., Yaroshenko A., Thies C., Smith W., Zhuravleva I., Komarova A., Minnemeyer S., Esipova E. "The last frontiers of wilderness: Tracking loss of intact forest landscapes from 2000 to 2013" *Science Advances, 2017*; 3:e1600821

For the web-based applications, the suggested reference as follows:

The IFL Mapping Team. "Intact Forest Landscapes 2000/2013/2016/2020" Available at www.intactforests.org

Technical description

The global IFL map is provided in the ArcGIS shapefile format in geographic coordinates using the WGS84 coordinate system. The recommended scale for data visualization is 1:1,000,000. The dataset includes the IFL extent for the years 2000, 2013, 2016, and 2020 (**ifl_2000.shp, ifl_2013.shp, ifl_2016.shp, ifl_2020.shp**). The year 2000 dataset contains the unique IFL patch ID combined from the IFL region code (see table below) and unique ID within the region, e.g. "AFR_25". The same ID was retained for the year 2013, 2016, and 2020 datasets; however, in case IFL patch was fragmented into separate patches, an additional unique index was added to the IFL ID, e.g. "AFR_25_1", "AFR_25_2", etc. The area of IFL patches was estimated in the Cylindrical equal-area projection (WGS 84 reference system) and provided in thousands of hectares. Due to the limitations and possible uncertainties in exact area estimation, the actual area threshold for the IFL patch inclusion was 49,000 (instead of 50,000) hectares.

Regional abbreviations

Africa	*AFR*
Australia and New Zealand	*AUS*
North and Central America	*NAM*
Northern Eurasia	*NEA*
South America	*SAM*
South-East Asia	*SEA*

The **forest_zone.shp** layer delineates the forest zone boundary. The extent of the forest zone was mapped using the global year 2000 tree canopy cover dataset *(Hansen et al., 2013)* with a 20% tree canopy cover threshold. Inland water bodies and naturally treeless ecosystems were included in the forest zone. Fragments of land in the forest zone with a contiguous area smaller than 500 km^2 were excluded from consideration. The database (DB field [Region]) specifies geographic regions used for the IFL analysis. Geographic regions within the forest zone were delineated using natural boundaries between forested areas. The boundary between northern boreal and southern boreal/temperate regions in North America and Northern Eurasia was based on Landsat data analysis and represents the de-facto dividing line between lands that have, and have not, been subject to industrial logging as of the year 2013. To delineate this boundary, we used Landsat images for the year 2013 to map the northernmost extent of industrial logging, applied a 5-km buffer around detected logging, and connected the resulting polygons.

List of geographic regions and corresponding DB codes

Code	Region
1	Africa
2	Australia and New Zealand
3	Temperate South America
4	Tropical and subtropical South America and Mesoamerica
5	Temperate and southern boreal North America
6	Northern boreal North America
7	Temperate and southern boreal Eurasia
8	Northern boreal Eurasia
9	West Hemisphere Pacific Islands
10	Southeast Asia and Oceania