Progress on the

New York Declaration on Forests

Technical Annexes

Goal 1: At least halve the rate of loss of natural forests globally by 2020 and strive to end natural forest loss by 2030

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Description of the Goal and the Indicators

Goal 1 aims to end natural forest loss by 2030, with at least a 50% reduction by 2020 as a milestone toward its achievement. While natural forests clearly do not include monoculture tree plantations, Goal 1 does not specify whether the aim is to reduce and then end gross or net loss of natural forests. Thus we have selected separate proxy indicators to monitor each type of loss (see Box 1 for definitions of gross and net loss).

We used data from Hansen et al. (2013a, updated by Global Forest Watch) for Indicator 1 and data from the Food and Agriculture Organisation of the United Nations' Global Forest Resources Assessment (FAO FRA, FAO 2015a) for Indicator 2. Each data source uses a different method and both embody substantial uncertainties (see Data Gaps and Limitations section and Technical Annex, below, for more detail). We are not advocating the use of one over the other for the purpose of monitoring progress towards Goal 1. Instead, we suggest that despite uncertainties and limitations, the two data sets show directional trends that can serve as proxies for monitoring. Improvements in these proxy measures, as well as new measures, should be considered as they emerge.

INDICATOR 1
Annual *gross* forest/tree cover loss in hectares

INDICATOR 2
Annual *net* natural forest/tree cover change in hectares

Main Concepts and Definitions

Crown cover	'Crown cover' refers to the percentage of ground covered by tree canopy in a selected area of land. Crown cover is used as a threshold to decide how much ground must be covered by tree canopy in order to classify the area as trees or forest.
Natural Forest	'Natural forest' is forest excluding plantations. The Food and Agriculture Organisation (FAO) defines natural forest as "naturally regenerated forest" (FAO 2015c) which may or may not be of native species.
Deforestation	'Deforestation' refers to the conversion of forest to other land use or the permanent reduction of the tree canopy cover below the minimum 10 percent threshold (FAO 2015c).
Tree cover loss	'Tree cover loss' indicates the removal or mortality of tree canopy cover and can be due to a variety of factors, including mechanical harvesting, fire, disease, or storm damage (Hansen 2013b). As such, 'loss' does not equate to deforestation.

Box 1: Differentiating gross and net loss of natural forests

***Gross* loss of natural forest measures the magnitude of annual change, counting all tree cover or forest area lost, without regard to any regeneration or reforestation of natural forest.** Since 1988, this approach has been used by the Brazilian Space Agency (INPE) to monitor deforestation in the Brazilian Amazon. INPE's analyses are widely recognized as credible and transparent. In this satellite-based approach, a pixel classified as forest in 1988 may be deforested only once, after which it is masked from future analysis, regardless of whether its conversion to "non-forest" is temporary or permanent. **Ending gross natural forest loss would mean that, from year-to-year, there would be no measurable clearing of natural forest area.**

***Net* loss of natural forests measures the difference in forest area between two points in time, averaged over the number of years between reporting periods.** The United Nations Food and Agriculture Organization's Global Forest Resources Assessment (FAO FRA) monitors net changes in forest area every five years, based on tabular data that are self-reported by participating countries – using their own inventories, surveys, and maps. Recent data assembled and analyzed by FAO FRA allow separation of net natural forest loss from plantation forest data. **Ending net natural forest loss would mean that the measurable area of natural forest regeneration/reforestation is equal to or greater than the measurable area of gross natural forest loss over a specified time period.**

Beyond the data limitations described for the Goal 1 indicators, there are important trade-offs between targeting gross vs. net natural forest loss:

- Gross forest loss treats loss as categorically distinct from regeneration/reforestation (noting that the latter is addressed in Goal 5), whereas net forest loss conflates the two. For numerous purposes, and in most (but not all) cases, newly regenerating/reforesting areas are inferior to the forests that they offset under a net accounting approach. These purposes include:
    - Carbon storage, insofar as it can take 30 to 300 or more years for an area of regenerated or restored forest to accumulate the amount of carbon emitted to the atmosphere from the same area of lost natural forest, hence regeneration/restoration is unlikely to offset carbon emissions from natural forest loss—especially if the "new forest" subsequently experiences cycles of clearing and regrowth. **Zero net forest loss does <u>not</u> equal zero net forest emissions.**
    - Hydrological cycle functions may return more quickly than carbon storage, but it generally takes well over a decade of regrowth to regain the extent of water-pumping from ground to atmosphere that deep-rooted natural forests provide, hence the potential impact on rainfall may be important.
    - Biodiversity differs between older and younger forests with marked changes in plant species composition, and structure in the new forests offering different habitats that attract different types of wildlife.

Achieving zero natural forest loss could result in perverse outcomes for both gross and net accounting approaches, unless modifications or contingencies to the definition of "zero" are developed and applied:

- **Because zero gross natural forest loss means no clearing of any natural forest for any purpose**, strict adherence would translate (inter alia) to:
    - No construction of roads or other infrastructure in natural forest areas.
    - No clearing of natural forest (including secondary forest) for agriculture of any kind, even by small farmers and/or indigenous peoples.
    - Overmanagement of forests to prevent loss, including where disturbances (e.g., natural fires) are part of maintaining a healthy ecosystem.
- **Because zero net natural forest loss conflates loss with reforestation/regeneration, this target could be successfully achieved at the same time as the world's remaining primary/old-growth forests are completely replaced by regenerated forests.**

Sources: Brown, S., and Zarin, D. (2013), FAO. (2015a), INPE. (2015)

Key Messages

INDICATOR 1: ANNUAL GROSS FOREST/TREE COVER LOSS IN HECTARES

- Based on satellite-based measurements, the annual rate of gross tree cover loss appears to have remained steady from 2005 to 2011, and has increased 9% in 2011-2014 compared to the 2001-2010 baseline.

INDICATOR 2: ANNUAL NET NATURAL FOREST/TREE COVER CHANGE IN HECTARES

- If natural forest regrowth is counted as offsetting natural forest clearing, the annual net loss of natural forest/tree cover area appears to be declining from a high in 2005 of 9.7 million hectares per year to 6.65 million hectares per year in 2015 (a 31% peak decrease and a 25% decrease compared to the 2000-2010 historical baseline).

Taken together, Indicators 1 and 2 illustrate that achieving the goal of at least halving the rate of natural forest loss by 2020 will be challenging, but possible. The Hansen/GFW data shows negligible progress in reducing tree cover loss, while the FAO data demonstrates progress that may in fact achieve a halving in the rate of forest loss by 2020 if the current trajectory is maintained.

Data Gaps and Limitations

One of the main gaps in both available data sets is the lack of direct measurements of natural forest change. The Hansen/GFW data set does not yet distinguish between natural forest and plantations, land-use designations, or types of forest disturbance (e.g., logging, fires, storms). Tree cover loss counts tree plantation rotations and shifting cultivations as well as natural disturbances, and does not distinguish them from anthropogenic natural forest conversion. GFW intends to delineate plantations for seven key tropical countries so they can be removed from this analysis.

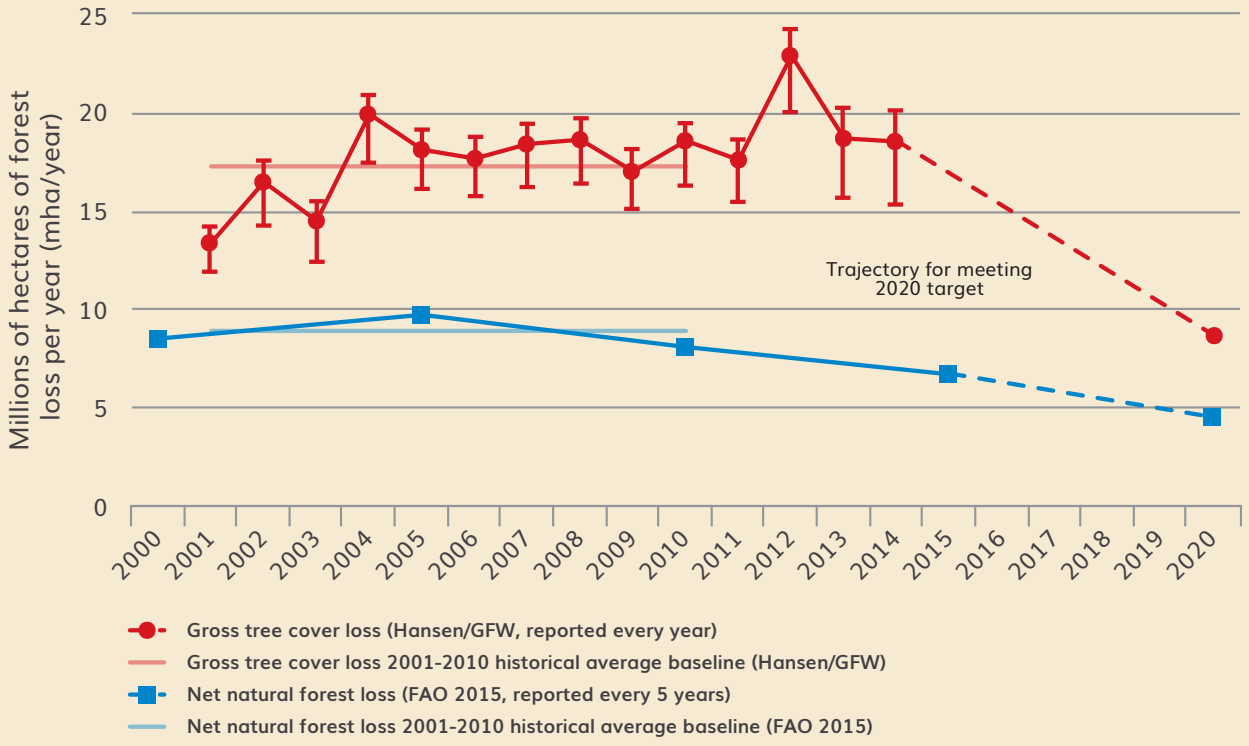
FAO FRA data rely on self-reporting by countries, hence, the quality and methodology of the data varies. Challenges with the FAO FRA data include: incomplete global reporting (not all countries are accounted for), incomplete country reporting (all forests may not be accounted for), inaccurate reporting (tiers of accuracy vary), data that are not spatially explicit, and changing methods in different reporting periods. There is also a significant time lag between the collecting, reporting, and publication of FAO data (MacDicken 2015).

Findings

INDICATOR 1: ANNUAL GROSS TREE COVER LOSS

Hansen/GFW estimates that an average of 17.2 million hectares (ha) of tree cover were lost per year from 2001 to 2010, and this rate has since increased. Compared to the historical baseline (2001-2010), *gross tree cover* loss increased by 9% between 2010 and 2014. In Figure 1, gross tree cover loss (red line) peaks in 2012, and trends downward in 2013 and 2014. The spike in 2012 is partially explained by an increase in boreal forest fires (Sizer et al. 2015). The overall trend of tree cover loss remains high and there is no significant progress toward halving gross annual loss by 2020. These data are presented in Figure 1 and Table 1.

Figure 1: Measures of gross (red) and net (blue) annual natural forest loss, 2000-15.



For the Hansen/GFW estimate, the line represents the default crown cover threshold of 30% while the alternative crown cover thresholders are represented by the upper (10%) and lower (50%) error bars.

Source: Climate Focus graph based on Hansen et al 2013 (updated on GFW) and FAO FRA 2015.

INDICATOR 2: ANNUAL NET NATURAL FOREST COVER LOSS

Data on net forest change are also presented in Figure 1, Figure 2, and Table 1. The FAO FRA data show a significant and continuous decline in net natural forest loss since the 2000-2005 reporting period. Net natural forest loss was 8.87 million ha per year from 2001 to 2010, and is now 6.65 million ha

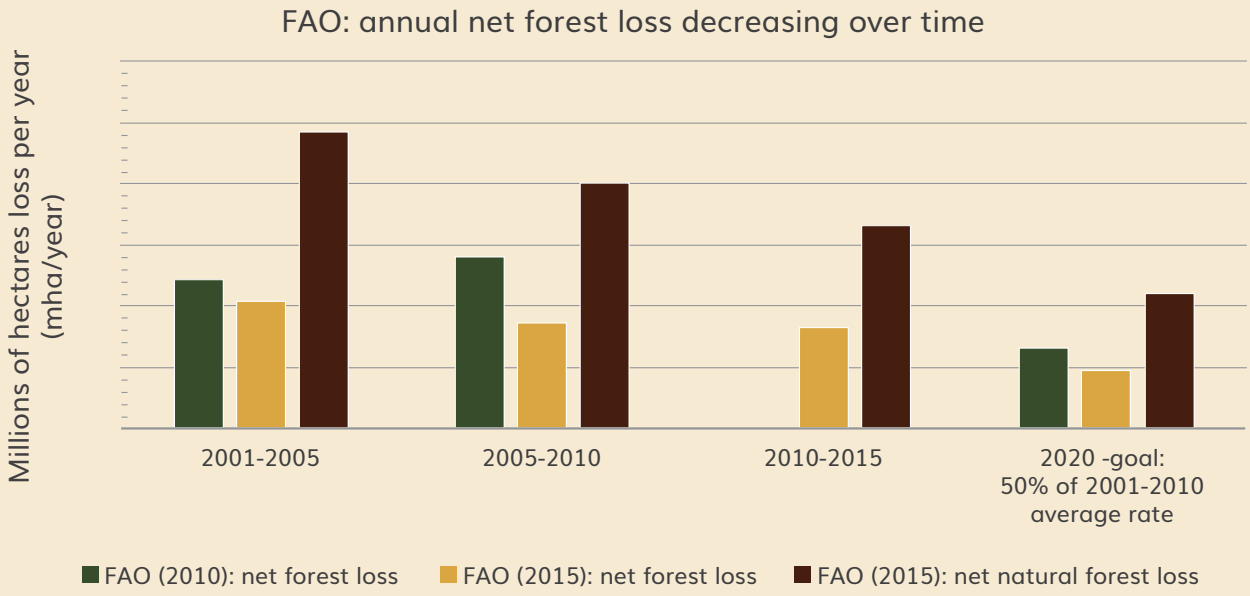
per year—a 25% decrease in the 2010-15 reporting period. To meet the goal of halving natural forest loss by 2020, rates would have to decline by an additional 2.2 million ha per year. The rate of net natural forest loss may be on a trajectory for meeting the milestone of halving natural forest loss by 2020.

For comparison, Figure 2 provides FAO data on the net rate of total forest cover loss for the same periods. The red and the blue bar represent FAO data from 2010 and 2015. Every reporting period produces different numbers on past years due to new/different methods for assessing forest loss. The shows, among others, the difference between the two reporting periods of 2010 and 2015. As is evident, net forest loss is lower when all forests are considered, largely due to the growth of planted forests worldwide, which offsets natural forest loss to some extent.

Net natural forest loss is only reported in 2015, so is only represented by that reporting period.

These two indicators show diverging results, which reflect differences in datasets including dates, areas included, methods, and definitions – forest vs. tree cover, net vs. gross loss – and constraints described above and in the Annex. Recognizing the limitations of the data, we infer that, globally, these divergent results reflect an overall trend of increasing natural forest cover re-established on abandoned or degraded land even though regeneration and reforestation are not keeping up with the rate of gross forest cover loss.

Figure 2: Annual net global forest loss and natural forest loss data from FAO (2010 and 2015), showing a steady decline in forest loss since 2000, with hypothetical 2020 targets provided for the three data sets.



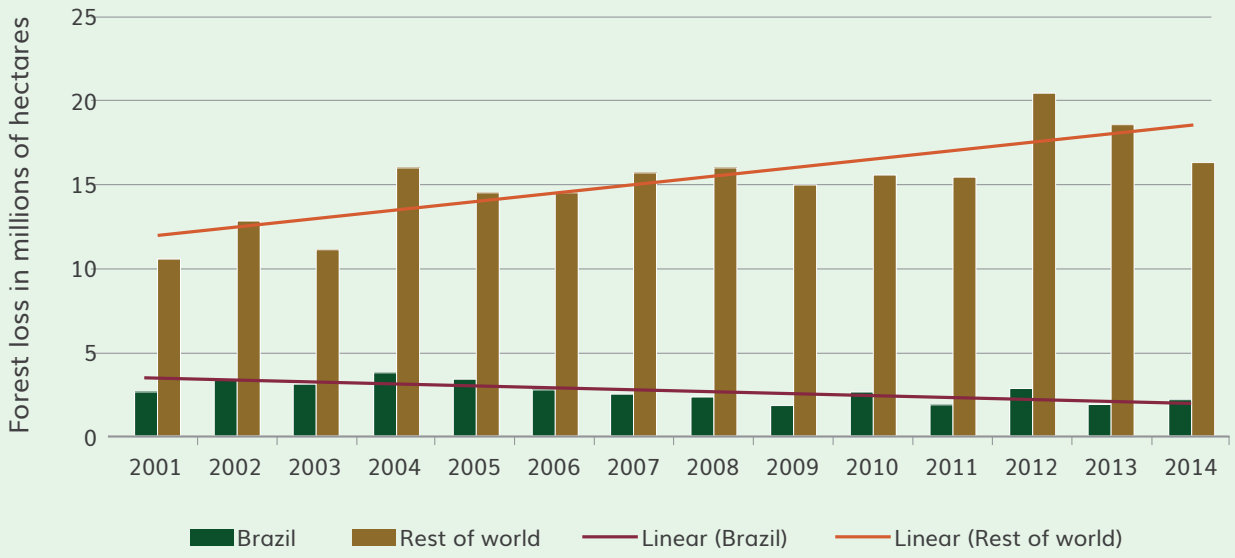
Source: Climate Focus Graph based on data from FAO Forest Resources Assessment (2015 and 2010).

Box 2: Forest loss case study

Forest loss in Brazil versus the rest of world

Given the large percentage of global forest cover located in Brazil, forest loss trends in Brazil have a large effect on global averages. Separating figures for Brazil from the rest of the world highlights international trends that are otherwise overshadowed. Figures from Global Forest Watch/Hansen indicate a falling annual rate of forest loss in Brazil from 2001 and 2014, with the implication that forest loss rates in the rest of the world are increasing at a significantly greater rate than the global average (Figure 3).

Figure 3: Forest loss in Brazil versus the rest of the world



Source: Climate Focus Graph based on data from Hansen/GFW. (2014).

Table 1. Summary of forest change baseline indicators.

Data source (variable or layer)	Crown cover threshold	Indicator	Baseline		Trends post-2010 by year						NYDF Goal 1: 50% reduction by 2020:	
			Hist. average	Static							Hist. avg. (2000-2010)	Static (2010)
			2001-2010	2010	2011	2012	2013	2014	2015	2016 …	2020	2020
Gross tree cover loss estimates from Hansen et al. (2013), updated on Global Forest Watch												
Hansen/GFW: Tree cover loss	10%	Annual forest loss (million ha/yr)	18.28	19.51	18.58	24.36	20.35	20.18			9.14	9.75
		Annual % forest loss	0.38%	0.40%	0.38%	0.50%	0.42%	0.42%			0.19%	0.20%
	30%	Annual forest loss (million ha/yr)	17.25	18.55	17.58	22.90	18.67	18.52			8.62	9.28
		Annual % forest loss	0.43%	0.46%	0.44%	0.57%	0.47%	0.47%			0.22%	0.23%
Annual net forest cover loss estimates from FAO												
FAO FRA (2010): net forest cover change	10%	Annual forest loss (million ha/yr)	5.21	5.58	n/a	n/a	n/a	n/a	n/a	n/a	2.61	2.79
		Annual % forest loss	0.13%	0.14%							0.065%	0.07%
FAO FRA (2015): net forest cover change	10%	Annual forest loss (million ha/yr)	3.99	3.41	n/a	n/a	n/a	n/a	3.31	n/a	2.00	1.71
		Annual % forest loss	0.10%	0.085%					0.082%		0.05%	0.043%
FAO FRA (2015): Net natural forest loss	10%	Natural forest loss (million ha/yr)	8.87	8.05	n/a	n/a	n/a	n/a	6.65	n/a	4.43	4.02
		Annual % natural forest loss	0.24%	0.22%					0.18%		0.12%	0.11%

Hansen/GFW's 10-year historical average uses data from 2001-2010, while FAO uses the average of data reported in 2005 and 2010, which each represent estimates for the five preceding years. Orange columns reflect results that will be added as they become available. Purple columns provide the targets that would be needed to achieve Goal 1 relative to the respective baseline. All values in the table, though positive, represent forest loss. n/a = not applicable

Source: Cimate Focus based on data from Hansen/GFW and FAO.

Technical Annex

Selection of Indicators

The indicators selected can be expressed in hectares per year, or in the percentage change of forest or tree cover per year. We provide both hectares and percentage change for the indicators. Using these indicators allows us to set a baseline of the rate of forest loss prior to the signing of the NYDF, and provide a quantitative benchmark for progress toward Goal 1 that uses existing data sources, updated periodically.

Methodology

For comparison, two reference periods are used to track the progress of the indicators: a 10-year historical average reference period and a static reference period from 2010 (Table 2). The 10-year historical average baseline uses 2001-2010 for both FAO and Hansen/GFW data. The static year of 2010 marks the year of the Cancun Agreements when many countries began committing to reduce emissions from deforestation (UNFCCC 2010). The historical average evens out annual variability, and is therefore a more reliable baseline to assess deforestation. Although the static baseline is provided for comparability, progress toward the NYDF targets are measured relative to the 10-year historical average baseline, and is the estimate highlighted in the Summary Report.

Table 2: Reference periods used for forest loss indicators.

TYPE OF REFERENCE PERIOD	HANSEN/GFW REFERENCE PERIOD	FAO FRA REFERENCE PERIOD	CHARACTERISTICS
10-year historical average baseline	2001-2010 average	2000-2010 average	• Hansen/GFW data is updated annually using last 10 years of data. • FAO data is updated every 5 years (2000, 2005, 2010, 2015, 2020)
2010 static baseline	2010 value	Data reported in 2005 and 2010 (five-year aggregates) divided by 5	• Year is selected based on the adoption of the Cancun Agreements (COP-16) • A single year may be an outlier value

Given the nature of the data, only gross tree cover change can be calculated from the Hansen/GFW data, and only net natural forest change can be calculated from the FAO data. For a detailed analysis of the difference between gross and net, please see Box 1.

For the Hansen/GFW data, gross tree cover loss and percent change were calculated using 2000 tree cover data and tree cover loss data from 2001-2014. Tree canopy cover thresholds—10%, 30% (default), and 50%—were used to calculate tree cover change to demonstrate variability in forest cover estimates (see Figure 1). A 30% threshold means that 30% of the 30x30 meter pixel must be covered by trees in order for the pixel to be counted as forest. Estimates using the 10% and 50% thresholds are displayed in the upper (10%) and lower (50%) error bars in Figure 1. The 30% setting is considered by Hansen/GFW to have the highest integrity. Annual forest change was calculated for the 10-year

historical baseline by dividing the total forest loss (in ha) from 2001 to 2010 by 10, and in turn dividing this by the 2000 global tree cover area to estimate annual percent forest loss. The static baseline was calculated as forest loss in 2010 (ha) divided by the 2000 forest cover (ha) to yield percent forest loss in 2010. The baseline values calculated are listed in the middle columns of Table 2. Results for gross forest change in Hansen/GFW, for years after 2010, were calculated the same way.

Note that methodological differences in how the tree cover layer, and tree loss and gain layers were produced means that they cannot be added and subtracted to calculate net forest change (e.g. 1 ha of forest loss in 2010 cannot be subtracted from 1 ha of forest cover in 2000). Calculating net forest change between the 2000 and 2010 global tree cover layers may therefore produce high uncertainties between the two data sources. For this reason, we do not aim to calculate net forest change using the Hansen/GFW data.

Net forest change from FAO is provided as the measurement of total forest cover every five years (the sum of all nationally-reported forest cover in hectares) which includes plantation forests, and is also provided as the sum of all natural forest cover data (nationally-reported) every five years. The net natural forest cover is most directly relevant to tracking progress for Goal 1, and is therefore the indicator highlighted in the summary report. Net forest change for each period (2000-2005, 2005-2010, and 2010-2015) is calculated by countries as the difference in total forest cover from one period to the next. Data from the FAO 2010 report is also provided for comparison to demonstrate that the previous year estimates of forest cover loss were since revised downward. All estimates of net forest loss obtained from FAO data are provided in Figure 2 for comparison.

To track progress against the indicators, the baseline data provided in Table 2 is then compared to the latest year's results (2011 to present) for both Hansen/GFW and FAO FRA (these cells are highlighted in orange). As new data become available from both of these data sets—annually from Hansen/GFW and every five years from FAO—the current rate of tree cover or natural forest loss, respectively, can be calculated and compared to these baseline calculations in order to gauge progress in reaching the NYDF target of at least halving natural forest loss by 2020, and ending natural forest loss by 2030. In both Figure 1 and Figure 2, progress toward the 2020 target is illustrated by calculating the average forest loss (in Ha) from 2000-2010, and dividing this by 2. This target, displayed on the far right of each graph, gives a visual estimate of progress toward the goal relative to the existing historical data. As the subsequent years' data points are completed, progress toward reaching the Declaration's goals will become easier to evaluate.

Data

Data to produce these indicators comes from the following two sources:

- The Global Forest Watch provides remote sensing data of global forest cover change using the Landsat 7 satellite (Hansen et al. 2013a). The Hansen/GFW platform uses global forest data originally reported by Hansen et. al. (2013b). The data set includes all vegetation of 5 meters or higher as forest, and sets a default canopy cover threshold at 30%. Other canopy cover thresholds may also be used (e.g., 10%, 30% and 50%).
- The FAO Forest Resources Assessment compiles country-level data on forest cover reported by countries (FAO 2010 and FAO 2015). Forests include areas with vegetation over 5 meters high and 10% minimum canopy cover (FAO 2015c).

The two datasets provide complementary approaches for monitoring global forest change but serve different purposes. The FAO Global Forest Resources Assessment provides national statistics on forests reported by countries, including forest cover, land use designations, growing timber stock, and economic indicators. FAO data reflects how countries manage and measure their forests, and data quality and methodology vary based on the resources available in each country as well as the surveying methodology: many countries are limited to ground-level assessments while others have access to satellite data. The FAO also counts forests based on land use classification rather than physical forest cover; for example, if natural forests are logged in a certain year, but the land is classified as a production forest, it will not be recorded as forest loss. Globally aggregated FAO figures are only included if countries are able to report them. Countries may also revise previous years' estimates on forest cover and change if better estimates are available during a new FAO reporting period. This means data are not truly longitudinal as methodologies can change from one report to the next. Forest Resource Assesment reports are also only released once every five years, providing less frequent tracking of forest change.

Global Forest Watch provides annual global data on tree cover using satellite imagery, and offers several advantages that complement the FAO data. Hansen/GFW characterizes all forest change and cover data consistently around the world, and can monitor areas where national-level resources are unavailable. Landsat satellites provide annual updating of forest change data, allowing for more up-to-date monitoring of forest change. Hansen/GFW also provides a user-friendly online platform making it accessible to the public. The distinction between tree cover and forest cover is important.

Hansen/GFW counts tree cover as any area with vegetation 5 meters tall or higher, but its limitations lie in the fact that it cannot distinguish between forest types, species, forest age/height, between natural forests and plantations, nor distinguish between land use designations or strategies. This can overestimate deforestation in countries with heavy rotation of plantations or large effects of natural disturbances, would fail to detect degradation beneath the canopy, and on its own, cannot distinguish between areas where regeneration is rapid versus areas where regeneration is unlikely.

In sum, while both datasets are imperfect proxies that cannot directly measure natural forest loss, used in parallel, they provide useful proxies for monitoring global progress using data that is widely available, regularly updated, and straightforward to analyze.

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