Chapter 1

OVERARCHING FOREST GOALS

Theme 1 Assessment

Chapter contents

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KEY MESSAGES

Did the world make progress on forest goals?

This report's overall finding is unmistakable: the world is off track to eliminate deforestation and forest degradation by 2030.

In 2022, global progress on protecting and restoring forests moved too slowly and, in some cases, progress was reverted. Global deforestation increased by 4 percent in 2022 compared to 2021. Each year that passes without sufficient progress, it becomes more and more challenging to meet global forest goals by 2030. Progress in 2021 was already insufficient, and the world needed to make up that lost ground (and more) in 2022.

The following key findings stand out from this year's Assessment:

- **In 2022, 6.6 million hectares of deforestation occurred worldwide.** That means that not only did the world miss its 2022 target for eliminating deforestation by the end of the decade, but there was a 4 percent increase in deforestation compared to 2021.
- **Regional deforestation targets were missed in all tropical regions, though not to the same degree.** Tropical Asia fared better than other tropical regions; it saw a 16 percent lower rate of deforestation in 2022 compared to baseline levels. While this progress is still slightly too slow (as deforestation in the region was still 1 percent higher than the Assessment-identified target), it shines in comparison to Tropical Latin America and the Caribbean (LAC), which saw a 9 percent increase in deforestation compared to baseline. That means tropical LAC is the tropical region farthest off track from the pathway to 2030 (with 35 percent higher deforestation than the Assessment-identified target for 2022).
- **Progress on reducing deforestation was mixed in the world's non-tropical regions,** with three out of five non-tropical regions (non-tropical Asia, and non-tropical Africa, North America) meeting their respective deforestation targets in 2022.
- **Global progress on eliminating primary forest loss was off track.** Not only did the world miss its 2022 target for eliminating primary forest loss, but there was a 10 percent increase in pantropical humid primary forest loss in 2022 compared to 2021. Though available data is limited to humid tropical forest loss (rather than all primary forests), it is clear that the world's progress on stopping the loss of these irreplaceable forests is vastly insufficient.
- **Gross emissions from deforestation increased.** Gross emissions from deforestation increased by 6 percent compared to 2021 – totaling 4 billion metric tons of carbon dioxide equivalent in 2022.
- **Forest degradation (data available only to 2021) fell somewhat below baseline overall.** Degradation was higher than the baseline in tropical and non-tropical regions of Latin America and Africa, whilst rates decreased in tropical and non-tropical Asia, Europe, and North America.
- **Forest regrowth in tropical deforested areas has increased exponentially over the past four years,** demonstrating the great capability of forests to recover from disturbances, but also signaling that at least a portion of deforested areas are abandoned after logging. Regrowth is certainly positive, but the ecological conditions characterizing mature forests may take decades to be reestablished.
- **While there is evidence that restoration is scaling up globally, tracking progress is hindered by the glaring lack of transparency on public and private efforts to restore forests across the world.** It is essential that both public and private sector actors step up to report their restoration data with a focus on quality, validation, and transparency.
- **Forested KBAs saw significant loss in tree cover in 2022, and forest degradation continues, while slightly slowing down between 2020 and 2021.** There was 1.2 million hectares of tree cover loss within KBAs – with only two regions meeting the Assessment-identified target needed to be on schedule to eliminate tree cover loss in forested KBAs by 2030.
- **Biodiversity in forests is declining at an alarming rate.** According to 2022 updated data from the Forest Specialists Index, monitored populations of forest specialists (i.e., species dependent on forest habitats for their survival or reproduction) declined in abundance by 79 percent on average between 1970 and 2018 with habitat loss, habitat degradation, overexploitation, and climate change as the most pressing threats.

How do we assess progress?

This chapter provides a summary of global progress on halting deforestation and degradation and advancing forest restoration. We estimate progress using several quantitative indicators. The **Technical Annex** provides the full list of indicators, which are divided among core and supplemental indicators. Core indicators pertain to the overarching targets on protecting and restoring forests. Supplemental indicators provide additional context on the state of forests through an estimate of forest carbon stocks and biodiversity within forests.

Core indicators:

- **Deforestation**, which uses estimates of global and regional deforestation,[a1] humid tropical primary forest loss,[2] and emissions from deforestation;[3]
- **Forest degradation**, estimated as Forest Landscape Integrity Index (FLII) units lost per year;[4]
- **Forest regrowth and restoration**, including estimates of tropical moist forest regrowth[5] and areas under restoration from multiple sources;

Supplemental indicators:

- **Forests' carbon storage**, both regionally and globally;[6] and
- **Biodiversity within forests**, assessed through tree cover loss within key biodiversity areas (KBAs),[b] forest degradation within KBAs, and the Forest Specialists Index.[7]

BOX 1.1. KEY TERMS AND METHODOLOGICAL EXPLANATIONS

This report tracks progress toward 2030 forest goals and indicates whether the world, regions, and individual countries are on track or off track towards these goals. It does this by reporting the latest estimates for multiple forest indicators and compares those values to an Assessment-identified target for the same year, where possible. This report uses the baseline period 2018-20 for creating these annual targets on the pathway to 2030.

DEFINITIONS OF ABOVE KEY TERMS:

2030 forest goals refer to the goals of globally eliminating gross deforestation and forest degradation and restoring 350 million hectares of forests by 2030. These goals are established by pledges like the New York Declaration on Forests, the Glasgow Leaders' Declaration, and the Bonn Challenge. Overall, this report aims to answer the question, "Is the world on track to reaching 2030 forest goals?" using the most up-to-date yearly estimates, which are from 2022.

Indicators refer to an observable, quantitative forest characteristic or process. This report uses several indicators to assess progress, including both "core" and "supplemental" indicators:

- **"Core" indicators** refer to deforestation, forest degradation, and forest regrowth and restoration. These are considered "core" indicators because their estimates relate to the subjects of the 2030 forest goals in question.
- **"Supplemental" indicators** refer to forests' carbon storage and biodiversity within forests. Estimating these indicators provides valuable information about the state of the world's forests. In the context of this report, they are considered "supplemental" because they provide additional information that (while important) does not directly relate to the subjects covered by 2030 forest goals.

A baseline estimate for each indicator is used as the "starting point" on the pathway towards 2030 forest goals. Baseline estimates are the averages of each indicator from 2018 to 2020. For example, gross deforestation in tropical Asia is averaged across 2018, 2019, 2020 and the resulting figure is used as a baseline for that indicator and region. The baseline period (2018-20) is illustrated in grey on charts.

[a] Global spatial data on forest change (Hansen et al. 2013, updated throughout 2022) differs in its definitions and methods from official national forest statistics. Moreover, the deforestation statistics used in this Assessment are derived from a map of drivers of tree cover loss (Curtis et al. 2018, updated through 2022) that attributes all tree cover loss to the same driver over the entire assessment period, even if changes in drivers do occur over time in regions or countries. In places where commodity-driven deforestation has declined significantly in recent years, current deforestation rates may be overestimated due to the large amounts of commodity-driven deforestation earlier in the period.

[b] Key Biodiversity Areas (KBAs) are sites that contribute significantly to the global persistence of biodiversity. KBAs are identified and designated using globally standardized criteria, and they extend the Important Bird Area (Crosby. M. J. et al. [1994]) concept to other taxonomic groups (Source: https://portals.iucn.org/library/node/49979).

Box 1.1 on **Key terms** and **methodological explanations** provides an explanation of our methodology for assessing progress on each of these indicators, as well as essential terms. Most forest change indicators fluctuate significantly from one year to the next, meaning that clearer assessments of progress – or lack thereof – will emerge as more annual data becomes available. Thus, the trends presented in this report will be further honed and validated with subsequent years of data. Additional methodological notes and analysis are available in the **Technical Annex.**

Importantly, this chapter provides a snapshot of progress as of 2022 on protecting and restoring forests but does not endeavor to explain the causes of identified trends. The other chapters of this report (**Chapter 2** on sustainable production & development, **Chapter 3** on finance for forests, and **Chapter 4** on forest rights & governance), as well as country case studies, assess stakeholder efforts and enabling conditions that, together, seek to explain the outcomes reported in this chapter.

This report tracks progress on forest goals using Assessment-identified targets along the pathway to 2030 for each indicator (see **Technical Annex** for more on how the Assessment created these targets). The pathway is defined as a straightforward linear trajectory, requiring a 10 percent reduction in the deforestation (or degradation) rate each year from 2021 to 2030, compared to a baseline of the average rate from 2018-2020. To assess progress, each indicator's progress in 2022 is compared to its corresponding target for the same year. This demonstrates whether the world, region, or country is "on track" or "off track" for that indicator:

- "On track" refers to when the world, region, or individual country meets its 2022 target for any given indicator.
- "Off track" refers to when the world, region, or individual country misses its 2022 target for any given indicator. This is illustrated by showing how much the observed indicator deviated from the target (expressed in a percentage). For instance, in a hypothetical example, if a country saw 2 million hectares of deforestation in 2022 and its target for that year had been 1.5 million hectares of deforestation, then that country would have missed its target by (or was "off track by") 33 percent.

FINDINGS

1.1 Is the world on track to eliminate deforestation by 2030?

In 2022, 6.6 million hectares of deforestation occurred worldwide, meaning the world remained off track on the pathway to no deforestation by 2030.

By the end of 2022, the world needed to meet the Assessment-identified target of 5.4 million hectares of global deforestation to be on track to eliminate gross deforestation by 2030. However, global deforestation in 2022 was 6.6 million hectares, which is 21 percent off track to eliminate deforestation by 2030 (**Figure 1.1**).

Further, compared to 2021, deforestation in 2022 increased by 4 percent. The world's collective actions to reduce deforestation globally have not resulted in sustained and sufficient results on the ground.

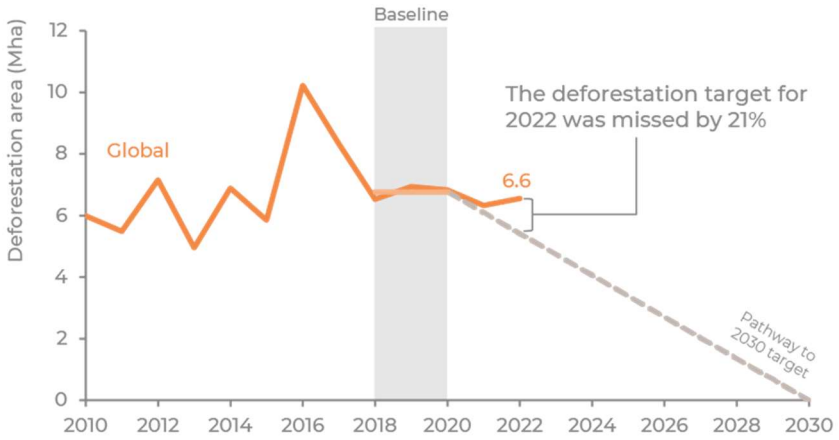
In 2021, the world was also off track on the pathway to 2030 goals; the world needed to make up that lost ground – and more – in 2022. Insufficient progress makes the challenge of reducing deforestation increasingly difficult in each remaining year leading up to 2030. The next interim target is to reduce global deforestation to 4.8 million hectares (or less) in 2023, meaning the world will need to reduce deforestation by 27.8 percent from 2022 levels to get on track. This will be a significant challenge.

How do we assess progress on halting deforestation?

Several global pledges have set the goal of "halting deforestation" by 2030, "Halting deforestation" is defined as reaching zero gross deforestation by 2030. In this report, "zero gross deforestation" refers to a state of no permanent land use change from forests to non-forests and no additional clearing of primary forests – irrespective of any forest gains (see Technical Annex for list of definitions). Assuming linear progress towards this goal, the world needs to see a 10 percent reduction in the deforestation rate each year from 2020 to 2030, compared to a baseline of the average deforestation rate from 2018-20 (see Technical Annex for more on methodology).

There are many different definitions of deforestation, and no method perfectly captures deforestation, therefore this report uses a set of proxy indicators to estimate global deforestation in 2022. The first indicator estimates global deforestation as the permanent conversion of forests to a new land use. The methodology adopted in the Assessment considers drivers of forest loss[8] to evaluate whether the conversion from forest to a new land use is permanent or not. The second estimates the loss of primary humid tropical forests.[9] The third estimates the emissions from deforestation,[10] given forests' significant contribution to meeting the Paris Agreement goals.

Figure 1.1. Global deforestation between 2010 and 2022, in million hectares (Mha)



Note: The baseline is calculated as the average deforestation between 2018 and 2020. The annual global deforestation targets are the points on the linear trajectory going from the baseline 2018-20 and the 2030 target of zero deforestation. In 2022, global deforestation was 6.56 Mha, which is 21 percent above the Assessment-defined target. Source: Figure based on original analysis for this report using data from Hansen et al. 2013, updated through 2022. Only tree cover loss that is deemed permanent (Curtis et al., 2018) or that occurs within humid tropical primary forests is considered here.

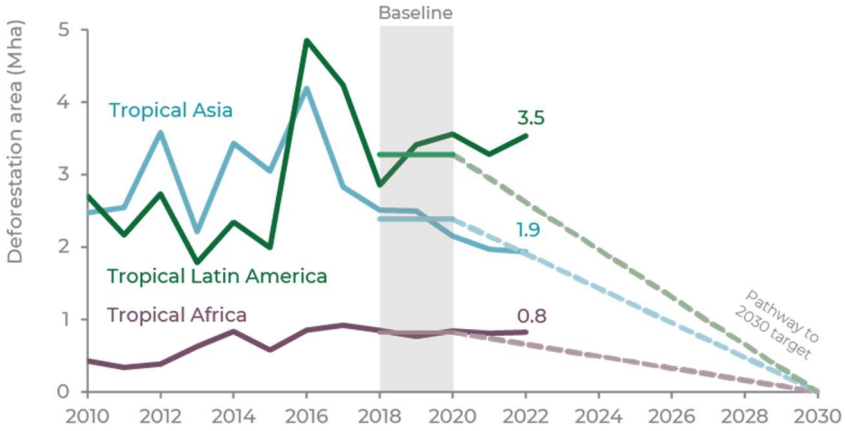
Regional deforestation targets were missed in all tropical regions, though not to the same degree. Deforestation in tropical Asia was only 1 percent higher than the Assessment-identified 2022 target, faring much better than other regions that missed their regional interim targets by a much greater margin.

Because the vast majority of global deforestation takes place in tropical regions (nearly 96 percent in 2022), reducing deforestation in the tropics is essential for meeting global forest goals.

In 2022, tropical Asia fared significantly better than other tropical regions; it saw 1.9 million hectares of gross deforestation, which is a 16 percent reduction from baseline levels. This is a positive trend that places tropical Asia off track by only 1 percent when compared to the interim target for 2022 (**Figure 1.2, Table 1.1**).

In contrast, tropical Latin America and the Caribbean (LAC) saw 3.5 million hectares of deforestation in 2022 – an 8 percent increase compared to baseline. This means that tropical LAC experienced a level of deforestation that was 35 percent higher than the Assessment-identified target for 2022 – the farthest off track of any tropical region (see **Figure 1.2, Table 1.1**).

Figure 1.2. Tropical regional deforestation between 2010 and 2022, in million hectares (Mha)



Note: The baseline is calculated as the average deforestation between 2018 and 2020. The annual deforestation targets are the points on the linear trajectory from the 2018-20 baseline to the 2030 target of zero deforestation. In 2022. deforestation in tropical Latin America. tropical Africa. and tropical Asia exceeded the Assessment-defined regional targets by 34. 26. and 2 percent respectively. Source: Figure based on original analysis for this report using data from Hansen et al. 2013, updated through 2022. Only tree cover loss that is deemed permanent (Curtis et al., 2018) or that occurs within humid tropical primary forests is considered here.

Table 1.1. Tropical, non-tropical, and global deforestation, in million hectares (Mha)

	Baseline 2018-20 (Mha)	Target for 2022 (Mha)	Deforestation 2022 (Mha)	Relative change from baseline	Deviation from target
Tropical Africa	0.82	0.65	0.82	1%	26%
Tropical Asia	2.39	1.90	1.93	-19%	1%
Tropical LAC	3.27	2.62	3.53	8%	35%
Europe	0.0013	0.0010	0.0013	1%	26%
Non-tropical Africa	0.0015	0.0012	0.0009	-38%	-22%
Non-tropical Asia	0.0261	0.0209	0.0183	-30%	-13%
Non-tropical LAC	0.0904	0.0723	0.1189	31%	64%
North America	0.1683	0.1346	0.1268	-25%	-6%
Global	**6.77**	**5.51**	**6.56**	**-3%**	**21%**

Source: Based on original analysis for this report using data from Hansen et al. 2013, updated through 2022. Only tree cover loss that is deemed permanent (Curtis et al., 2018) or that occurs within humid tropical primary forests is considered here

Progress on reducing deforestation was mixed in the world's non-tropical regions, with three out of five non-tropical regions meeting their respective interim deforestation targets for 2022.

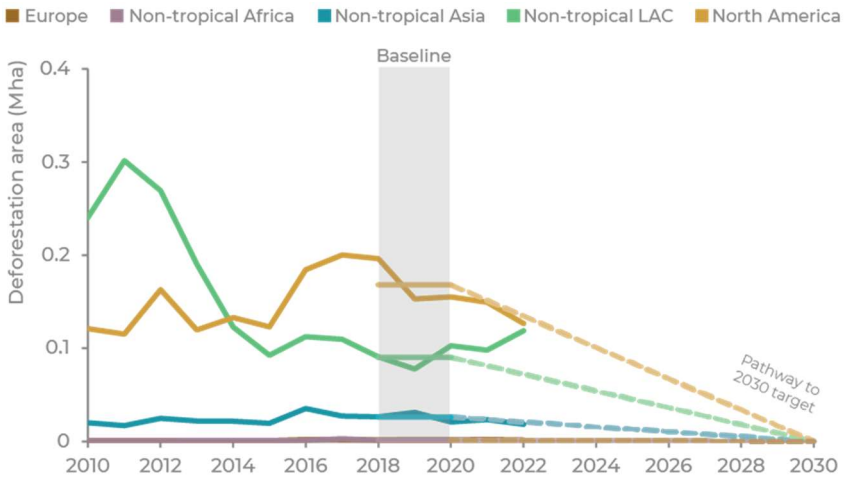
Three out of five non-tropical regions (North America, non-tropical Asia, and non-tropical Africa) met their respective deforestation targets in 2022 **(Figure 1.3).**

Globally, deforestation is heavily concentrated in tropical regions; deforestation in all non-tropical regions, combined, accounts for approximately 4 percent of global deforestation, or 8 percent of the deforestation observed in Latin America in 2022 (see **Table 1.1**).

Still, the importance of halting deforestation in non-tropical regions cannot be overlooked. The act of removing forest canopy and replacing it with roads, parking lots, homes, or cultivation areas has an immediate impact on the land's ability to absorb water and mitigate the destructive effects of floods,[11] which are occurring at increasing frequency and intensity also in non-tropical regions.[12]

Furthermore, forests in non-tropical regions play a crucial role in regulating temperatures both on a global and local scale. The removal of forests in North America, Europe, and non-tropical Asia is estimated to lead to an increase in global temperatures of approximately 0.49 degrees Celsius,[13] further exacerbating climate change and making it increasingly challenging to meet the climate targets outlined in the Paris Agreement.

Figure 1.3. Non-tropical regional deforestation between 2010 and 2022, in million hectares (Mha)



Note: The baseline is calculated as the average deforestation between 2018 and 2020. The annual deforestation targets are the points on the linear trajectory going from the baseline 2018-20 and the 2030 target of zero deforestation. Source: Figure based on original analysis for this report using data from Hansen et al. 2013, updated through 2022. Only tree cover loss that is deemed permanent (Curtis et al., 2018) or that occurs within humid tropical primary forests is considered here.

In 2022, only three of the ten countries with the greatest absolute areas of deforestation met their respective interim target to be on track for meeting 2030 forest goals.

The ten countries that had the greatest absolute areas of deforestation in 2022 displayed mixed progress in 2022 **(Table 1.2).** On track progress by some countries – like Malaysia, Paraguay, and Indonesia – was exceeded by failure to sufficiently reduce deforestation in other countries – like Brazil and Bolivia (see **Bolivia case study** for more on drivers of deforestation in this country). Of the three countries with the greatest absolute areas of deforestation, only Indonesia met the Assessment-identified target for 2022, with a 21 percent decrease from 2018-20 baseline levels.

Major forest countries continue to see an increase in deforestation – or see reductions, but at too slow a pace – to meet 2030 forest goals. If these trends continue, it will be very difficult for the world to achieve the 2030 global goal of eliminating gross deforestation, regardless of other countries' positive progress. Additional country data is available in the **Technical Annex.**

In 2022, the countries with the greatest decreases in deforestation from baseline levels were Venezuela, Guatemala, and Nicaragua, followed by Malaysia and Vietnam.

These countries have had the greatest success in the fight against deforestation by achieving the most drastic decreases in deforestation in 2022 compared to the baseline 2018-20 **(Table 1.3).** These countries demonstrate that the 2030 goals are still within reach if the world steps up to the challenge.

Table 1.2. The ten countries with the largest absolute area of deforestation in 2022, in million hectares (Mha)

	Baseline 2018-20 (Mha)	Target for 2022 (Mha)	Deforestation 2022 (Mha)	Relative change from baseline	Deviation from target
Brazil	1.93	1.55	2.34	21%	51%
Indonesia	1.05	0.84	0.83	-21%	-2%
Bolivia	0.47	0.38	0.53	12%	40%
DRC	0.48	0.39	0.51	6%	32%
Laos	0.28	0.22	0.26	-6%	18%
Malaysia	0.35	0.28	0.24	-32%	-15%
Myanmar	0.22	0.18	0.19	-15%	7%
Peru	0.17	0.14	0.17	-2%	23%
Paraguay	0.23	0.19	0.16	-29%	-12%
Colombia	0.17	0.13	0.14	-17%	4%

Note: Additional country data is available in the **Technical Annex**. Source: Figure based on original analysis for this report using data from Hansen et al. 2013, updated through 2022. Only tree cover loss that is deemed permanent (Curtis et al., 2018) or that occurs within humid tropical primary forests is considered here.

Table 1.3. The ten countries that most drastically decreased deforestation in 2022 compared to baseline, in million hectares (Mha)

	Baseline 2018-20 (Mha)	Target for 2022 (Mha)	Deforestation 2022 (Mha)	Relative change from baseline	Deviation from target
Venezuela	0.06	0.04	0.02	-61%	-52%
Guatemala	0.03	0.03	0.01	-59%	-48%
Nicaragua	0.04	0.03	0.02	-43%	-29%
Vietnam	0.16	0.13	0.1	-35%	-19%
Malaysia	0.35	0.28	0.24	-32%	-15%
Madagascar	0.08	0.06	0.05	-31%	-14%
Paraguay	0.23	0.19	0.16	-29%	-12%
Mexico	0.07	0.06	0.05	-28%	-9%
United States of America (the)	0.16	0.13	0.12	-26%	-8%
Cambodia	0.12	0.1	0.09	-24%	-5%

Source: Figure based on original analysis for this report using data from Hansen et al. 2013, updated through 2022. Only tree cover loss that is deemed permanent (Curtis et al., 2018) or that occurs within humid tropical primary forests is considered here.

In 2022, 4.1 million hectares of primary tropical forest were lost. That's 33 percent higher than the target of 3 million hectares to be on track with the goal of zero primary forest loss by 2030.

Though available data is limited to humid tropical primary forest loss (rather than all primary forests), it is clear that the world is off track on halting primary forest loss. Primary tropical forest loss increased by 6 percent in comparison to baseline levels.

Because primary forests have only been mapped extensively in the humid tropics, this report looks at data on humid tropical primary forest loss (a subset of all primary forests) in the absence of a wider dataset.

BOX 1.3. CONTEXT FOR PRIMARY FOREST LOSS

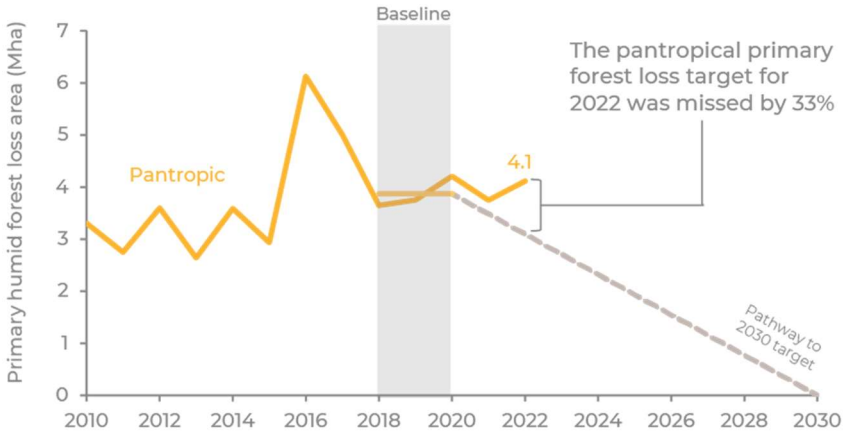
So far, this chapter has assessed overall deforestation, which is defined as 1) permanent tree cover loss event or 2) tree cover loss in primary humid tropical forest boundaries.

It is essential to focus on primary forest loss because the loss of the carbon stored in primary forests is irreversible in relevant time scales,[14] and their biodiversity resources are irreplaceable.[15]

Forest loss that occurs in primary forests (i.e., ancient, intact forest ecosystems) is considered "deforestation". This is because it can take hundreds or even thousands of years to re-establish the structures and the ecological functions that characterize a primary forest. That means that if a primary forest is cut down and replaced by a new. regrowth forest (i.e., a secondary forest), that loss is not fully compensated because the new forest will not host the great variety of species lost in the primary forest, nor will it store the same volumes of carbon.

It's essential to track progress specifically on avoiding loss of primary forest ecosystems. In the absence of data on global primary forest loss, this report looks at pantropic data on humid tropical primary forests.[16] This is not a perfect proxy for all primary forest loss because it overlooks dry tropical primary forests and primary forests outside the tropics.

Figure 1.4. Pantropic humid primary forest loss between 2010 and 2022, in million hectares (Mha)



Note: The baseline is calculated as the average pantropic humid primary forest loss between 2018 and 2020. The annual targets are the points on the linear trajectory going from the baseline 2018-20 and the 2030 target of zero deforestation.

Source: Figure based on original analysis for this report using data from Hansen et al. 2013. Only tree cover loss occurring within primary forest boundaries is considered (Turubanova et al., 2018).

Table 1.4. Regional and global humid primary forest loss, in million hectares (Mha)

	Baseline 2018-20 (Mha)	Target reduction in 2022 (Mha)	Primary forest loss in 2022 (Mha)	Relative change from baseline	Deviation from target
Tropical Africa	0.78	0.66	0.80	2%	28%
Tropical Asia	0.72	0.58	0.64	-12%	10%
Tropical LAC	2.35	0.19	2.66	13%	42%
Non-tropical regions	0.015	0.012	0.023	51%	47%
Global	3.86	3.09	4.12	6%	33%

Note: Primary tropical forests occur primarily in countries designated as "tropical" and grouped in "tropical" regions, However, a fraction of primary tropical forests also occurs in countries assigned to "non-tropical" regions (e.g., North America). Thus, the cumulated loss of primary tropical forests in non-tropical regions is also included in the table.

Source: Figure based on original analysis for this report using data from Hansen et al. 2013. Only tree cover loss occurring within primary forest boundaries is considered (Turubanova et al., 2018).

Tropical regions are off track to eliminate primary forest loss by 2030.

Tropical regions continue to struggle to stop the destruction of primary forests. Tropical Asia experienced 0.6 million hectares of primary forest loss in 2022. This means the region failed to meet its 2022 Assessment-identified target **(Table 1.5).** However, the direction of the trend is even more concerning: tropical Asia saw an increase in the rate of primary forest loss between 2021 and 2022.

This is noteworthy given the improvements the region had seen in 2021, when tropical Asia was on track with its Assessment-identified target.

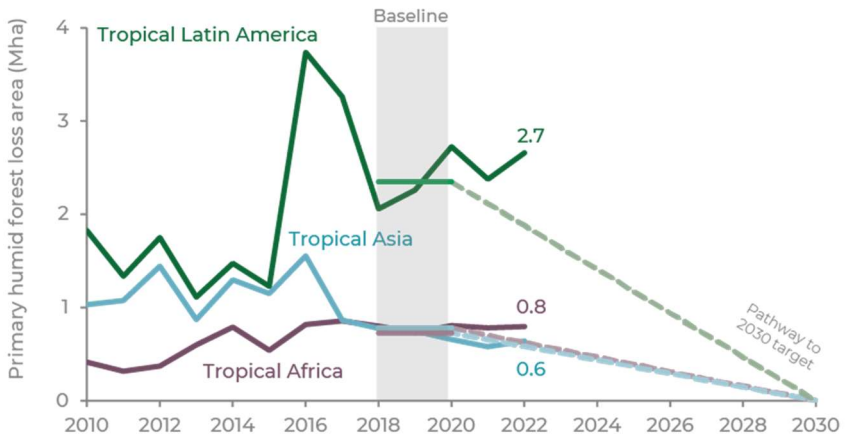
Other tropical regions also underperformed on reducing primary forest loss. Tropical Latin America experienced 2.7 million hectares of primary forest loss in 2022, which means the region experienced an increase in primary forest loss and missed its regional 2022 target by 42 percent. Tropical Africa also missed its 2022 target (by 28%) needed to stay on track to eliminate primary forest loss by 2030.

In 2022, the countries with the greatest absolute areas of tropical primary forest loss were Brazil, the Democratic Republic of the Congo, and Bolivia. None of these countries met their 2022 primary forest loss targets, with Bolivia even experiencing twice the level of primary forest loss than the 2022 target required to be on track.

The ten countries with the largest absolute areas of humid tropical primary forest loss in 2022 (**Table 1.5**) have varied in their progress on eliminating the destruction of irreplaceable ecosystems for their species composition, carbon storage, and the provision of life-sustaining ecosystem services.

Of this group, Brazil had the largest absolute area of humid primary tropical forest loss in 2022 (1.77 million hectares) – constituting a greater area than the primary forests losses in the other nine countries combined (1.72 million hectares). This means Brazil missed the interim target for 2022 by a wide margin (with 51 percent higher primary forest loss than needed to be on track).

Figure 1.5. Regional humid primary forest loss between 2010 and 2022, in million hectares (Mha)



Note: The baseline is calculated as the average humid primary forest loss between 2018 and 2020. The annual targets are the points on the linear trajectory going from the baseline 2018-20 and the 2030 target of zero deforestation.

Source: Figure based on original analysis for this report using data from Hansen et al. 2013. Only tree cover loss occurring within primary forest boundaries is considered (Turubanova et al., 2018).

Table 1.5. The ten countries that recorded the largest areas of primary forest loss in 2022, in million hectares (Mha)

	Baseline 2018-20 (Mha)	Target in 2022 (Mha)	Primary forest loss in 2022 (Mha)	Relative change from baseline	Deviation from target
Brazil	1.47	1.18	1.77	21%	51%
DRC	0.48	0.39	0.51	6%	33%
Bolivia	0.24	0.19	0.38	60%	100%
Indonesia	0.31	0.25	0.23	-26%	-8%
Peru	0.16	0.13	0.16	-2%	23%
Colombia	0.15	0.12	0.13	-16%	5%
Laos	0.07	0.06	0.09	34%	67%
Cameroon	0.07	0.06	0.08	8%	35%
Papua New Guinea	0.06	0.05	0.07	25%	56%
Malaysia	0.11	0.09	0.07	-36%	-20%

Source: Based on original analysis for this report using data from Hansen et al. 2013. Only tree cover loss occurring within primary forest boundaries is considered (Turubanova et al., 2018).

Bolivia also stands out as a country with particularly poor performance: humid tropic primary forest loss increased in Bolivia by 60 percent from the baseline (0.38 million hectares). This level of primary forest loss is twice the rate of the country's 2022 target for primary forest loss (see **Table 1.5**). Two countries met their 2022 targets for reducing primary forest loss: Indonesia and Malaysia.

In 2022, the countries with the greatest decreases in primary forest loss from baseline levels were Guatemala, Venezuela, and Côte d'Ivoire.

These countries achieved the 10 most drastic decreases in primary forest loss in 2022 compared to baseline 2018-20 (**Table 1.6**). Guatemala and Venezuela top this list, with both countries seeing a 58 percent decline in primary forest loss in 2022 compared to baseline levels.

Table 1.6. The ten countries that achieved the most drastic decreases in primary forest loss in 2022 compared to baseline, in million hectares (Mha)

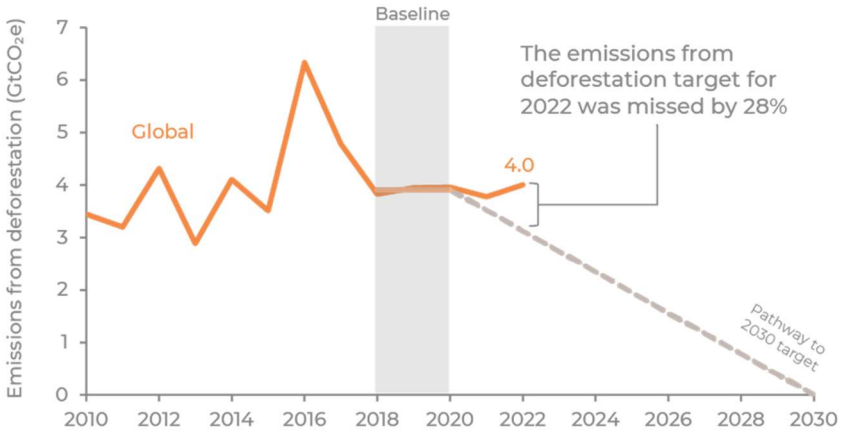
	Baseline 2018-20 (Mha)	Target in 2022 (Mha)	Primary forest loss in 2022 (Mha)	Relative change from baseline	Deviation from target
Guatemala	0.03	0.02	0.01	-58%	-48%
Venezuela	0.05	0.04	0.02	-58%	-48%
Côte d'Ivoire	0.02	0.01	0.01	-49%	-36%
Nicaragua	0.04	0.03	0.02	-43%	-28%
Malaysia	0.11	0.09	0.07	-36%	-20%
Mexico	0.06	0.05	0.04	-36%	-20%
Vietnam	0.03	0.03	0.02	-33%	-16%
Madagascar	0.07	0.06	0.05	-32%	-16%
Paraguay	0.04	0.04	0.03	-27%	-9%
Indonesia	0.31	0.25	0.23	-26%	-8%

Source: Based on original analysis for this report using data from Hansen et al. 2013. Only tree cover loss occurring within primary forest boundaries is considered (Turubanova et al., 2018).

In 2022, gross emissions from deforestation increased by 2 percent compared to baseline levels – totaling 4 billion metric tons of carbon dioxide equivalent.[17]

Gross emissions from deforestation (i.e., all emissions, not accounting for any removals) totaled 4 billion metric tons of carbon dioxide equivalent in 2022 (**Figure 1.6**). This is a 2 percent increase compared to the 2018-20 baseline. To put the scale of these emissions in perspective, if deforestation in 2022 was its own country, it would be the third-highest emitter after China and the United States.[c]

Figure 1.6. Global emissions from deforestation from 2010 to 2022 in billion metric tons of carbon dioxide equivalent ($GtCO_2e$)



Note: The baseline is calculated as the average deforestation between 2018 and 2020. The annual targets are the points on the linear trajectory going from the baseline 2018-20 and the 2030 target of zero emissions from deforestation.

Source: Figure based on original analysis for this report using data from Harris et al., 2021, Hansen et al. 2013, and Curtis et al. 2018, updated through 2022.

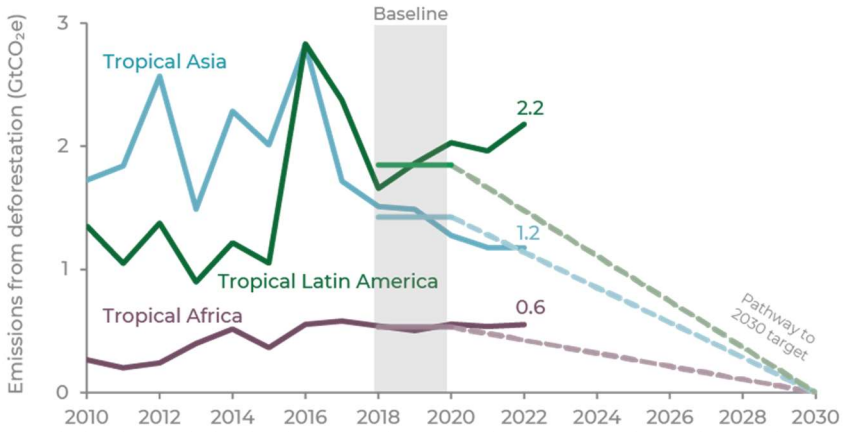
[c] As reported by the World Emissions Clock by the World Data Lab, China's 2022 emissions amount to 14.7 GtCO2e and the United States amount to 6.2 GtCO2e. The next highest emitter is India, listed at 3.9 GtCO2e.

In 2022, deforestation in the tropics caused the emission of 3.90 billion metric tons of carbon dioxide equivalent. Tropical Latin America alone produced 2.18 billion metric tons of carbon dioxide equivalent, nearly as much as the energy sector in the United States in the same year (2.5 billion metric tons of carbon dioxide equivalent).[18]

At the regional level, emissions from deforestation in the tropics were in the order of billions of metric tons of carbon dioxide equivalents (**Figure 1.7, Table 1.8**), while emissions in non-tropical regions amounted to tens of millions of metric tons (**Figure 1.8, Table 1.9**). In addition to their role in the global carbon cycle, tropical forests also play a critical role in the hydrological cycle and influence local and regional precipitation[19] (**Box 1.4**).

None of the tropical regions met the regional interim target for 2022, with tropical Latin America missing by a 47 percent. Tropical Asia is the only tropical region showing a decrease in emissions from deforestation in comparison to baseline levels. However, the region missed the regional interim target of 1.14 billion metric tons of carbon dioxide equivalent by 3 percent. Additionally, the region's emissions from deforestation increased in 2022 compared to 2021. Emissions from deforestation remain lower in tropical Africa than in other regions, while showing an increase of 4 percent from the regional baseline level (**Figure 1.7, Table 1.7**).

Figure 1.7. Tropical regional emissions from deforestation, in billion metric tons of CO2 equivalent ($GtCO_2e$)



Note: The baseline is calculated as the average deforestation between 2018 and 2020. The annual targets are the points on the linear trajectory going from the baseline 2018-20 and the 2030 target of zero emissions from deforestation.

Source: Figure based on original analysis for this report using data from Harris et al., 2021, Hansen et al. 2013, and Curtis et al. 2018, updated through 2022

Table 1.7. Tropical regions' emissions from deforestation in 2022, in billion tons of carbon dioxide equivalent ($GtCO_2e$)

	Baseline 2018-2020 ($GtCO_2e$)	Target in 2022 ($GtCO_2e$)	Emission from deforestation in 2022 ($GtCO_2e$)	Relative change from baseline	Deviation from target
Tropical Africa	0.53	0.43	0.55	4%	29%
Tropical Asia	1.42	1.14	1.17	-18%	3%
Tropical LAC	1.84	1.48	2.18	18%	47%

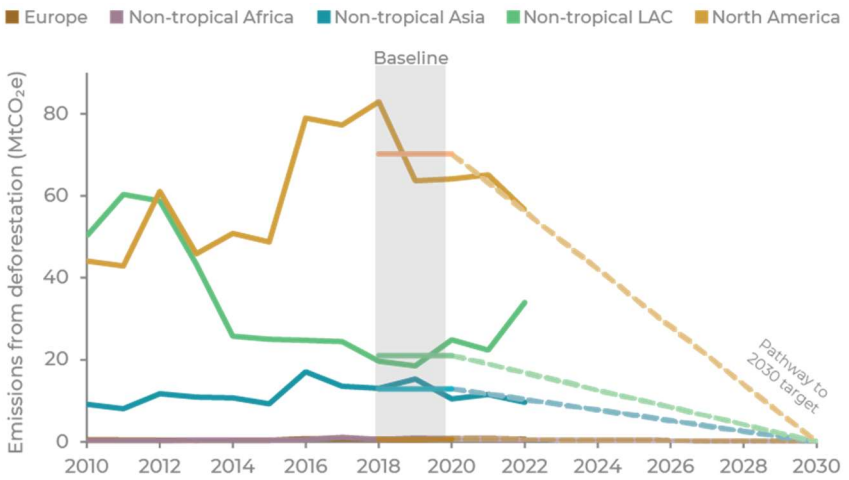
Source: Figure based on original analysis for this report using data from Harris et al., 2021, Hansen et al. 2013, and Curtis et al. 2018, updated through 2022

In 2022, emissions from deforestation in non-tropical regions reached 101.20 million metric tons of carbon dioxide equivalent, which is in the same scale of the emissions caused by the energy sector in Italy during the same period (107.6 million metric tons of carbon dioxide equivalent).[20]

The cumulative emissions from deforestation in non-tropical regions represent about 2.5 percent of the global emissions from deforestation. The non-tropical region with highest gross emissions from deforestation is North America (70.23 million metric tons of carbon dioxide equivalent). Even though North America has the highest gross emissions, the region experienced a 19 percent decrease from the baseline level and missed the regional interim target for 2022 by only 1 percent. Two non-tropical regions met their 2022 targets: non-tropical Africa and non-tropical Asia (**Figure 1.8, Table 1.8**).

Non-tropical Latin America, on the other hand, experienced a significant jump in emissions from deforestation. The region saw a 61 percent increase in emissions from the baseline, with 33.92 million metric tons of carbon dioxide equivalent caused from deforestation in 2022.

Figure 1.8. Non-tropical regional emissions from deforestation, in million metric tons of carbon dioxide equivalent ($MtCO_2e$)



Note: The baseline is calculated as the average deforestation between 2018 and 2020. The annual targets are the points on the linear trajectory going from the baseline 2018-20 and the 2030 target of zero emissions from deforestation.

Source: Figure based on original analysis for this report using data from Harris et al., 2021, Hansen et al. 2013, and Curtis et al. 2018, updated through 2022

Table 1.8. Non-tropical regions' emissions from deforestation in 2022, in million metric tons of carbon dioxide equivalent ($MtCO_2e$)

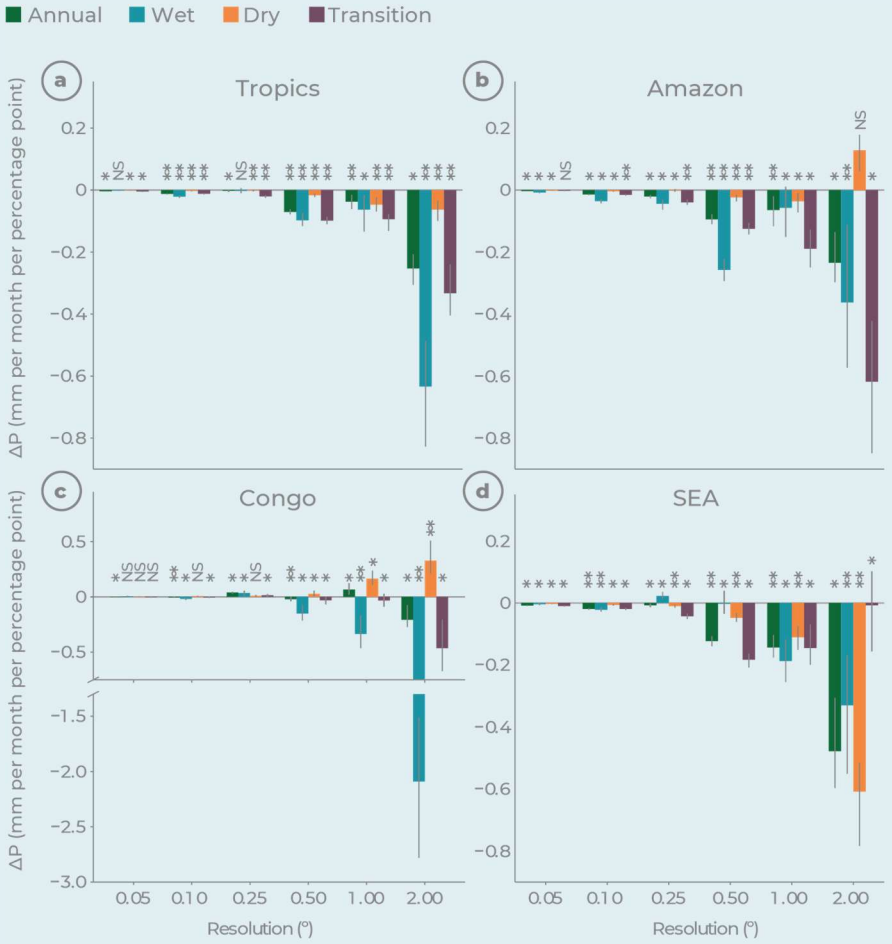
	Baseline 2018-2020 ($MtCO_2e$)	Target in 2022 ($MtCO_2e$)	Emission from deforestation in 2022 ($MtCO_2e$)	Relative change from baseline	Deviation from target
Europe	0.62	0.49	0.63	2%	28%
Non-tropical Africa	0.75	0.60	0.40	-47%	-34%
Non-tropical Asia	12.93	10.34	9.62	-26%	-7%
Non-tropical LAC	21.04	16.83	33.92	61%	102%
North America	70.23	56.18	56.61	-19%	1%

Source: Based on original analysis for this report using data from Harris et al., 2021, Hansen et al. 2013, and Curtis et al. 2018, updated through 2022

BOX 1.4. CASE STUDY: TREE COVER LOSS AND PRECIPITATION IN THE TROPICS

Not only do tropical forests have a crucial role in the global carbon cycle, but they also play a critical function for the hydrological cycle and influence local and regional precipitation.[21] A new pan-tropical study[22] investigates investigates the influence of tropical forest loss on precipitation patterns across different spatial scales – ranging from 5 km to 200 km – using various precipitation datasets. Satellite-based data reveal that deforestation leads to statistically significant decreases in annual mean precipitation across all examined scales. The larger the forest area being lost, the more pronounced the decline in precipitation. Losses on the scale of millions of hectares corresponded to a reduction of approximately 0.25 millimeters per month in annual precipitation for each percentage point of forest cover loss. The study estimates that deforestation in the Congo Basin could reduce regional-level precipitation by 8-10 percent by 2100. Future deforestation and associated reduction in precipitation can still be avoided, highlighting the close link between forest conservation and climate change resilience.

Figure box 1.4. Changes in seasonal precipitation due to forest loss (Smith et al. 2023). Note: Bars indicate the median change in precipitation (millimeters per month) per percentage point forest cover loss for satellite datasets during 2003–2017 for tropics (a), Amazon (b), Congo (c) and SEA (d). Error bars indicate ±1 standard error from the mean. Statistically significant (*P < 0.05; **P < 0.01) and nonsignificant (NS) differences in changes in mean precipitation over deforested regions compared with controls are indicated. Results are shown for the wettest 3 months (wet), the driest 3 months (dry) and the transition months (remaining 6 months).



1.2 Is the world making progress on ending forest degradation by 2030?

Extensive forest degradation has occurred both globally and in each region. As reported in the 2022 Assessment, the rate of degradation appears to have decreased between 2020 and 2021, compared to the baseline period 2018-20.

During the baseline period degradation was indicated by an average loss of 0.13 FLII units per year, whilst during 2020-21 the loss was only 0.09 FLII units, a reduction greater than that required to be on track to halt degradation by 2030 (**Figure 1.9**). However, as the figures below show, the degradation being detected by the FLII indicator shows substantial year-to-year fluctuations, demanding further years of data before a clear trend can emerge. Moreover, since observed rates increased in four out of the eight global regions, it cannot yet be concluded that the world is consistently on track for this target.

BOX 1.5. CONTEXT ON ASSESSING FOREST DEGRADATION

Forest degradation is the result of a progressive decline in the structure, species composition and ecological functions upon which the existence and resilience of a forest is based.[23] Drivers of forest degradation include logging activities, livestock grazing, and roads construction.[24] Long-term studies (1992-2014) in the Brazilian Amazon revealed that the total area of degraded forests exceeded the extent of deforestation in the region.[25]

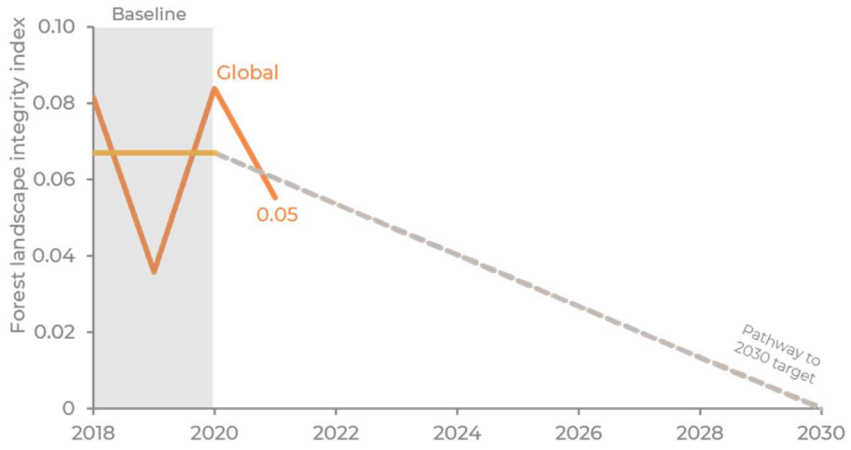
Degradation dynamics result in forest fragmentation and increased access by humans to areas that were previously covered by dense forests. This often anticipates deforestation[26] that, in turn, creates new forest edges, increasing the exposure of forests to human-made disturbances, as well as to biotic and abiotic factors that further exacerbate degradation.[27] Besides the effects of degradation on forest structure and functions, carbon emissions caused by forest degradation in the Amazon are estimated to exceed those caused by forests loss.[28]

How do we assess progress on eliminating forest degradation?

Despite the importance of monitoring forest degradation worldwide, the Forest Landscape Integrity Index (FLII)[29] remains the only available source of yearly estimates of forest degradation globally. The FLII methodology accounts for multiple parameters such as forest extent, forest connectivity, direct pressure from human activities and inferred pressure from edge effects to estimate forest integrity through a FLII score, with higher scores corresponding to higher levels of forest integrity.[30] Thus, a decrease in the FLII score corresponds to an increase in forest degradation.

The Assessment uses the yearly change in FLII score to track progress towards the 2030 goal of halting and reversing forest degradation. In numerical terms, halting and reversing forest degradation translate into no reduction or an increase of the FLII score at global and at regional level. Due to temporary delays in producing 2022 estimates of the FLII score, this chapter presents FLII trends from 2017 to 2021, which are the latest available data at the time of this study.

Figure 1.9. Loss of forest integrity at global level, expressed as yearly change in Forest Landscape Integrity Index



Note: Reaching zero loss of forest integrity by 2030 equates to halting forest degradation.

Source: Figure based on original analysis for this report using data from Grantham et al., 2020 updated through 2021.

In 2021, forest degradation – as measured by the FLII – increased sharply from baseline levels in three regions: tropical and non-tropical Latin America, and non-tropical Africa. Conversely, forest degradation substantially decreased in non-tropical Asia the same year.

Forest degradation also increased marginally in tropical Africa (**Table 1.9**). In contrast, tropical and non-tropical Asia, Europe, and North America, show decreases from baseline levels, and may be on track to halt forest degradation by 2030. Data for the three tropical regions are shown in **Figure 1.10**. A longer time series is needed before firm conclusions can be drawn, since year-to-year fluctuations can obscure longer term trends.

Forest degradation is a global phenomenon with diverse dynamics and impacts varying across countries and regions. Notably, local hotspots for forest degradation are observed both in tropical regions[31] and in the boreal forests of Europe[32] and North America (see **Canada case study**).[33] In boreal regions, forest management poses significant threats to forest habitats, leading to the erosion of local biodiversity resources,[34] and forest carbon storage.[35] It is also important to notice that, unlike forest loss, forest degradation does not imply the conversion of large forest patches to a new land use. Degraded forests remain forests, but their structure and ecological functions are weakened or reduced, with short- and long-term effects on forests' resilience and delivery of ecosystem services.[36]

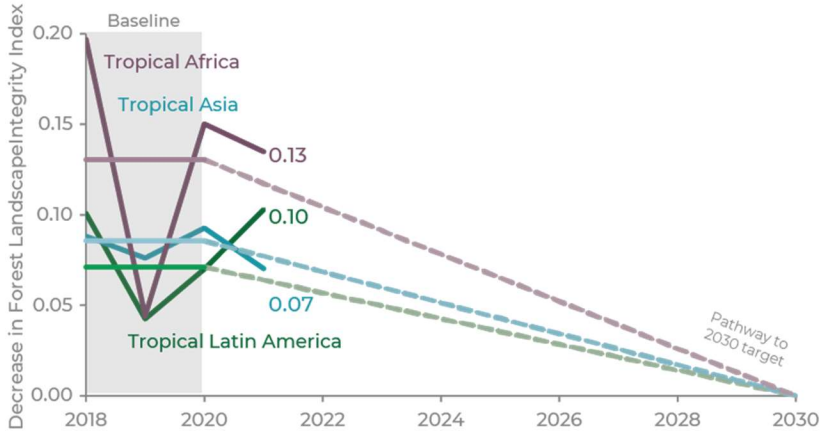
Given the complexities of forest degradation, the authors of this report acknowledge that the grouping of temperate and boreal regions as "non-tropical," cannot capture the nuances of forest degradation dynamics occurring at the local level. Furthermore, the FLII is not designed to detect certain categories of human impact such as those related to climate change or distortion of natural fire regimes. It is anticipated that updated data and refinements to the methodology employed in this section will offer deeper insights into degradation dynamics in the future.

Table 1.9. Regional and global change in forest integrity as estimated by the Forest Landscape Integrity Index

	Baseline rate of degradation 2018-2020 (decline in FLII units per year)	Target rate of degradation in 2020-21 (FLII units per year)	Observed rate of degradation in 2020-21 (FLII units per year)	Change in rate of degradation relative to baseline	Difference between observed and target rate of degradation in 2020-21
Tropical Africa	0.130	0.117	0.135	3%	15%
Tropical Asia	0.086	0.077	0.070	-18%	-9%
Tropical LAC	0.071	0.064	0.103	45%	61%
Europe	0.181	0.163	0.120	-34%	-27%
Non-tropical Africa	0.168	0.151	0.342	103%	126%
Non-tropical Asia	0.043	0.039	0.011	-76%	-73%
Non-tropical LAC	0.044	0.040	0.097	119%	143%
North America	0.025	0.022	0.015	-40%	-33%
Global	**0.067**	**0.060**	**0.055**	**-18%**	**-8%**

Source: Based on original analysis for this report using data from Grantham et al., 2020 updated through 2021

Figure 1.10. Loss of forest integrity at regional level, expressed as yearly change in Forest Landscape Integrity Index



Note: Reaching zero loss of forest integrity by 2030 equates to halting forest degradation.

Source: Figure based on original analysis for this report using data from Grantham et al., 2020 updated through 2021

1.3 Where are global forests' stock carbon located?

Forests function as Earth's natural carbon sinks, sequestering carbon and storing it in different places. Through photosynthesis, trees assimilate carbon dioxide, incorporating it into their organic structures. Aboveground biomass (AGB) refers to the collective mass of tree components such as trunks, branches, leaves, and roots visible above the soil surface. Conversely, belowground biomass (BGB) encompasses the hidden reserves within the forest soil, comprising decomposed organic matter, intricate root systems, and microbial communities. These subterranean carbon reservoirs play a crucial role in maintaining overall carbon equilibrium.[37] Understanding the distribution of carbon stocks is crucial for making informed land management decisions, and significant advancements have been made over the years to enhance this understanding (**Box 1.2**).

Forests act as formidable agents in climate change mitigation, regardless of geographical location or climatic conditions, retaining substantial carbon stocks. However, carbon stocks are not uniformly distributed across forests at different latitude. According to latest estimates, 157.37 billion metric tons of carbon (AGB) is stocked in tropical forests. This corresponds to over 60 percent of the global forest carbon stock (AGB), which is estimated to 250.24 billion metric tons of carbon.[38]

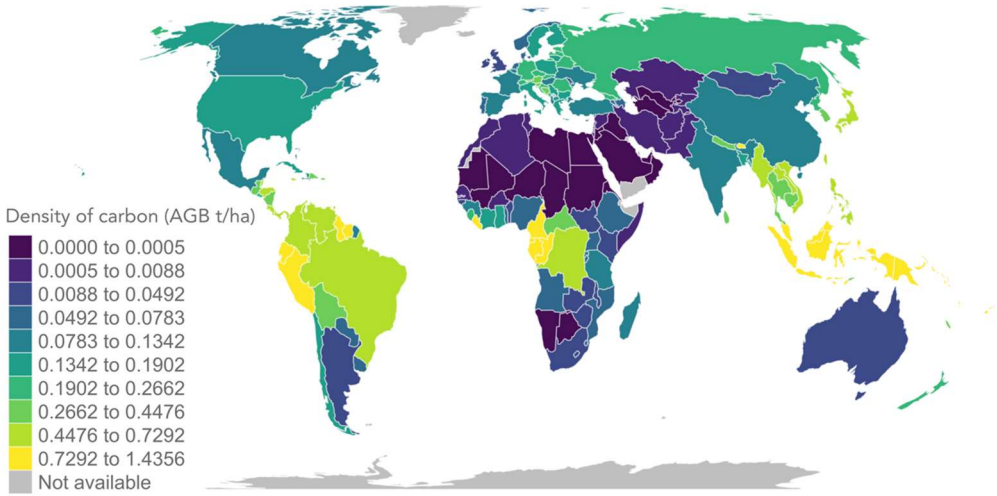
Accounting for the inhomogeneous distribution of carbon stocks across regions, with the tropics displaying the highest densities (see **Table 1.10**), is crucial for devising effective climate mitigation strategies. However, it is imperative to recognize that the ecological and economic value of forests goes beyond the carbon they store. Therefore, while formulating forest conservation strategies, it is essential to consider not only carbon densities but also the positive central role of forests for conserving biodiversity resources and supporting human livelihoods.[39]

Table 1.10. Density of carbon in aboveground biomass (AGB) by region, in metric tons per hectare

	Density of Carbon (t/Ha)	Standard Deviation
Tropical Africa	17.13	40.42
Tropical Asia	50.58	64.09
Tropical LAC	49.97	60.86
Europe	13.98	18.13
Non-tropical Africa	14.78	23.15
Non-tropical Asia	9.14	14.18
Non-tropical LAC	6.01	16.24

Source: Figure based on original analysis for this report using data from Ma et al., 2023

Figure 1.11. Average density of carbon in aboveground biomass (AGB) by country, in metric tons per hectare (t/ha) (Ma et al. 2023).



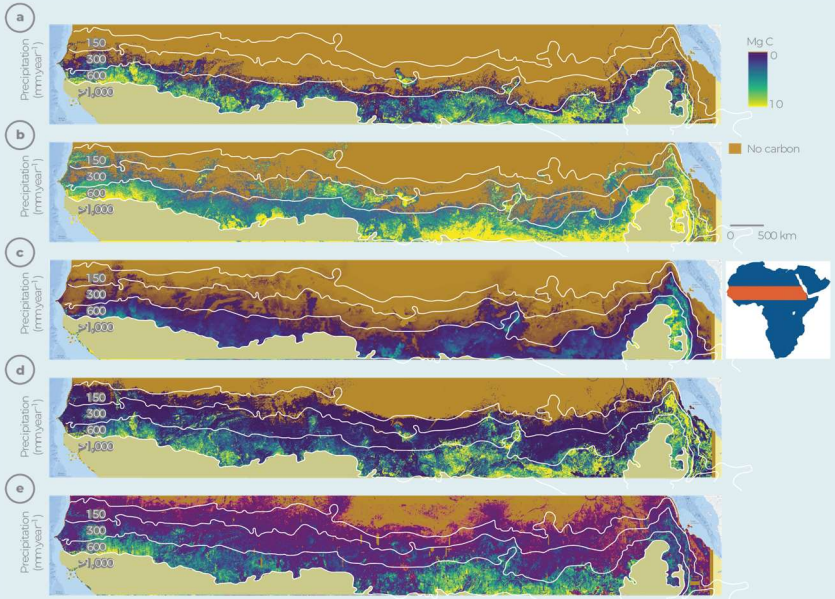
Note: Details on the query are provided in the Technical Annex.
Source: Figure based on original analysis for this report using data from Ma et al., 2023

BOX 1.6. CASE STUDY: CARBON STOCKS IN ISOLATED TREES OF AFRICA DRYLANDS

Understanding the distribution and features of dryland trees on a large scale is a crucial but often overlooked area of research. This knowledge is vital for ecological conservation, accurate carbon calculations, effective climate strategies, and restoring dryland ecosystems. Despite their significance, there has been limited comprehensive insights into dryland trees, which has limited informed decisions for land management.

In a recent study,[40] researchers used satellite images and advanced machine learning to examine over 9.9 billion trees in sub-Saharan Africa's semi-arid regions. This thorough analysis unveiled new aspects of these ecosystems. The study revealed a range of average carbon stocks per tree, from 0.6 to 4 tons of carbon per hectare, varying across rainfall zones.

Box 1.6 Figure. Comparison of different aboveground carbon-density maps.



Note: Tucker et al. (2023) show the aboveground carbon density for our study area compared with different sources. Areas beyond 1,000-millimeter rainfall per year are masked out. Data are from a) Santoro et al. (2021); b) Baccini et al. (2012); c) Hanan et al. (2020); d) Bouvet et al. (2018); e) Tucker et al. (2023).

These findings have practical implications. The study estimated that isolated trees in Africa drylands hold a carbon stock of 0.9 (±19.8%) billion metric tons of carbon and offers a more accurate measure than previous simulations. This understanding of tree density and carbon stocks rectifies past estimates, providing a solid foundation for developing policies and climate mitigation strategies. In fact, the database of tree traits and carbon stocks are a useful resource for scientists, policymakers, and restoration practitioners, empowering effective measures to protect and rehabilitate these important landscapes.

1.4 Is the world on track to restore 350 million hectares of forest by 2030?

In 2022, data on global restoration efforts remain fragmented and inconsistent. A global overview of natural forest recovery is also missing.

Deforested and degraded forests have the ability to grow back naturally over time. Surprisingly, not all deforested land is put to immediate use; around half of deforested areas in the tropics are eventually left abandoned.[41] In these areas, nature takes its course and forests can regrow on their own.

Starting from 2015, forest regrowth gradually increased in tropical moist forests (see Figures 1.12 and 1.13). Based on the definition of regrowth adopted in this study,[d] the increase in forests' regrowth results from a combination of factors, such as the increase in deforestation in tropical regions, and the abandonment of deforested areas following logging.

These regrowing forests are considered a positive force in the fight against climate change. They act like sponges, soaking up carbon dioxide from the atmosphere as they rebuild their woody structure.[42] However, it's important to note that when tropical forests are cut down, they release more carbon into the atmosphere from the soil and deadwood than what they capture during regrowth. This makes logged tropical forests a net source of carbon emissions for at least 10 years after logging.[43]

How do we assess progress?

Neither up-to-date data (i.e., as of 2022) on forest cover gain at global scale nor a global dataset of the area under restoration are currently available. In the absence of such datasets, this report estimates forest restoration by looking at two metrics. Tropical moist forest regrowth[44] indicates the area of deforestation that recovered after logging. Area under restoration – as reported by Restor and the 2022 Restoration Barometer Report – provides an indication of forest restoration efforts at global scale.

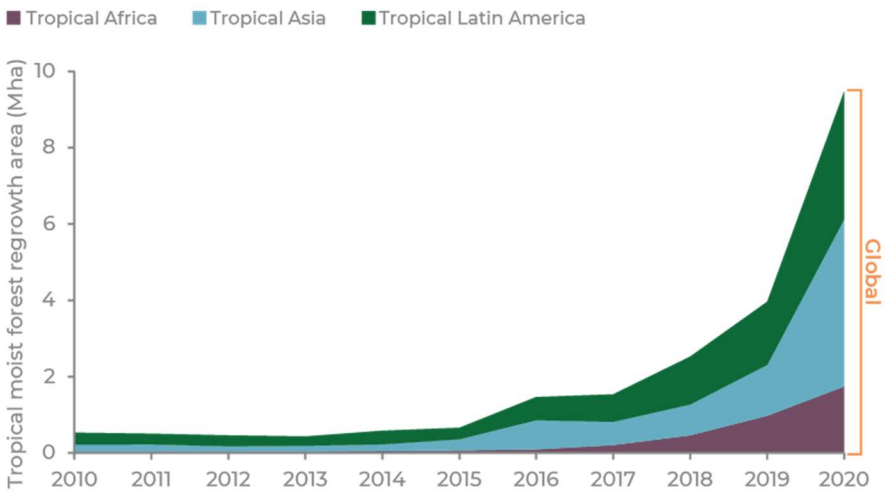
The lack of available data on forest restoration highlights a major data gap for forests. While available data provides an approximate, "best-guess" estimate on global restoration progress, these figures are almost certainly insufficient to support decision making.

BOX 1.7. CONTEXT FOR ASSESSING PROGRESS ON FOREST RESTORATION

The Bonn Challenge enshrined the global goal to restore 350 million hectares of degraded and deforested landscapes by 2030, a goal which was affirmed by the New York Declaration on Forests. Through the Glasgow Leaders' Declaration on Forest and Land Use, over 140 countries have committed to accelerate forest restoration and, in the Kunming-Montreal Global Biodiversity Framework, the Parties to the Convention on Biological Diversity agreed to the ambitious target to restore at least 30 percent of degraded land by 2030. Over the previous two decades (2000-20), global tree cover increased by roughly 130.9 million hectares43 – an area slightly larger than Peru. Three quarters of the global gain was concentrated in 13 countries. However, these gains were offset by 231.4 million hectares of tree cover loss in the same countries during that period.

[d] Forest regrowth is a two-phase transition from moist forest to (i) deforested land and then (ii) vegetative regrowth. A minimum of 3-year duration of permanent moist forest cover presence is needed to classify a pixel as forest regrowth (to avoid confusion with agriculture). (Vancutsem et al. 2021).

Figure 1.12. Global tropical moist forest regrowth after deforestation (Vancutsem et al. 2021)



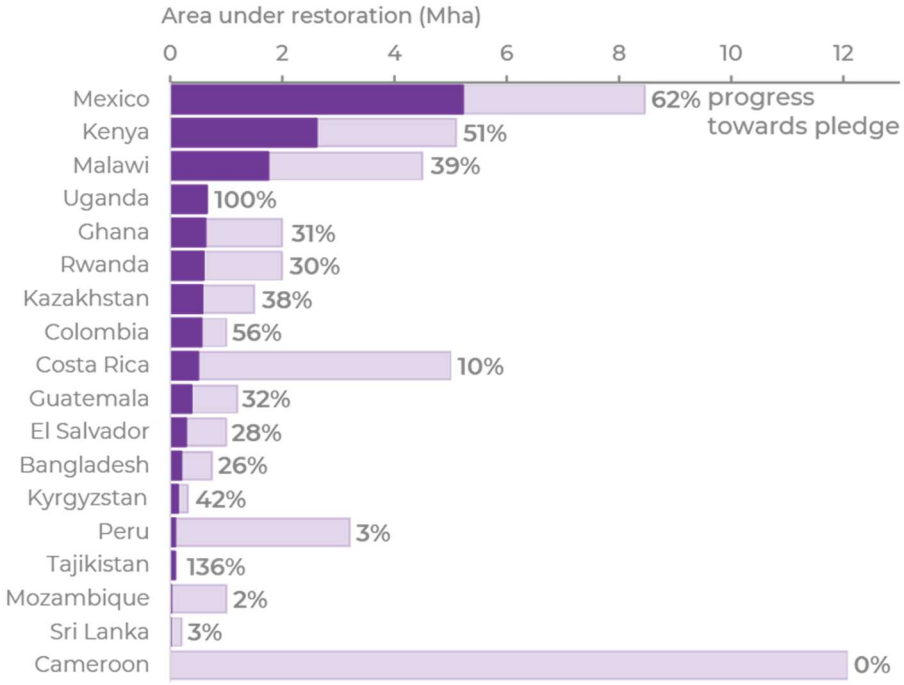
Source: Figure based on original analysis for this report using data from Vancutsem et al., 2021

According to country disclosures through the Restoration Barometer in 2022, only 18 countries have disclosed progress towards their ecosystem restoration pledges.[45]

The total area under forest restoration in those 18 countries is estimated to be 4 million hectares, which is about 28 percent of the area under restoration across all ecosystems.[e] The area under forest landscape restoration reported by the 18 countries corresponds to 2.6 percent of the 2020 target set by the Bonn challenge (150 million hectares). It is likely though that the information reported by 18 countries constitutes only a small portion of the area under restoration at the global level.

The progress toward national pledges varies greatly across countries, with one exceeding the pledge by 36 percent by restoring 90 thousand hectares across all ecosystems – as in the case of Tajikistan – and others making minimal progress towards ambitious pledges, as in the case of Cameroon, which reported restoring 100 thousand hectares over the 12 million pledged (**Figure 1.13**).

Figure 1.13. Country pledged on ecosystems restoration and progress reported up to 2022 through the Restoration Barometer, in million hectares



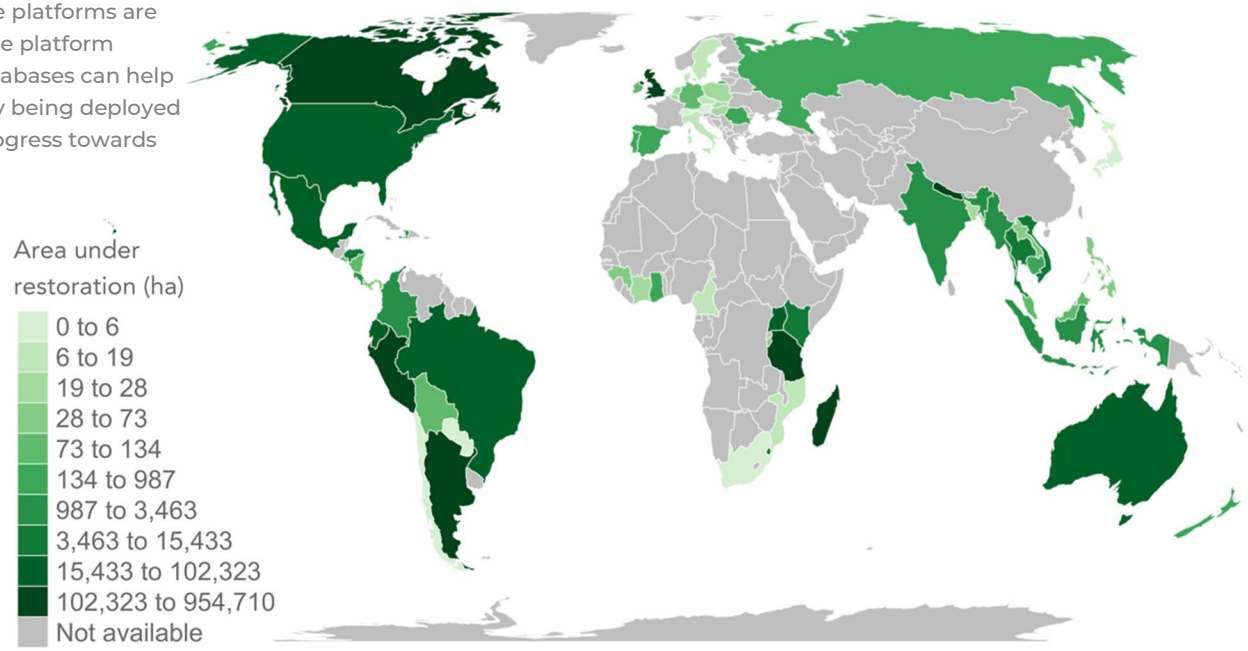
Source: Figure based on data retrieved from the IUCN Barometer 2022 Report

[e] Coasts and mangroves (15% of total progress). Deserts and semi-deserts (8%). Farmlands and mixed-use areas (17%). Forests and woodlands (28%). Grasslands, shrublands and savannahs (10%). Peatlands (3%). Rivers, streams and lakes (wetlands) (13%). Urban areas (5%).

Project-level data provided by Restor[f] – one of the largest data platforms cataloguing ecosystem restoration projects – reveals that forests' restoration projects are taking place both in those countries that are and are not reporting progress through the Restoration Barometer, as well as in countries that have not made restoration data public (**Figure 1.14**). Based on project-level data, the total area under restoration in forests' ecosystems is approximately 3 million hectares, which constitutes approximately 2 percent of the 2020 target outlined in the Bonn Challenge.

It is important to note, however, that the geographic distribution of project-level data featured on restoration platforms like Restor is likely to be limited by the capacity of platform curators to engage with projects across broad geographical regions. Furthermore, the data stored on these platforms are often not subject to any external validation – including by the platform curators. The snapshot of restoration provided in project databases can help us understand the attributes and activities that are currently being deployed across the globe. However, their contribution to tracking progress towards global or regional restoration targets is limited.

Figure 1.14. Area under restoration at national level, per data retrieved by the RESTOR database



Note: Details on the query are provided in the technical notes.
Source: Figure based on data retrieve from the Restor databse (Crowther et al, 2020)

[f] The sites included in this analysis are those which have been made publicly viewable on the Restor platform – and this subset of sites is generally of higher quality than the full suite of locations in the full database (which includes sites uploaded for private use). However, Restor makes no guarantee that the summaries provided are accurate or complete. For further details on Restor database please refer to Crowther et al. (2020). Available at: https://doi.org/10.1016/j.oneear.2022.04.003

1.5 Is the world making progress on protecting biodiversity in forests?

In 2022, 1.2 million hectares of forests were lost within forested KBAs. While this remains a significant loss, it represents a 30 percent decrease from the baseline period of 2018-20. This progress indicates that the world is making strides towards eliminating tree cover loss in these critical sites of global biodiversity importance.

Halting tree cover loss in forested KBAs is crucial for preserving species that depend on forest habitats for their survival or reproduction (**Figure 1.15**). Looking at the regional level, the analysis of tree cover loss in forested KBAs shows that nearly all regions have seen a reduction in tree cover loss compared to the baseline period 2018-20, although only two regions are on track for halting tree cover loss in forested KBAs by 2030 (**Table 1.11**). Particularly notable is non-tropical Asia, which has experienced a remarkable 81 percent decrease from the baseline period.

While this positive trend is encouraging, there is still room for improvement. Tropical forests, despite covering less than 10 percent of Earth's land surface, support at least two-thirds of the world's biodiversity.[46] In tropical regions, however, the rate of decrease in tree cover loss was not sufficient to be on track for halting forest loss in forested KBAs by 2030 (**Figure 1.16**; see non-tropical regions in **Figure 1.17**).

BOX 1.5. CONTEXT ON FORESTED KBAS

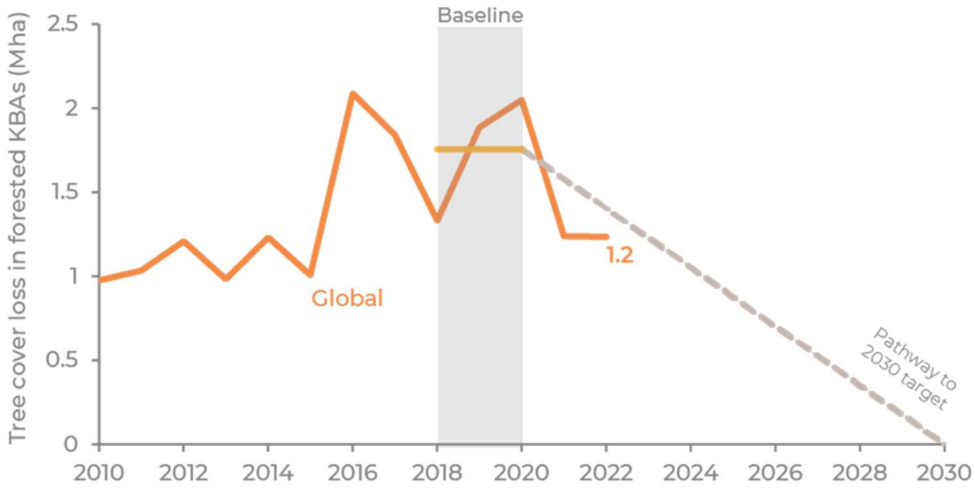
Key Biodiversity Areas (KBAs) are sites that contribute significantly to the global persistence of biodiversity. They are identified based on a set of criteria relating to threatened or geographically restricted species or ecosystems, biological processes, ecological integrity, and irreplaceability.[47] Globally, 16,337 KBAs cover over 2 billion hectares encompassing seas, subterranean and freshwater ecosystems, as well as grasslands, deserts and, of course, forests. Currently, there are no formal commitments in place to stop the loss of tree cover in KBAs, nor are there targets to halt forest loss in KBAs by 2030. KBAs are useful for setting national priorities for establishing or expanding protected areas and other effective area-based conservation measures, such as community-managed areas.[48]

Recognizing the great value of KBAs for biodiversity conservation and management, the Assessment extends to forested KBAs the overarching goals of halting forest loss and degradation by 2030.

Forested KBAs represent a subset of KBAs selected according to three criteria:[49]

1. spatial overlap with the data layer defining global tree cover in 2000[50]
2. spatial overlap with the Forest Landscape Integrity Index,[51] and
3. presence of at least one forest specialist that triggered KBA criteria at the site. Forest specialists are defined as species that depend on forest habitats for their survival or reproduction. While evaluating this aspect, season was considered for migratory species that are not forest-dependent throughout their annual life cycle.

Figure 1.15. Global tree cover loss (TCL) in forested KBAs, in million hectares (Mha)



Source: Figure based on original analysis for this report using data from Hansen et al. 2013. Only tree cover loss occurring within forested KBAs is considered (Crowe et al., In Review).

Globally, degradation in forested KBAs decreased by 17 percent from baseline levels to 2021.

The degradation of forest ecosystems is among the most significant drivers of biodiversity loss and ecosystem service decline globally.[52] According to the FLII indicator, between 2017 and 2021 forest integrity inside KBA's declined by 8 percent (~2% per year), which means that degradation of forested KBAs is ongoing both globally, with an average loss of 0.12 FLII units per year, and in all individual regions. Yet, the global rate of degradation appears to show a small decline from 2020-21 compared to the baseline, with a loss of 0.10 FLII units, thus roughly aligning itself with the annual degradation rate target (**Figure 1.19**). Since annual losses show substantial year-to-year fluctuations, further years of data are required before a clear trend can be identified.

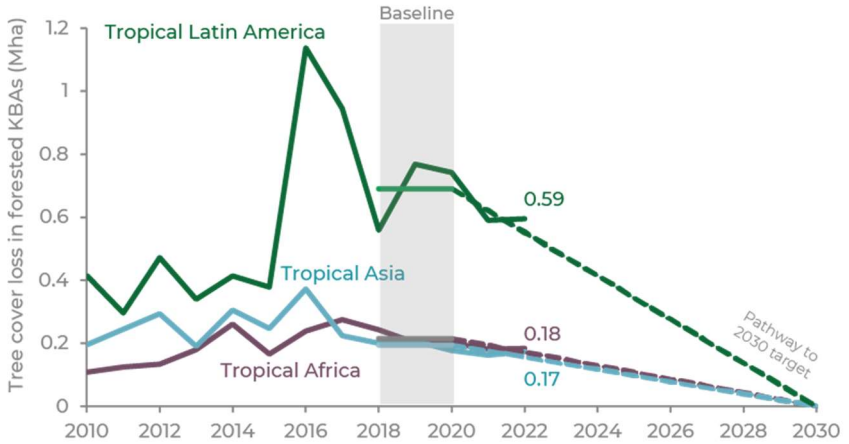
Drivers of degradation in the forested KBAs analyzed in this assessment are region and country specific, but with most factors aligning to those described at national scales, including logging, road and infrastructure construction, agriculture expansion, and fires.

Table 1.11. Regional, and global tree cover loss in forested KBAs, in hectares

	Baseline 2018-2020 (Ha)	Target in 2022 (Ha)	Tree cover loss in forested KBAs (Ha)	Relative change from baseline	Deviation from target
Tropical Africa	215,221	172,177	184,141	-14%	7%
Tropical Asia	194,742	155,794	172,945	-11%	11%
Tropical LAC	690,067	552,054	595,253	-14%	8%
Europe	129,419	103,535	110,705	-14%	7%
Non-tropical Africa	14,673	11,738	12,190	-17%	4%
Non-tropical Asia	446,274	357,019	85,585	-81%	-76%
Non-tropical LAC	14,634	11,708	35,340	141%	202%
North America	50,000	40,000	38,764	-22%	-3%
Global	**1,755,031**	**1,404,024**	**1,234,923**	**-30%**	**-12%**

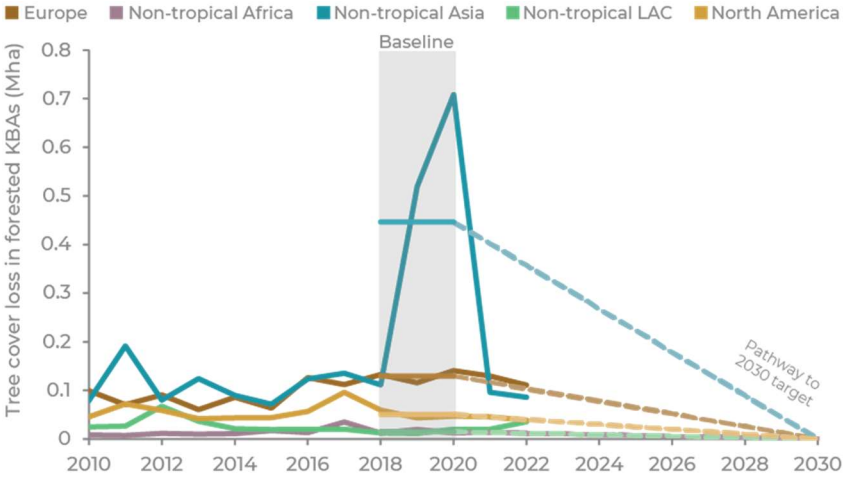
Source: Based on original analysis for this report using data from Hansen et al. 2013. Only tree cover loss occurring within forested KBAs is considered (Crowe et al., In Review).

Figure 1.16. Tree cover loss (TCL) in forested KBAs in tropical regions, in million hectares (Mha)



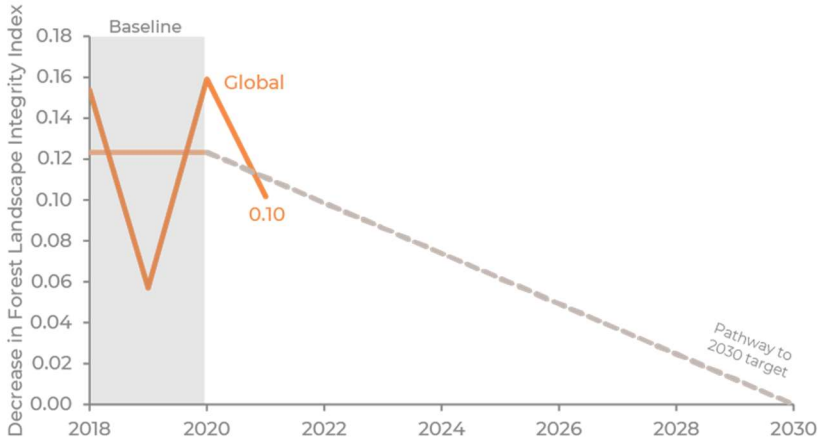
Source: Figure based on original analysis for this report using data from Hansen et al. 2013. Only tree cover loss occurring within forested KBAs is considered (Crowe et al., In Review).

Figure 1.17. Tree cover loss in forested KBAs in non-tropical regions, in million hectares (Mha)



Source: Figure based on original analysis for this report using data from Hansen et al. 2013. Only tree cover loss occurring within forested KBAs is considered (Crowe et al., In Review).

Figure 1.19. Loss of forest integrity at in KBAs at global level, expressed as yearly change in Forest Landscape Integrity Index



Note: Reaching zero loss of forest integrity by 2030 equals to halting forest degradation.

Source: Figure based on original analysis for this report using data from Graham et al. 2020. Only chenges in FLII occurring within forested KBAs is considered (Crowe et al., In Review).

Table 1.14. Regional and global change in forest integrity within forested KBAs, as estimated by the Forest Landscape Integrity Index (Grantham et al. 2020)

	Baseline 2018-2020	Target 2021	Change FLII 2021	Relative change from baseline	Deviation from target
Tropical Africa	0.127	0.114	0.104	-18%	-9%
Tropical LAC	0.133	0.119	0.127	-4%	7%
Tropical Asia	0.126	0.113	0.092	-27%	-19%
Europe	0.121	0.109	0.099	-18%	-9%
Non-tropical Africa	0.163	0.147	0.164	0%	12%
Non-tropical Asia	0.115	0.104	0.082	-29%	-22%
Non-tropical LAC	0.111	0.100	0.139	25%	38%
North America	0.101	0.091	0.082	-19%	-10%
Global	**0.123**	**0.111**	**0.102**	**-17%**	**-8%**

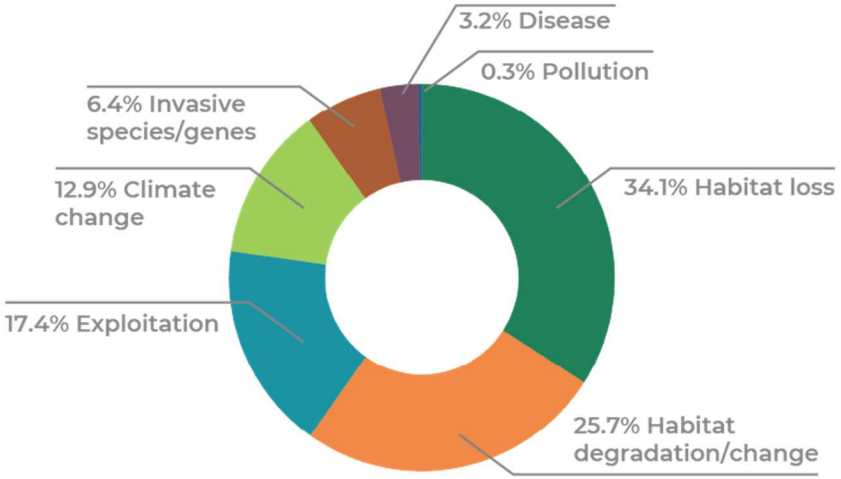
Source: Based on original analysis for this report using data from Graham et al. 2020. Only chenges in FLII occurring within forested KBAs is considered (Crowe et al., In Review).

According to latest data, the Forest Specialists Index – based on species that depend on forest habitats – declined by 79 percent between 1970 and 2018.

The world's biodiversity crisis involves all ecosystems. and forests represent a crucial component of this global emergency.[53] Biodiversity in forests – as represented by the Forest Specialists Index – declined drastically over the past 50 years (**Figure 1.23**), with habitat loss and habitat degradation as the most frequently reported drivers of such decline, followed by overexploitation (**Figure 1.22**). Forest specialists (the many species of birds, mammals, reptiles, and amphibians, that only live in forest habitats) are fundamental for maintaining the intricate web of life that characterizes and sustains forests ecosystems.

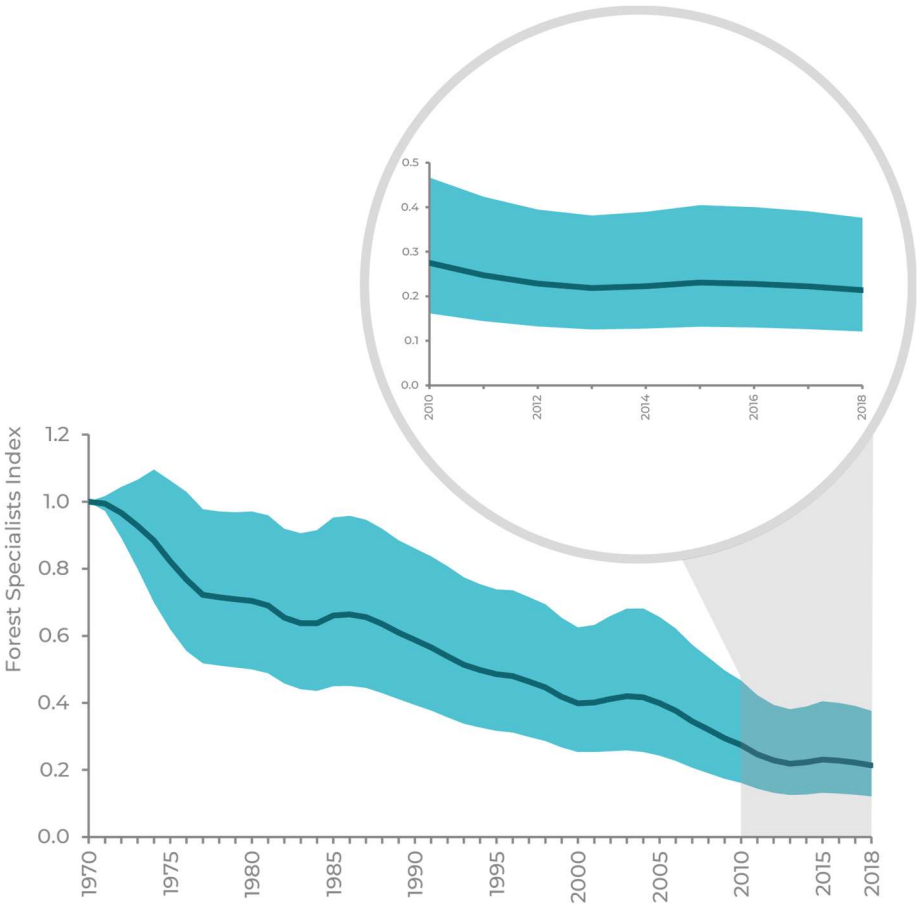
Forest specialists provide irreplaceable ecosystem services. A major decline in forest biodiversity – such as the one measured by FSI – will likely have negative effects on forest health and resilience, hindering forests' ability to mitigate climate change and to deliver life-sustaining ecosystems services.[54]

Figure 1.22. Types of threats as a percentage of all threats faced by forest specialist species, based on population-level information in the Living Planet Index database



Source: Figure based on data retrieved from the Living Planet Index Database.

Figure 1.23. The Forest Specialists Index: 1970 to 2018



Note: The reference year for the Forest Specialists Index (FSI) is 1970, which takes value equal to 1. Values below the 1970 value indicate a decline in the monitored populations in comparison to the reference year. According to the latest update, in 2022, the FSI declined by 79% from 1970 to 2018. This is based on the average change in relative abundance of 1.428 populations of 343 forest specialist species monitored across the globe. The cyan line shows the index values, and the shaded areas represent the statistical certainty surrounding the trend (range -88% to -61%). The FSI is not calculated for more recent years due to the publication time lag - the time taken for data to be collected, analysed, and published.

Source: Figure based on data from the 2022 update of Green et al. 2020.

BOX 1.6. CONTEXT FOR USING THE FORESTS SPECIALISTS INDEX AS AN INDICATOR OF BIODIVERSITY WITHIN FORESTS

Forest ecosystems – and particularly tropical forests – are among the areas at highest conservation value worldwide.[55] When forests are deforested or degraded, the species inhabiting them are also threatened. In turn, the erosion of biodiversity resources threatens the health and resilience of forests. For example, trees that rely on animals to disperse their seeds may struggle to reproduce if animal populations decline. Addressing the global biodiversity crisis. climate change. and protecting global forests are inseparable causes.

This report uses the Forest Specialists Index (FSI) to evaluate the status of biodiversity within forests, which is especially important given the ongoing and escalating global biodiversity crisis. The FSI is a derivative of the Living Planet Index developed by World Wildlife Fund and the Zoological Society of London as an indicator for forest biodiversity. The FSI is based on population trend data from vertebrate species that only occur in forest habitats (per the IUCN Red List). The fluctuations of the FSI reflect the average change in relative abundance recorded in 1428 vertebrate populations worldwide.

The FSI is updated every two years by including population data newly available or collected and published after the last update. This study features the latest FSI values, which were published in 2022, covering the period 1970-2018.

CHAPTER 1 ENDNOTES

[1] Hansen, M. C., Potapov, P. V., Moore, R., Hancher, M., Turubanova, S. A., Tyukavina, A., et al. (2013). High-Resolution Global Maps of 21st-Century Forest Cover Change. *Science*, *342*(6160), 850–853. https://doi.org/10.1126/science.1244693.

[2] Turubanova, S., Potapov, P. V., Tyukavina, A., & Hansen, M. C. (2018). Ongoing primary forest loss in Brazil, Democratic Republic of the Congo, and Indonesia. *Environmental Research Letters*, 13(7), 074028. https://doi.org/10.1088/1748-9326/aacd1c.

[3] Harris, N. L., Gibbs, D. A., Baccini, A., Birdsey, R. A., de Bruin, S., Farina, M., et al. (2021). Global maps of twenty-first century forest carbon fluxes. *Nature Climate Change*, *11*(3), 234–240. https://doi.org/10.1038/s41558-020-00976-6.

[4] Grantham, H. S., Duncan, A., Evans, T. D., Jones, K. R., Beyer, H. L., Schuster, R., et al. (2020). Anthropogenic modification of forests means only 40% of remaining forests have high ecosystem integrity. *Nature Communications, 11*(1), 5978. https://doi.org/10.1038/s41467-020-19493-3.

[5] Vancutsem, C., Achard, F., Pekel, J.-F., Vieilledent, G., Carboni, S., Simonetti, D., et al. (2021). Long-term (1990–2019) monitoring of forest cover changes in the humid tropics. *Science Advances, 7*(10), eabe1603. https://doi.org/10.1126/sciadv.abe1603.

[6] Ma, L., Hurtt, G., Tang, H., Lamb, R., Lister, A., Chini, L., et al. (2023). Spatial heterogeneity of global forest aboveground carbon stocks and fluxes constrained by spaceborne lidar data and mechanistic modeling. *Global Change Biology, 29*(12), 3378–3394. https://doi.org/10.1111/gcb.16682.

[7] Green, E. J., McRae, L., Freeman, R., Harfoot, M. B. J., Hill, S. L. L., Baldwin-Cantello, W., et al. (2020). Below the canopy: global trends in forest vertebrate populations and their drivers. *Proceedings of the Royal Society B: Biological Sciences, 287*(1928), 20200533. https://doi.org/10.1098/rspb.2020.0533.

[8] Curtis, P. G., Slay, C. M., Harris, N. L., Tyukavina, A., & Hansen, M. C. (2018). Classifying drivers of global forest loss. *Science, 361*(6407), 1108–1111. https://doi.org/10.1126/science.aau3445.

[9] Turubanova, S. et al. (2018).

[10] Harris, N. L. et al. (2021).

[11] Ellison, D., Morris, C. E., Locatelli, B., Sheil, D., Cohen, J., Murdiyarso, D., et al. (2017). Trees, forests and water: Cool insights for a hot world. *Global Environmental Change, 43*, 51–61. https://doi.org/10.1016/j.gloenvcha.2017.01.002.

[12] Tellman, B., Sullivan, J. A., Kuhn, C., Kettner, A. J., Doyle, C. S., Brakenridge, G. R., et al. (2021). Satellite imaging reveals increased proportion of population exposed to floods. *Nature, 596*(August 2020), 80–86. https://doi.org/10.1038/s41586-021-03695-w.

[13] Lawrence, D., Coe, M., Walker, W., Verchot, L., & Vandecar, K. (2022). The Unseen Effects of Deforestation: Biophysical Effects on Climate. *Frontiers in Forests and Global Change, 5*. https://www.frontiersin.org/articles/10.3389/ffgc.2022.756115.

[14] Noon, M. L., Goldstein, A., Ledezma, J. C., Roehrdanz, P. R., Cook-Patton, S. C., Spawn-Lee, S. A., et al. (2022). Mapping the irrecoverable carbon in Earth's ecosystems. *Nature Sustainability, 5*(1), 37–46. https://doi.org/10.1038/s41893-021-00803-6.

[15] Gibson, L. (2006). The Role of Lethal Control in Managing the Effects of Apparent Competition on Endangered Prey Species. *Wildlife Society Bulletin, 34*(4), 1220–1224. https://doi.org/10.2193/0091-7648(2006)34[1220:TROLCI]2.0.CO;2.

[16] Turubanova, S. et al. (2018).

[17] Harris, N. L. et al. (2021).

[18] World Data Lab. (2023). World Emissions Clock. https://worldemissions.io/.

[19] Lawrence. D., & Vandecar. K. (2015). Effects of tropical deforestation on climate and agriculture. *Nature Climate Change. 5*(1). 27–36. https://www.nature.com/articles/nclimate2502

[20] World Data Lab (2023). World Emissions Clock. https://worldemissions.io/.

[21] Lawrence. D.. & Vandecar. K. (2015). Effects of tropical deforestation on climate and agriculture. *Nature Climate Change. 5*(1). 27–36. https://www.nature.com/articles/nclimate2502

[22] Smith. C.. Baker. J. C. A.. & Spracklen. D. V. (2023). Tropical deforestation causes large reductions in observed precipitation. *Nature. 615*. 270-275. https://www.nature.com/articles/s41586-022-05690-1

[23] Vásquez-Grandón, A., Donoso, P. J., & Gerding, V. (2018). Forest Degradation: When Is a Forest Degraded? Forests, 9(11), 726. https://doi.org/10.3390/f9110726.

[24] Kissinger. G., Herold. M., & De Sy. V. (2012). *Drivers of deforestation and forest degradation: A synthesis report for REDD+ Policymakers*. Vancouver, Canada: Forest Carbon Partnership Facility. https://www.forestcarbonpartnership.org/sites/fcp/files/DriversOfDeforestation.pdf_N_S.pdf

[25] Matricardi, E. A. T., Skole, D. L., Costa, O. B., Pedlowski, M. A., Samek, J. H., & Miguel, E. P. (2020). Long-term forest degradation surpasses deforestation in the Brazilian Amazon. *Science, 369*(6509), 1378–1382. https://doi.org/10.1126/science.abb3021.

[26] Vancutsem, C. et al. (2021).

[27] Lapola, D. M., Pinho, P., Barlow, J., Aragão, L. E. O. C., Berenguer, E., Carmenta, R., et al. (2023). The drivers and impacts of Amazon forest degradation. *Science, 379*(6630), eabp8622. https://doi.org/10.1126/science.abp8622.

[28] Qin, Y., Xiao, X., Wigneron, J.-P., Ciais, P., Brandt, M., Fan, L., et al. (2021). Carbon loss from forest degradation exceeds that from deforestation in the Brazilian Amazon. *Nature Climate Change, 11*(5), 442–448. https://doi.org/10.1038/s41558-021-01026-5; Maxwell, S. L., Evans, T., Watson, J. E. M., Morel, A., Grantham, H., Duncan, A., et al. (2019). Degradation

and forgone removals increase the carbon impact of intact forest loss by 626%. *Science Advances, 5*(10), eaax2546. https://doi.org/10.1126/sciadv.aax2546.

[29] Grantham, H. S. et al. (2020).

[30] Maxwell, S. L. et al. (2019).

[31] Shapiro, A. C., Bernhard, K. P., Zenobi, S., Müller, D., Aguilar-Amuchastegui, N., & d'Annunzio, R. (2021). Proximate Causes of Forest Degradation in the Democratic Republic of the Congo Vary in Space and Time. *Frontiers in Conservation Science*, *2*. https://www.frontiersin.org/articles/10.3389/fcosc.2021.690562.

[32] Maes, J., Bruzón, A. G., Barredo, J. I., Vallecillo, S., Vogt, P., Rivero, I. M., et al. (2023). Accounting for forest condition in Europe based on an international statistical standard. *Nature Communications*, *14*(1), 3723. https://doi.org/10.1038/s41467-023-39434-0.

[33] Betts, M. G., Yang, Z., Hadley, A. S., Smith, A. C., Rousseau, J. S., Northrup, J. M., et al. (2022). Forest degradation drives widespread avian habitat and population declines. *Nature Ecology & Evolution*, *6*(6), 709–719. https://doi.org/10.1038/s41559-022-01737-8.

[34] Määttänen, A.-M., Virkkala, R., Leikola, N., & Heikkinen, R. K. (2022). Increasing loss of mature boreal forests around protected areas with red-listed forest species. *Ecological Processes*, *11*(1), 17. https://doi.org/10.1186/s13717-022-00361-5.

[35] Malcolm, J. R., Holtsmark, B., & Piascik, P. W. (2020). Forest harvesting and the carbon debt in boreal east-central Canada. *Climatic Change*, *161*(3), 433–449. https://doi.org/10.1007/s10584-020-02711-8.

[36] Vásquez-Grandón, A. et al. (2018).

[37] Walker, W. S., Gorelik, S. R., Cook-Patton, S. C., Baccini, A., Farina, M. K., Solvik, K. K., et al. (2022). The global potential for increased storage of carbon on land. *Proceedings of the National Academy of Sciences, 119*(23), e2111312119. https://doi.org/10.1073/pnas.2111312119.

[38] Ma, L. et al. (2023).

[39] Buřivalová, Z., Yoh, N., Butler, R. A., Chandra Sagar, H. S. S., & Game, E. T. (2023). Broadening the focus of forest conservation beyond carbon. *Current Biology, 33*(11), R621–R635. https://doi.org/10.1016/j.cub.2023.04.019.

[40] Tucker. C., et al. (2023). Sub-continental-scale carbon stocks of individual trees in African drylands. *Nature, 615*, 80–86. https://www.nature.com/articles/s41586-022-05653-6

[41] Pendrill, F., Gardner, T. A., Meyfroidt, P., Persson, U. M., Adams, J., Azevedo, T., et al. (2022). Disentangling the numbers behind agriculture-driven tropical deforestation. *Science, 377*(6611), eabm9267. https://doi.org/10.1126/science.abm9267. https://www.science.org/doi/10.1126/science.abm9267.

[42] Heinrich, V. H. A., Vancutsem, C., Dalagnol, R., Rosan, T. M., Fawcett, D., Silva-Junior, C. H. L., et al. (2023). The carbon sink of secondary and degraded humid tropical forests. *Nature, 615*(7952), 436–442. https://doi.org/10.1038/s41586-022-05679-w. https://www.nature.com/articles/s41586-022-05679-w.

[43] Mills, M. B., Malhi, Y., Ewers, R. M., Kho, L. K., Teh, Y. A., Both, S., et al. (2023). Tropical forests post-logging are a persistent net carbon source to the atmosphere. *Proceedings of the National Academy of Sciences, 120*(3), e2214462120. https://doi.org/10.1073/pnas.2214462120. https://www.pnas.org/doi/10.1073/pnas.2214462120.

[44] Vancutsem, C. et al. (2021). https://www.science.org/doi/10.1126/sciadv.abe1603.

[45] IUCN, (2022). IUCN Restoration Barometer: 2022 Report. Gland, Switzerland: International Union for Conservation of Nature.

[46] Giam, X. (2017). Global biodiversity loss from tropical deforestation. *Proceedings of the National Academy of Sciences, 114*(23), 5775–5777. https://doi.org/10.1073/pnas.1706264114.

[47] IUCN. (2022). *Guidelines for using A global standard for the identification of Key Biodiversity Areas : version 1.2*. https://doi.org/10.2305/IUCN.CH.2022.KBA.1.2.en.

[48] Maxwell, S. L., Cazalis, V., Dudley, N., Hoffmann, M., Rodrigues, A. S. L., Stolton, S., et al. (2020). Area-based conservation in the twenty-first century. *Nature, 586*(7828), 217–227. https://doi.org/10.1038/s41586-020-2773-z; Kullberg, P., Di Minin, E., & Moilanen, A. (2019). Using key biodiversity areas to guide effective expansion of the global protected area network. *Global Ecology and Conservation, 20*, e00768. https://doi.org/10.1016/j.gecco.2019.e00768.

[49] Crowe et al. In review.

[50] Hansen, M. C. et al. (2013). https://www.science.org/doi/10.1126/science.1244693

[51] Grantham, H. S. et al. (2020). https://www.nature.com/articles/s41467-020-19493-3

[52] IPBES (2019): Summary for policymakers of the global assessment report on biodiversity and ecosystem services of the Intergovernmental
Science-Policy Platform on Biodiversity and Ecosystem Services. S. Díaz. J. Settele. E. S. Brondízio E.S.. H. T. Ngo. M. Guèze. J.
Agard. A. Arneth. P. Balvanera. K. A. Brauman. S. H. M. Butchart. K. M. A. Chan. L. A. Garibaldi. K. Ichii. J. Liu. S. M. Subramanian.
G. F. Midgley. P. Miloslavich. Z. Molnár. D. Obura. A. Pfaff. S. Polasky. A. Purvis. J. Razzaque.
B. Reyers. R. Roy Chowdhury. Y. J. Shin.
I. J. Visseren-Hamakers. K. J. Willis. and C. N. Zayas (eds.). IPBES secretariat. Bonn. Germany. 56 pages

[53] FAO and UNEP. (2020).

[54] Brockerhoff, E. G., Barbaro, L., Castagneyrol, B., Forrester, D. I., Gardiner, B., González-Olabarria, J. R., et al. (2017). Forest biodiversity, ecosystem functioning and the provision of ecosystem services. *Biodiversity and Conservation, 26*(13), 3005–3035. https://doi.org/10.1007/s10531-017-1453-2.

[55] FAO and UNEP. (2020). *The State of the World's Forests 2020: Forests, biodiversity and people. In The State of the World's Forests (SOFO): Vol. 2020.* https://doi.org/10.4060/ca8642en.