

# How the Glasgow Declaration on Forests can help keep alive the 1.5 °C target

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At last year's 26th UN Climate Change Conference of the Parties (COP26) in Glasgow, 141 countries committed to halt and reverse forest loss and land degradation by 2030 (1). It was part of one of several side deals designed to keep the objectives of the Paris agreement within reach. The UK government boasted that these nations had made a landmark pledge to end deforestation (2).

Yet, one crucial detail was left out: whether that deforestation will be gross or net. The distinction matters, because differing interpretations of how countries can "end deforestation" significantly impact future carbon dioxide emissions. Put simply, ending gross deforestation would be a major step forward for the climate. But considering only net deforestation could be anecdotal and even be detrimental to biodiversity.

Overall, human activities related to land use emit 4 gigatonnes (Gt) of carbon dioxide (CO<sub>2</sub>) per year to the atmosphere (3). These are net emissions, comprising both carbon losses and carbon gains. On the loss side, the destruction of tree biomass during deforestation, for large-scale agriculture, cattle ranching, or shifting cultivation (cycles of cutting forest for agriculture, then abandoning to recover soil fertility, then returning), and the legacy emissions from harvested wood products, form the bulk of gross emissions, totaling 14 Gt CO<sub>2</sub> per year (3). On the gain side, secondary forest regrowth after reforestation, agricultural abandonment, or during shifting cultivation form the bulk of the gross carbon

**Differing interpretations as to how countries can "end deforestation" will have significant impacts on future carbon dioxide emissions. Only ending gross deforestation would be a major step forward for the climate. Image credit: Shutterstock/guentermanaus.**

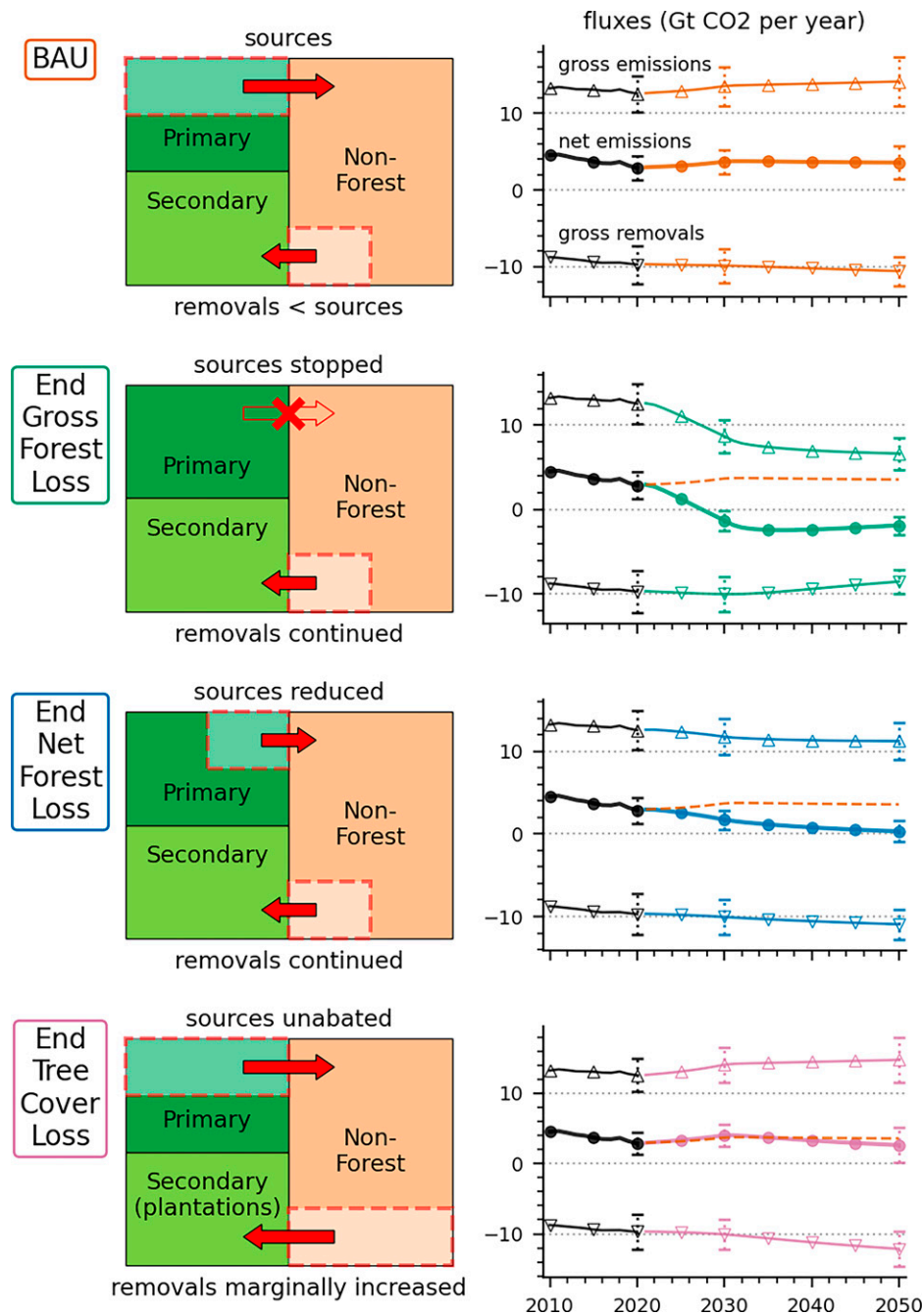
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**Fig. 1.** Here we illustrate “business as usual” (BAU) along with three Glasgow-compliant scenarios and implied fluxes. *Left* panels illustrate the main land use change occurring in the scenarios. *Right* panels show the carbon fluxes to the atmosphere. Net emissions are made of gross emissions and gross removals. The BAU net emissions are recalled in other panels with a dashed line. Uncertainty bars are one standard deviation range. Supplementary Information includes further details of the scenario descriptions.

removal, totaling  $-10$  Gt  $\text{CO}_2$  per year (3). The 4 Gt headline emission figure for land use, then, comes from the simple imbalance between these two much larger gain and loss figures.

If countries interpret the Glasgow commitment as needing to halt *gross* forest area loss, in the way the UK government presented the pledge to the world, then the gross carbon source will rapidly reduce, whereas the carbon uptake from secondary forests will sustain for a few decades. Should this happen in all signatory countries, we estimate it would generate a net carbon uptake in 2030 of about 1 Gt  $\text{CO}_2$  annually. This is a 5-Gt  $\text{CO}_2$  saving from current policies, and it would contribute to closing the gap

between the national pledges submitted under the Paris Agreement and the efforts needed to limit warming to  $1.5^\circ\text{C}$  (4).

At the other extreme, if all countries aimed to halt *net* forest loss by expanding monoculture plantations to compensate for the areas lost to continued deforestation, the gross source will not be abated and the low-carbon plantations will deliver little removal, leading to carbon emissions in 2030 that are comparable with those of the 2010s.

It is therefore vital that countries specify how they intend to meet their commitment. To do so, they should produce separate estimates of their target areas of intact primary forests and of new secondary forests—the latter

with a breakdown of areas of plantations and of naturally regenerating or restored forests. Countries could include this information in their new updated and enhanced climate pledges, known as nationally determined contributions (NDCs), to be announced before COP27 in Egypt in November 2022.

#### Key Contrasted Scenarios

To demonstrate the importance of the distinction between gross and net forest area loss, we developed a “business-as-usual” (BAU) scenario along with three illustrative scenarios that all fulfill the Glasgow commitment to halt forest area loss by 2030. We simulated global land use CO<sub>2</sub> emissions implied by these scenarios, using the compact Earth system model OSCAR and its bookkeeping module (5, 6).

The BAU scenario linearly extrapolates land use activity trends from the last five years until 2030 and maintains that level afterwards. This leads to a decrease in forest area and a stabilization of land use CO<sub>2</sub> emissions around the last decade’s level, at about 4 Gt CO<sub>2</sub> per year as of 2030, with slowly but steadily increasing gross emissions and gross removals (see Fig. 1).

In the “End Gross Forest Loss” scenario, gross deforestation in signatory countries is brought to a halt by 2030. This leads to a steep decrease of net emissions that switch to a net removal of CO<sub>2</sub> from the atmosphere slightly before 2030, reach about –2 Gt CO<sub>2</sub> per year after, and maintain this level of removal for about two decades. This source to sink transition is explained by the reduction in gross emissions (by about a factor two) from significantly stopping biomass destruction, whereas gross removals from forest regrowth remain mostly steady until they begin to slow as new forests grow older.

In the intermediate “End Net Forest Loss” scenario, gross deforestation in signatory countries is reduced, albeit only to the point of matching their BAU gross plantation/reforestation level. Despite reaching a net zero forest area change in 2030 similar to the previous scenario, the continuation of some deforestation (including shifting cultivation) does not reduce gross emissions enough to turn global forests into a carbon sink. In 2030, net emissions reduce by half compared with BAU to 2 Gt CO<sub>2</sub> per year, and they reach close to zero only in 2050.

In the “End Tree Cover Loss” scenario, the signatory countries follow their BAU gross deforestation level but increase their forest area by developing new plantations to balance these gross deforestation losses. This scenario contrasts with others because its net emissions are slightly higher than the BAU in 2030 (by about 10%), owing to increased gross emissions triggered by the conversion of land into plantations. Only later does the marginally increased gross removal catch up with gross emissions so that net emissions slowly go down, albeit not at a

pace capable of compensating for much of the earlier emissions.

In summary, even though the three scenarios all appear to comply with the Glasgow commitment, they produce widely different net carbon gains. Our simulations demonstrate that the level of emissions reduction (if any) depends on whether gross or net deforestation is reduced to zero. These differences sum to globally significant amounts when considering land-use emissions through to 2050. Compared with the BAU, the End Gross Forest Loss scenario sequesters around 143 ± 38 Gt CO<sub>2</sub> by 2050, whereas the End Net Forest Loss scenario does half as much (68 ± 20 Gt CO<sub>2</sub>), and the End Tree Cover Loss scenario produces no significant carbon sequestration (8 ± 16 Gt CO<sub>2</sub>).

Should countries interpret the Glasgow pledge as a commitment to reduce net deforestation, the results could follow the unsatisfactory example of the Bonn Challenge (7), a global call to restore 350 million hectares of forest by 2030. In this restoration challenge, 45% of the pledged area is converted to monoculture plantations (8). Although this is not what most people would think of as forest restoration, it does meet the UN Food and Agriculture Organization’s definition of forests that encompasses pristine forests, restored forests, and monoculture plantations.

Similarly, although most would interpret the Glasgow Declaration on Forests as halting the loss of primary old-growth forests, it could be met by simply replacing high-carbon and high-biodiversity primary forests with monoculture plantations. This is why participating signatory countries must distinguish among all three types of forests—old-growth primary forests, regenerating and restored forests, and plantations—in the plans of how nations will comply with their commitment and in their progress reports. If they don’t, the Glasgow Declaration risks resembling an intergovernmental greenwashing operation.

**Data and materials availability.** The source code of OSCAR v3.1.2 is available at <https://github.com/tgasser/OSCAR>. The original GCB2021 outputs are available at <https://www.globalcarbonproject.org/carbonbudget>. Additional data and outputs are available on request.

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