# Flawed Logic

## Why forest conservation cannot offset fossil emissions

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**Proponents of the fossil fuel industry frequently argue that emissions caused by burning fossil carbon could be offset by forest conservation. Using forest offsets, the argument goes, would allow for the continuation of business as usual without any detrimental effects on the climate. This briefing explains the flawed logic behind this reasoning. There are many reasons to stop deforestation and protect forests but using forests as a carbon offset mechanism for fossil emissions is not one of them and will not save the climate.**

Recent estimates suggest deforestation is responsible for about 12-20 % of anthropogenic global greenhouse gas (GHG) emissions[i]. Consequently, stopping deforestation is a vital component in achieving the dramatic emission cuts we need to avoid catastrophic climate change. However, **reductions in deforestation rates must be in addition to, and not instead of, cuts in fossil carbon emissions**.

### Forest carbon is different to fossil carbon

Climate change is caused by greenhouse gases, primarily $CO_2$, accumulating in the atmosphere. There are two principal pools of carbon that contribute to the rise in atmospheric $CO_2$:

- The **active carbon pool** or "biosphere" comprises all carbon that circulates between the atmosphere, land and oceans[ii]. Only carbon in this pool can actively contribute to climate change.
- The **passive carbon pool** or "lithosphere" comprises carbon that has been buried underground for several hundred million years (for example, as coal, oil or gas). Carbon in this pool does not contribute to climate change as long as it is not transferred to the active carbon pool.

Plants, and in particular woody plants such as trees, contain carbon. When these are destroyed, by deforestation for example, this carbon is released into the atmosphere where it contributes to climate change. However, the carbon in trees is already part of the active carbon pool, and it is ultimately the size of this pool that is critical for climate change. The bigger this active carbon pool is, the more $CO_2$ can easily get released into the atmosphere, causing climate change. Therefore, while it is crucial to stop deforestation to maintain as much of the biospheric carbon as possible in the world's forests, it is equally important not to increase the overall amount of carbon in the active carbon pool.

Stopping the increase of carbon in the active pool can only be achieved by reducing and ultimately stopping the burning of fossil fuels. Burning these fuels essentially transfers carbon that was stored for hundreds of millions of years in the passive carbon pool to the active carbon pool. As a consequence, there is more carbon to circulate round the biosphere, including in the atmosphere, where it produces the greenhouse effect and gives rise to climate change.

This means that fossil carbon and forest carbon are not interchangeable. Increases in the release of the former cannot simply be made up by decreases in the release of the latter. Using forests as an offset option creates the false impression that we can continue to burn fossil fuels if we just reduced deforestation when in reality we are turning passive carbon into active carbon that will further increase $CO_2$ concentrations in the atmosphere.

### Forests only take up a limited amount of carbon over long periods

Proponents of forest offsets often suggest that trees could actually remove all the carbon that is released by burning fossil fuels. Reality, unfortunately, is much more complex than this. Carbon dioxide emissions – independent of their source – enter the atmosphere immediately. The removal of $CO_2$ from the atmosphere, however, takes much longer, with several processes operating over different time scales varying from decades to millions of years[iii].

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Although complex, all models by climate scientists show a long "tail" for the period of time that $CO_2$ remains in the atmosphere. This is also referred to as "residence time of atmospheric $CO_2$". A simplified residence time model by the IPCC estimates that, within a few decades, 20-25% of $CO_2$ emissions that enter the atmosphere are taken up into the landmass (mostly by trees), with a similar proportion absorbed by the oceans over the same timescale[iv]. An additional 30% of emissions will be removed within a few centuries, and the remaining 20% may stay in the atmosphere for many thousands of years. **This means about half of mankind's $CO_2$ emissions remain in the atmosphere for decades or more.**

Thus, it is not possible to keep burning fossil carbon and expecting the biosphere to absorb the resulting atmospheric $CO_2$. Even though both new forest growth and mature (old-growth) forests take $CO_2$ out of the atmosphere[v], the process can only remove a portion of atmospheric $CO_2$ and is too slow to prevent the predicted changes to the world's climate. This renders forests inherently unfit as an offset option to allow the continued burning of fossil fuels.

Given the urgency of addressing climate change, immediate reductions in $CO_2$ emissions and concentrations in the atmosphere are required. Only bold action that tackles deforestation and reduces industrial emissions at the same time can place us on a path to a sustainable future. Doing just one will simply not be enough.

## Conclusion

Conservation of forests cannot be used to offset $CO_2$ emissions from the burning of fossil fuels. Forests take up $CO_2$ only slowly, and even then only a portion of fossil emissions can be taken up. The only way to stop climate change is to avoid carbon emissions from all sources. This means that we have to reduce and ultimately stop the burning of fossil fuels while **at the same time** conserving forests, both for the carbon as well as the biodiversity they contain.

For more information, contact:
pressdesk.int@greenpeace.org

Greenpeace International
Ottho Heldringstraat 5
1066 AZ Amsterdam
The Netherlands
Tel: +31 20 7182000

**greenpeace.org**

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i Baccini A *et al.* (2012). Estimated carbon dioxide emissions from tropical deforestation improved by carbon-density maps. Nature Climate Change 2: 182;
Harris NL, Brown S, Hagen SC, Saatchi SS, Petrova S, Salas W, Hansen MC, Potapov PV & Lotsch A (2012). Baseline map of carbon emissions from deforestation in tropical regions. Science 336: 1573-1576;
Pan Y *et al.* (2011). A large and persistent carbon sink in the world's forests. Science 333: 988-993.

ii These processes occur over timescales ranging from months to thousands of years, making for a rather complex carbon cycle. Biospheric carbon is also termed "labile" or "mobile" carbon as it is taken up from the atmosphere by plants or the ocean, and then returned during processes such as the decay of organic matter.

iii Archer D, Eby E, Brovkin V, Ridgwell A, Cao L, Mikolajewicz U, Caldeira K, Matsumoto K, Munhoven G, Montenegro A & Tokos K (2009). Atmospheric lifetime of fossil fuel carbon dioxide. Annual Review of Earth and Planetary Sciences 37: 117-134.

iv IPCC (2007). Climate Change 2007: The physical science basis. Contribution of Working Group 1 to the Fourth Assessment Report of the intergovernmental Panel on Climate Change, Cambridge University Press. Ch. 7

v Phillips O, Lewis SL, Baker TR, Chao KJ & Higuchi N (2008). The changing Amazon forest. Philosophical Transactions of the Royal Society. B 363: 1819-1827;
Luyssaert S, Schulze E-D, Börner A, Knohl A, Hessenmöller D, Law BE, Ciais P & Grace J (2008). Old-growth forests as global carbon sinks. Nature 455: 213-215;
Lewis SL *et al.* (2009). Increasing carbon storage in intact African tropical forests. Nature 457: 1003-1007.