Flawed Logic

Why forests cannot offset fossil fuel emissions

November 2013

The fossil fuel industry frequently argues that emissions caused by burning oil, coal and gas or other fossil carbon could be made up for by forest conservation. Using forests as an offset, the argument goes, would allow industry to keep emitting without having any detrimental effects on the climate. This briefing explains the flawed logic behind that argument. There are countless reasons to protect forests but using them as a carbon offset mechanism for emissions from fossil fuels is not one of them and will not save the climate. Recent estimates suggest deforestation is responsible for about 10 to 15 % of anthropogenic – or manmade – carbon dioxide (CO_2) emissions[1]. Consequently, stopping deforestation is a crucial component in achieving the dramatic emission cuts we need to make in order to avoid catastrophic climate change. Offsets, by definition, do not reduce overall emissions but merely shift them from one place to another. In addition to that the unique characteristics of forest carbon (explained below), illustrate that it is impossible to replace fossil carbon with forest carbon. Taken together this makes it mandatory that **reductions in deforestation are 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 whose differences and very unique characteristics are frequently misunderstood:

- The **active carbon pool** or "biosphere" is made up of all carbon that circulates between the atmosphere, land and oceans[2]. **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 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 cut down, for example by deforestation, this carbon is released into the atmosphere where it contributes to climate change. Protecting the world's forests is therefore crucial to maintain as much of their carbon as possible locked up. At the same time, however, it is important not to increase the overall amount of carbon in the active pool because it is ultimately the size of this pool that is critical for climate change. The bigger the active carbon pool is, the more CO_2 is in the atmosphere, contributing to climate change.

Stopping the increase of carbon in the active pool can only be achieved by reducing and ultimately stopping the burning of fossil carbon. **Burning fossil fuels almost irreversibly transfers carbon that was stored for millions of years in the passive carbon pool to the active carbon pool.** As a consequence, there is more carbon available to be in the atmosphere, where it enhances the natural greenhouse effect and gives rise to climate change.

This means that fossil carbon and forest carbon are not interchangeable. **A tonne of fossil carbon is not the same as a tonne of forest carbon.** 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 the already dangerous CO_2 concentrations in the atmosphere.**

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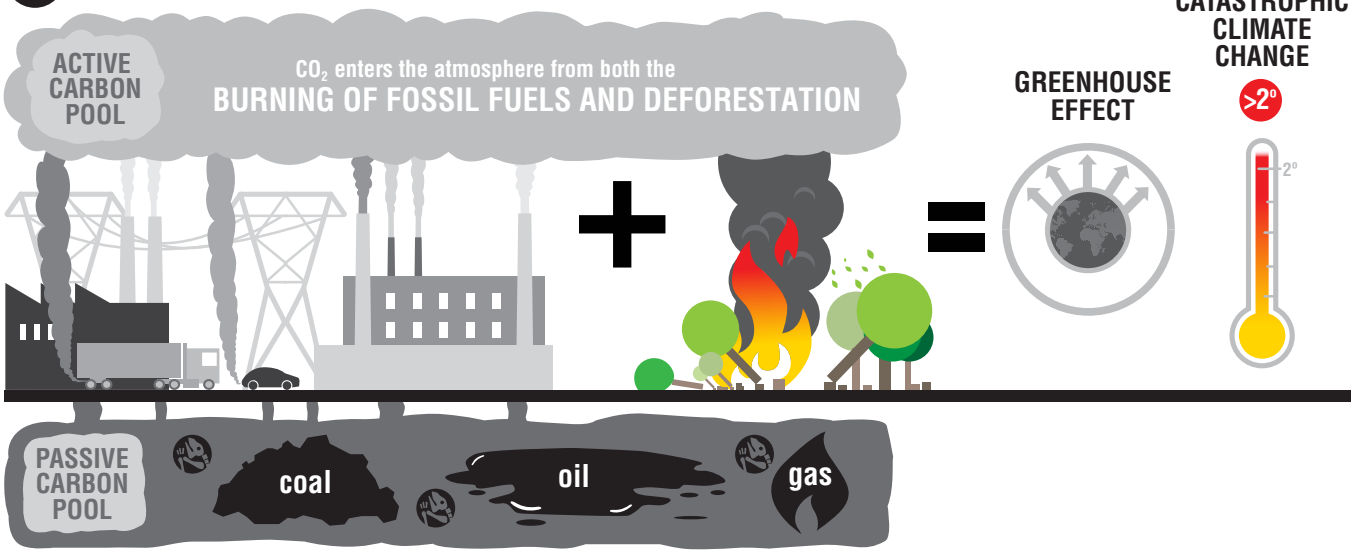
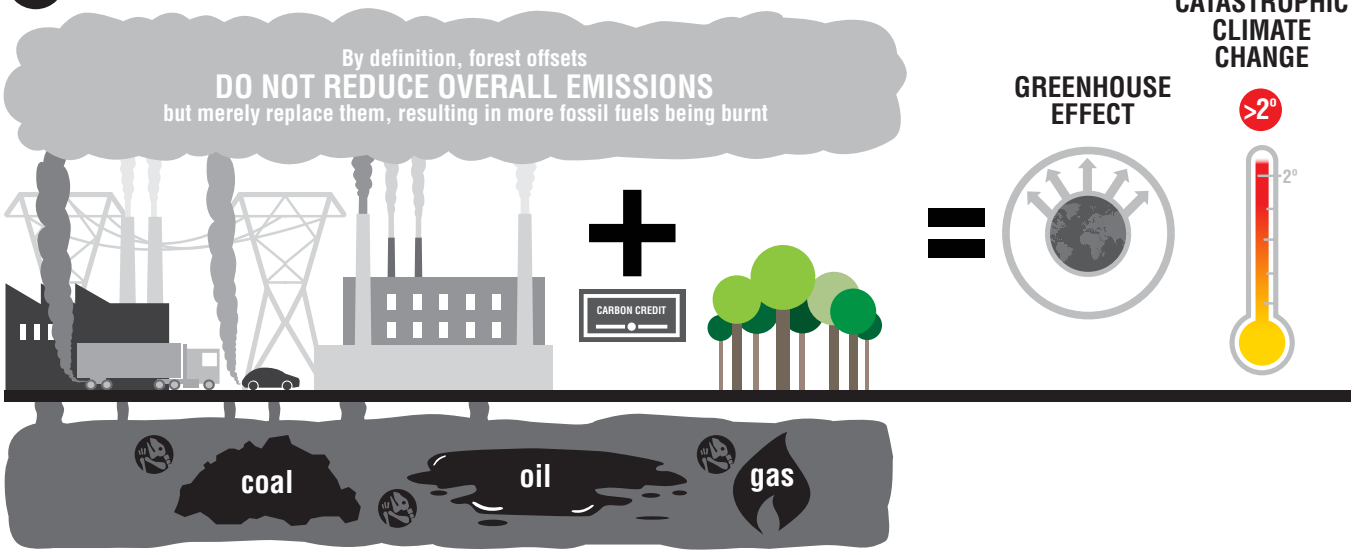
Burning fossil fuels irreversibly transfers carbon stored for millennia in the passive carbon pool to the active carbon pool where it can contribute to climate change. Offsetting fossil fuel emissions with forest protection does not reduce carbon emissions. Only reductions in fossil emissions and protection of forests reduces the chance of catastrophic climate change.

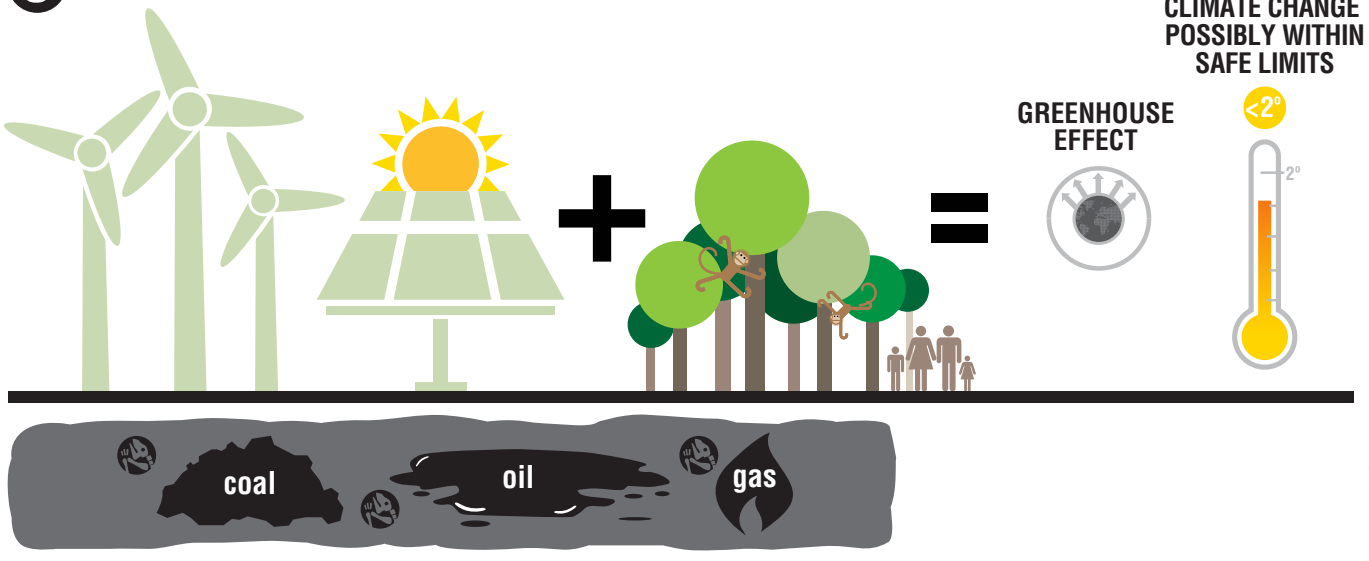
1 BURNING FOSSIL FUELS WITH DEFORESTATION



2 BURNING FOSSIL FUELS WITH FOREST OFFSETS



3 FOSSILS FUELS LEFT IN THE GROUND WITH ZERO DEFORESTATION



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

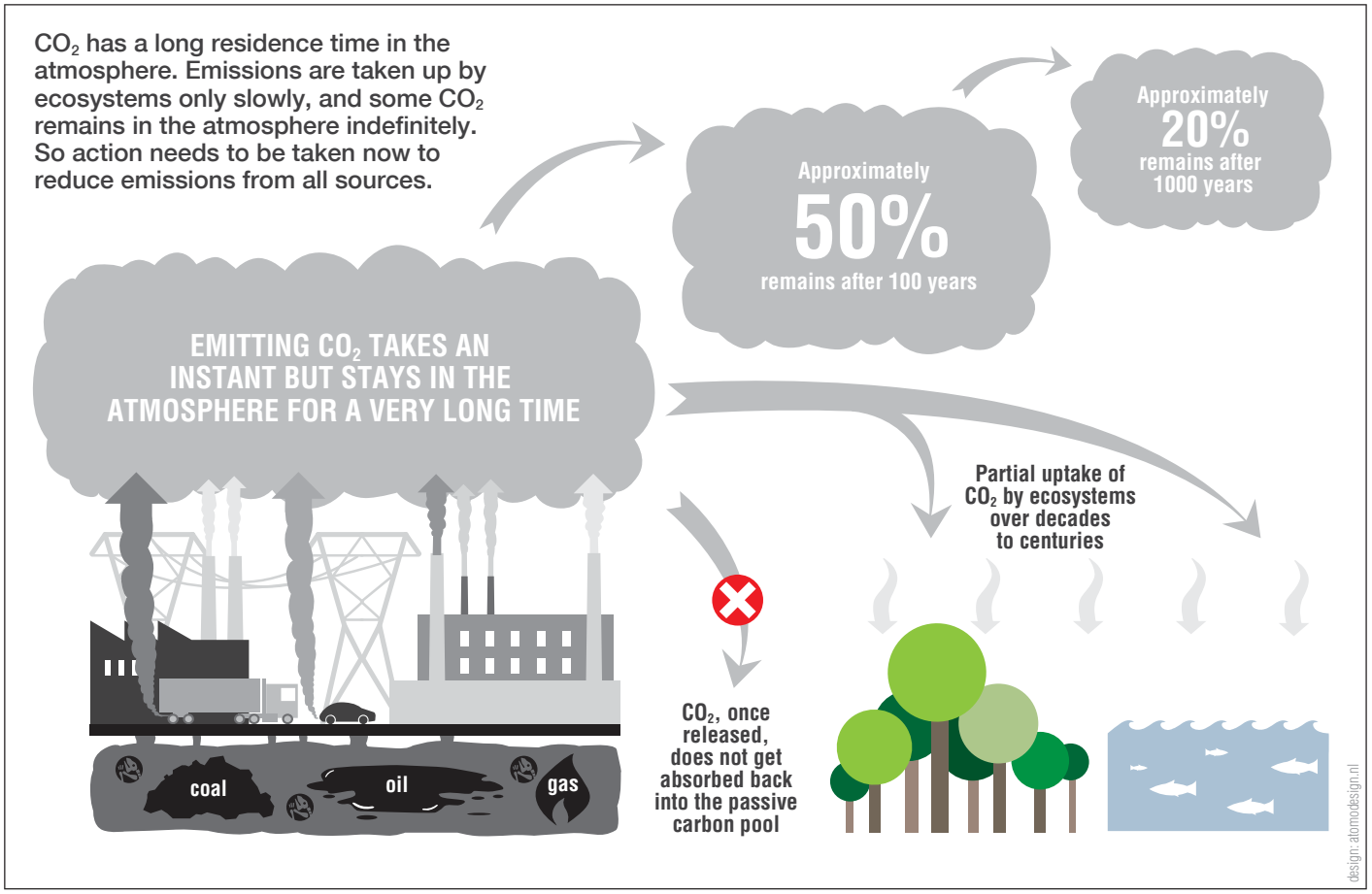
Proponents of forest offsets often suggest that trees could actually replace a substantial part of the carbon that is released by burning fossil fuels. This claim, however, is not backed by climate science. **Carbon dioxide emissions – independent of their source – enter the atmosphere immediately.** The **removal of CO_2 from the atmosphere**, on the other hand, **takes much longer**, with several processes operating over different time scales varying from decades to millions of years[3].

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**". The residence time models used by the Intergovernmental Panel on Climate Change (IPCC) estimates that, within a few decades, 15 to 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[4]. 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 expect forests or other parts of 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[5], **the process can only remove a portion of atmospheric CO_2 and is much 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 are required. Only bold action that tackles deforestation and reduces fossil emissions simultaneously can place us on a path to a sustainable future. Doing just one will simply not be enough.

LONG LASTING CARBON DIOXIDE



Conclusion

Burning fossil fuel instantly, and almost irreversibly, releases additional CO_2 into the atmosphere. Forests, on the other hand, take up CO_2 only slowly, and even then only a portion of fossil emissions can be taken up. Allowing forests to be used as offsets would set us on a trajectory of burning even more of the fossil fuels that we need to leave in the ground in order to avoid catastrophic climate change. Our only chance to stop climate change is to **avoid carbon emissions from all sources**, meaning that we need to ultimately end burning fossil fuels while **at the same time** protecting forests. Protecting forests is important not just for the carbon they contain, but also for biodiversity and the people they support.

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Endnotes

1 IPCC (2013) Climate Change 2013: The Physical Science Basis. Working Group I contribution to the IPCC 5th Assessment Report Ch. 6 http://www.ipcc.ch/report/ar5/wg1/#.Um6XYDhFD5o
Baccini A, Goetz SJ, Walker WS, Laporte NT, Sun M, Sulla-Menashe D, Hackler J, Beck, PSA, Dubayah R, Friedl MA, Samanta S & Houghton RA. (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;

2 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.

3 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.

4 IPCC (2013) Climate Change 2013: The Physical Science Basis. Working Group I contribution to the IPCC 5th Assessment Report Ch. 6 http://www.ipcc.ch/report/ar5/wg1/#.Um6XYDhFD5o;
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5 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;
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