Nature and "net zero"

To keep global temperature rise below 1.5 °C above pre-industrial conditions, we have to stop burning fossil fuels. That fact is abundantly clear. What is also clear is that we have a very short timeframe in which to accomplish this task.

CO_2 resides in the atmosphere for hundreds to thousands of years, so the only way to stop the accumulation of CO_2 in the atmosphere, and therefore global warming, is to stop putting it there. Yearly global emissions of carbon dioxide, primarily from the burning of fossil fuels, are well over 40 Gt CO_2. In its latest estimates, the Intergovernmental Panel on Climate Change estimates that if only 300 Gt more CO_2 resulting from human actions were emitted in total, we would have about an 83% chance to stay below the 1.5 °C target. For a 66% chance, our remaining carbon budget increases to 400 Gt CO_2.

Do the math—40 Gt of emissions a year inside a 400 Gt carbon budget remainder and the urgency is clear.

Nature and carbon

Nature becomes implicated in the race to zero because it shares an element in common with fossil fuels: carbon. Like fossil fuels, living organisms are made of carbon. Indeed, fossil fuels are just formerly living organisms with their constituent carbon and hydrogen condensed under very high pressure over millions of years.

But the fact that nature and fossil fuels share this element in common has been used to construct false equivalences between them. The superficial equivalence between nature and fossil fuels is exploited by a whole range of actors in search of new means of both wealth accumulation and the delay of climate action, in the process turning nature and its carbon into a highly sought-after commodity. The #NetZeroFiles unpack these problematic assumptions in this and other briefs.

Plants have the amazing ability to fix carbon, pulling carbon dioxide out of the atmosphere and storing it as carbon in their tissues. That carbon, and companion nutrients, sustain all the organisms on the planet, those that eat plants and all those further up the food chain.

But plants' ability to draw down and store carbon from the atmosphere also holds a great deal of attraction for humans who are looking for ways to decrease the concentrations of carbon dioxide in the atmosphere—carbon dioxide removal [CDR].

But the potential of nature to fix and store carbon is limited in a number of important ways. Plants can indeed sequester carbon, but for relatively short periods of time in relation to the very long lifespan of carbon dioxide molecules in the atmosphere. Storage in natural ecosystems is, by nature, temporary.

There is a finite amount of land and terrestrial ecosystems in which carbon might be stored. The largest potential for carbon drawdown into natural ecosystems is through ecosystem restoration and reforestation. Restoration implies, of course, a reversal of a process of degradation or destruction. When those ecosystems were initially degraded or deforested, carbon was released into the atmosphere, as carbon dioxide, and the task is now to bring that carbon back into those ecosystems. In other words, there is definitely room for carbon to be sequestered through ecosystem restoration, but not the enormous sums imagined by fossil fuel giants, in their impossible dreams of carbon-neutral fuels.

> *The capacity of terrestrial ecosystems to store carbon is finite and the current sequestration potential primarily reflects depletion due to past land use. Avoiding emissions from land carbon stocks and refilling depleted stocks reduces atmospheric CO_2 concentration, but the maximum amount of this reduction is equivalent to only a small fraction of potential fossil fuel emissions.*" (Mackey et al. 2013)

Carbon budgets

According to the IPCC, the term **carbon budget** refers to "the maximum amount of cumulative net global anthropogenic CO_2 emissions that would result in limiting global warming to a given level with a given probability, taking into account the effect of other anthropogenic climate forcers." The *total* carbon budget starts from the pre-industrial period and the *remaining* carbon budget starts from a recent specified date, such as 2020.

In its recent report, the IPCC calculates that cumulative emissions to date (from 1850-2019) have been 2390 Gt CO_2. Because emissions are cumulative, history is important. We only have 300 Gt CO_2 that we can still emit and still have a very good chance to stay below 1.5 °C, because of the large amounts of carbon dioxide that have already been emitted, primarily by wealthy industrialized countries, over the past two and a half centuries.

Other key terms used in this Brief are defined on the next page.

Of course, there is a finite amount of carbon that could be sequestered in that finite land. Littleton and co-authors [forthcoming] have reviewed and revised estimates for how much carbon could be sequestered by natural ecosystems over the course of the 21st century, using an ecological and rights-based lens. These authors estimate that 93 GtC, or about 367 Gt CO_2-e, could be taken up through processes of forest restoration, reforestation, reduced harvest, agroforestry, and silvopasture systems. An upper bound of more or less 100 Gt C sequestration in ecosystems is a robust finding, defining a reasonable limit for sequestration in the land sector if land rights, food security, and other considerations in line with sustainable development goals are taken into account.

The authors note that peak uptake in their models happens around 2045-2050. There is a lag time for carbon sequestration because of the time plants need to grow. And there is a peak because ecosystems become saturated: sequestration in natural ecosystems works well as a removal strategy for the next few decades, but the potential for further sequestration will decline substantially past mid-century.

In the future, warming temperatures and changed precipitation regimes are anticipated to turn ecosystems from sinks into sources of carbon as they are themselves degraded by processes of climate change. Already scientists say that part of the Amazon has turned from sink to source. In the United States, bark beetles and drought have ravaged the forests of the Rocky Mountains; forest fires across the western part of the country are increasing in size and intensity as the region battles unprecedented recurring heat waves and settles further into a decades-long drought with no end in sight.

Nature is more than carbon

Of course, living organisms are far more than carbon and ecosystems far more than carbon storehouses.

Portraying nature as a mechanism (solution!) for carbon removal and storage, makes the allocation of huge swaths of land to bioenergy carbon capture and storage (BECCS) or large-scale afforestation seem rational. Livelihoods and biodiversity are flattened out of mitigation-driven models. Those models in turn are used in carbon market design. We have seen completely far-fetched assumptions built into models, leading to outrageous and incomprehensible conclusions, for example arguing that a land area twice the size of India might be needed for bioenergy production to fuel furnaces with carbon capture and storage.

When complex dynamics of socio-ecological systems are reduced to carbon budgets and temperature thresholds, words like overshoot creep into discourse without a thought to the large-scale disruptions to rainfall dynamics, ecosystem integrity, species ranges, agricultural production, and passing of tipping points that are anticipated if temperatures exceed 1.5 °C of warming.

Defining Key Terms

Neutralization. The Science-based Targets Initiative (SBTi) uses the term **neutralization** to refer to permanent **removals** that compensate for **residual emissions** at the end of a deep decarbonization pathway. This is what the SBTi considers would be credible "netting" of emissions in a net zero target.

Offset (used as a noun and a verb). The IPCC defines a **carbon offset** as a unit of CO_2-equivalent emissions that is reduced, avoided, or sequestered to compensate for emissions occurring elsewhere. Entities that are responsible for carbon emissions will buy offset credits, assuming that their emissions are somehow being cancelled out by emissions being avoided or sequestered elsewhere.

Sometimes the word "offset" is used as a verb, in its more general sense (in English) of "compensate for." Using the word "offset" in this more general sense of "compensation" can muddy the water.

Removals. The IPCC defines anthropogenic **removals** as "the withdrawal of greenhouse gases (GHGs) from the atmosphere as a result of deliberate human activities."

Residual emissions. **Residual emissions** are those emissions that will be residual *after all efforts* to getting to zero might be exhausted. Indeed, some emissions will be extremely difficult to bring to zero. For example, even with a real dedication to removing emissions from agricultural production through small-scale agroecological approaches, the processes of growing, marketing, cooking, eating, and disposing of food waste will be responsible for some emissions.

Distinguishing offsets from removals is fundamental for clarity in the "net zero" debate

Offsets and removals are different concepts.

The main danger in conflating these terms is that carbon offsets can then be seen as a legitimate or appropriate mechanism by which "net zero" is achieved. Removals will be necessary to get from near zero to net zero. Offsets are purchased *in lieu of* decarbonization.

The SBTi approach is to make visible *both* the decarbonization pathways of companies *and* the amount of residual emissions, and therefore the amount of neutralization, they are assuming at the end of that pathway. With that transparency and clarity it will become clear just how much the natural world is being expected to remove.]

Biodiversity loss and climate change are twin crises of this time; it is insane to make the biodiversity crisis worse in attempts to control global warming. The need for ecosystem resilience in the face of climate change shocks demands solutions that address these twin crises together. Biodiversity protection and restoration must be fundamental to the approaches used to enhance sequestration, and thus also act as a constraint on the types of land-based climate mitigation actions that can be pursued. The role of Indigenous Peoples and community-based systems of governance for protecting biodiversity and ecosystems are well understood. This role must be maintained and enhanced to build and steward the ecological resilience necessary to confront the climate crisis. Rights-based approaches must therefore be at the center of our response—not carbon-centered approaches.

False equivalence and the faulty math of "net" zero

The "net" in "net zero" requires a conceptual adding together of two quantities—emissions of carbon dioxide (primarily from the burning of fossil fuels) and removals of carbon by living organisms in natural ecosystems—and an assumption that this equation makes any sense at all. It doesn't.

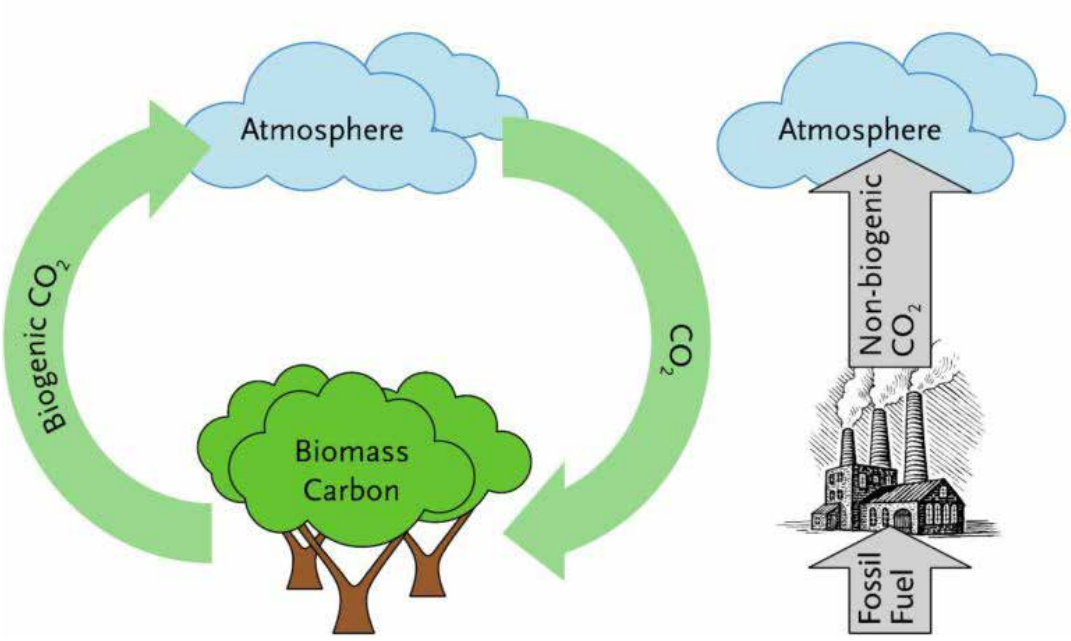
Fossil carbon was created many millions of years ago, by plants and plankton, and huge amounts were buried deep in the earth over hundreds of thousands of years. Extracting and burning that fossil carbon reverses hundreds of thousands of years of sequestration.

Living, terrestrial carbon cycles in a fast carbon cycle. Trees and grasses grow, accumulate carbon, are harvested, and die, cycling their carbon back into the atmosphere. This cycle is not the place to store hundreds of thousands of years' worth of exhumed and combusted fossil carbon. One cannot fit the geosphere into the biosphere.

In other words, there is no "net." There are greenhouse gas emissions and there are removals. Adding them together is like adding together coal deposits and mango trees. Of course removals by nature's sinks are important, critically important, in addition to emission reductions. But this is the only way in which the addition makes sense—not in the zero-sum sense of "net" but in the *both/and* sense that all actions are necessary to keep warming below 1.5°C. We need to stop burning fossil fuels and we need to plant more mango trees.

Mitigation contributions of sequestration in natural ecosystems can only help to keep warming below 1.5 °C if that sequestration *accompanies* an ambitious fossil fuel phase-out. Recent science shows that a phase-out can get us close to 1.5 °C, but ecosystem removals are necessary *in addition* to get below that temperature threshold and avoid overshoot. Ecosystem removals only begin to make a serious difference after a couple of decades, well past the time when fossil emissions must reach near zero.

GRAPHIC BY ETHAN CORNELL



The age of offsetting is over

> *"[C]onsidering carbon storage on land as a means to 'offset' CO_2 emissions from burning fossil fuels (an idea with wide currency) is scientifically flawed."* (Mackey et al. 2013)

Offset "credits", often shortened to "offsets", are claims made by one actor to having carried out some amount of climate action, with the credit usually quantified in units of tons of carbon. Those claims are purchased by another actor who is not taking action themselves but still wanting to look as if they have done something good for the climate. One entity keeps on polluting and the theory is that the offset in some way compensates for the ongoing pollution.

Many corporate "net zero" claims currently rely on offsetting, with the offsets overwhelmingly coming from nature-based projects: reforestation, afforestation, avoided deforestation, sustainable forest management, or reduced harvesting. Their strategy relies on the assumption that offsetting is a legitimate and scientifically defensible means to reach "net" zero, paying for someone else to remove carbon from the atmosphere while the company carries on with business- and emissions-as-usual.

It bears repeating, because there is a great degree of obscuring and 'strategic imprecision' about the relationship between offsets and removals. To keep temperature rise below 1.5 °C requires the world to be on a path to achieving **zero fossil emissions** in the next decades. What removals are possible through reforestation and ecosystem restoration will ensure we can stay below 1.5 °C of warming. Ecosystem removals are not instead of decarbonization—they must be in addition to decarbonization.

There is no room in a 300 Gt or even a 500 Gt carbon budget (providing a 50% chance of remaining below 1.5 °C) for continuing emissions-as-usual. We cannot phase-out fossil fuels overnight, and therefore we need to assume that there are already significant committed emissions built into our existing energy, transportation, and housing infrastructure that will likely add up to 300 Gt within the timeframe we have to phase out fossil fuels. Some analysts have suggested that due to our 'committed emissions', we're already locked in to 1.5°C of warming, in the best case. If the remaining carbon budget is being used up as we take the rapid steps needed toward decarbonization, there is no room for some to carry on with business as usual and buy their way out of reductions. In other words, there is no space for offsetting.

The expansion of offset markets (including voluntary and compliance markets and various forest schemes like REDD+ and LEAF), for the ostensible purpose of "efficiently" enabling some to continue to emit while nature sequesters carbon, dangerously undermines the pathway to 1.5 °C. The limited removal capacity of nature should be reserved for the most necessary of residual emissions, otherwise we squander this crucial contribution that nature can make.

We cannot offset our way to zero. And we also cannot offset our way to "net" zero, as achieving net zero will require rapid and deep decarbonization across all economies and sectors to near zero.

Misusers of nature and their enablers

With their "net zero" strategies, governments and corporate actors are dodging hard choices about the transformations needed to move toward a zero-carbon economy. They promote the scientific impossibility that nature removals can compensate for continued fossil emissions into the foreseeable future. Fossil fuel companies make fraudulent claims about their fuels being "carbon neutral" because they bought

some old offsets. Meat and dairy companies propose emission intensity improvements as a means to continue business as usual—nothing close to "net zero". Ongoing negotiations on Article 6 under the UNFCCC—supposed to be about international cooperation on mitigation—are instead focused entirely on carbon market creation. Carbon marketeers are busy at buying and selling the carbon sequestration potential of nature to those who feel some responsibility to "offset" their own emissions by sequestering some elsewhere.

All these uses of nature for sequestration likely add up to several planet's worth of forests and other carbon-rich ecosystems. And all of these uses of nature assume continued fossil emissions, and therefore the continued accumulation of carbon dioxide in the atmosphere, hurtling us towards 3 or 4 °C of warming.

It is in this way that the concept of "net zero" has created, seemingly overnight, an enormous demand for nature-as-solution, and also, a scary placeholder for geoengineering. Governments and companies are devising new schemes—from LEAF to the Task Force on Scaling Voluntary Carbon Markets—to rapidly increase the amount of nature carbon for sale, which at the same enables them to green their images with ''net zero."

These schemes overwhelming are designed to allow continued emissions in the Global North while relying on carbon sequestration in the Global South, the latest chapter in neocolonialism and a new dimension of global inequity. Northern elites continue to appropriate and extract value from the resources of the Global South for their own benefit and profit. The limited removal capacity of nature is reserved for the highest bidder, operating within rapidly-globalizing carbon markets, with the economic and political power to determine that their emissions are "hard-to-abate" and therefore residual.

Towards (real) zero

"We have to get from net zero to near zero."
—Alberto Carillo Pineda, Science-based Targets Initiative.

Net zero was invented to buy time, to extend the age of fossil fuels by hiding ongoing emissions.

But that time has run out. The age of fossil fuels is ending. The era of offsetting is over.

Zero is the operative word here. Near zero. Real zero. Getting to zero, on a pathway of systemic transformation, is uncontestably the only way we remain below temperature targets. It is the only way that nature might have a chance at making a small net contribution to the enormous challenge ahead.

An approach that focuses on *zero*, rather than *net*, could avoid reducing nature to its constituent carbon, and would not measure success or value in terms of tons sequestered. Non-market approaches are needed. So too is the integrated consideration of climate change and biodiversity.

Getting to zero will require stopping deforestation and restoring forests and other ecosystems, including but not exclusively those ecosystems that sequester high amounts of carbon.

Pathways to zero will require getting fossil emissions to zero, so that the limited carbon we can sequester in ecosystems focuses on livelihoods and food security—not luxury consumption.

There is an urgent need to mobilize resources to all these ends: protecting nature, its ecosystems, and its species alongside the dramatic, urgent reduction in fossil emissions and biomass burning. "Net zero" strategies obscure both the amount of reductions that are actually being attempted and the amount of nature that is being assumed as carbon sink.

Our finances, words, and actions need to focus attention on what really matters: protecting and restoring nature on the way to zero.

The CLARA network includes climate justice advocates, faith groups, conservation groups, land-rights campaigners, agroecologists, and representative of peoples movements around the globe. Our commitment to social justice brought us into the climate debate and informs our approaches to climate solutions. For more information about CLARA, visit **www.CLARA.earth**

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