

Dear UNFCCC,

Please accept the following related to the inclusion and value of short term storage of carbon and short term valuation of long term storage of carbon.

1. Short term valuation has a role even if short term storage does not. How do you sell the last 20 years of a 30-year mortgage? How do you sell the credits from a permanent reduction if you no longer need them - how many credits are left and how do you calculate that? We need methods for placing value on segments of permanent (long term) efforts. For a permanent reduction, when do you receive credit - all at once when the decision is made or spread out as the permanence plays out? How do you distribute the credits earned over time? This all has to do with short term valuation (not storage). Continued development and refinement of these theories is important and should be encouraged and supported.

2. Previous attempts to codify and quantify short term storage have had fatal flaws to them. This was mostly based on a fixed static time horizon that created differences in area under the curve when shifted. This approach has serious mathematical and scientific flaws. This failure should not be ascribed to every method proposed that happens to use the same units of measure (tonne years). Tonne years is a unit, not a method. Parisa et al proposed an approach to short term storage that corrects most of the problems with the previous methods. It may have other flaws but should not be discounted simply because of the units it uses - it still serves as a valid (and mathematically correct) basis for short term valuations of long term (or "permanent") storage. It is the same mathematics used in the financial industry.

If necessary, I would encourage a delay in the use of short term storage rather than a dismissal. You might say that no current methods are acceptable without outright denial of the value of short term storage (see more below).

3. A common misunderstanding is the delineation between an inventory and an account. Inventories are data driven tabulations of where CO<sub>2</sub> resides as a function of time. There is error and uncertainty from estimations, approximations, and projections, but the physical values use the best science to understand the distribution of CO<sub>2</sub> in space and time. Discounting has no role in inventories.

Accounts take inventories and flows and assign values and attribution. Accounts are used to incentivize behavior. Methods to incentivize behavior can range widely depending on the urgency of the need and the relative merit of different behaviors. Since discounting is an inherent part of all current financial theory, it is hard to imagine a system that assigns value but fails to recognize the role of discounting.

There has been a great deal of discussion in recent years over the appropriate discount rate for carbon emissions. While the discussion has focused which value to use, a more useful discussion would be to gain agreement on how it should be calculated. Banking interest rates change fluidly over time with no disruption in business while new values are calculated. Discount rates for carbon emissions should likely be just as fluid. The reason for the stress has been an attempt to pick a single discount rate that should be applied for long periods of time - resulting from excessively long term static agreements. Instead, we should be building consensus on how it is calculated and regularly updated. Contracts can still be long term but valued on the short term, with regular updates to key

parameters. This is no different than working out the details of an Adjustable Rate Mortgage (ie a 5 year ARM such as I have for my current house) and allows values to change as new information is available.

4. There is an interesting issue of scaling that seems to be causing trouble. International assessment measures are likely not relevant at the land-owner or project level. Heterogeneities smooth out at larger scales. Small landowners are already excluded (financial viability) from most offset programs. With parcelization on the rise, we -need- more small landowners vested in the process, voting for additional measures, and feeling a part of the solution. Recall that the goal is to incentivize a change in behavior that supports the long term goals.

A single tree has a relatively short finite life-span. However a forest, composed of single trees, can sequester and sustain a large carbon stock. We might similarly propose that a company such as NCX which is comprised of small short term storage projects might be in itself a long term storage project. At what scale is the assessment appropriate - at the individual tree scale, at the forest scale, or at the global scale? It is my opinion that the useful scale is one where some of the heterogeneities are smoothed out. We don't need to worry about tiny dips and bumps if the larger trend is moving in the right direction on the right time scale.

It is also important to note that long term commitments are many times short term commitments that have been renewed. If we have good programs that truly move us in the right direction with fair and equitable incentives, people will turn their short term projects into long term projects. If we have bad programs, no one should sign up in the first place.

5. In reference to 4. above, removing short term storage inherently removes the importance of all carbon stocks of the biosphere, which is made up of short lived components. I hope this is not the intention but it is worth making sure that policies scale appropriately.

At the same time, the real battle we are facing is one of a unequal flow rate between inactive carbon stocks (coal, gas, oil, deep ocean, rock, etc) and active carbon stocks (biosphere, atmosphere, surface ocean). Eventually we need to balance the flows by increase the flow from the active to the inactive. Among the current options such as BECCS and CCS, we also have long lived wood products and landfills (not all harvested wood products, but some). These two pools constitute a large quantity of relatively inactive carbon that has a minimal chance of unexpected reversion and has a predictable life cycle. The difference between the climate impact of paper and plywood is larger than the difference between plywood and not-harvesting. This is something we should be using. Maybe this is not the number one priority, but it should not be closed off.

6. Much of the condescension toward short term storage originates with a paper by Allen at al. from 2009. While that paper and those that follow it provide a useful part of the overall discussion, they are based on simplifying assumptions that limit their applicability.

In those papers, the assumptions that drives the dismissal of the importance of time is a combination of three items:

1) We will stabilize the carbon (GHG) balance asymptotically over time.

2) The stabilization will be approached from below and the new stabilization will be that which also relates to the cumulative CO2 emissions.

3) Once we reach the new stabilized level, we will stay there in perpetuity.

That is, there will be no overshoot and resettling. We cannot pull that quantity back down to more preferable levels below that which results from the asymptotic approach. This means that they are assuming that there is no peak that we wish to lower and no duration of the peak we attempt to shorten. That is, for simplicity of the model calculations, they are assuming the importance of time out of the model. With that assumption of course short term efforts do not matter and the timing will not matter - because they assumed it away.

This is exactly the opposite of what happened with Covid where we were trying to flatten the curve and lower the peak, knowing we could bring the active case load down after that peak. This is exactly the opposite of many processes where we attempt to minimize the damages over time by both shortening peak exposure and lowering the magnitude of the peak (minimizing the integral). They are assuming that this is not possible with CO2 and warming.

This also assumes we will not develop new technologies or implement new strategies that will enable a lower peak. If we include those, the timing of the peak would matter - delaying tactics would then be important since a slower rise would provide extra time to develop and implement. They are not considering anything but a steady path to peak cumulative emissions and assuming that the height of that peak is predetermined from the outset.

Of note, I think the Allen paper (and the others in the same line) provides a useful contribution to understanding the boundaries of the full system and perhaps even a constructive approach to setting initial targets. However I am too optimistic to abandon hope of all other possibilities. And I am not sure they have fully thought through the implications for forest stocks if short term value/storage is deemed unimportant. I think we need to convey that these papers constitute one boundary of a very large and complex system. The other boundaries need definition as well and for those other boundaries, time and timing matters.