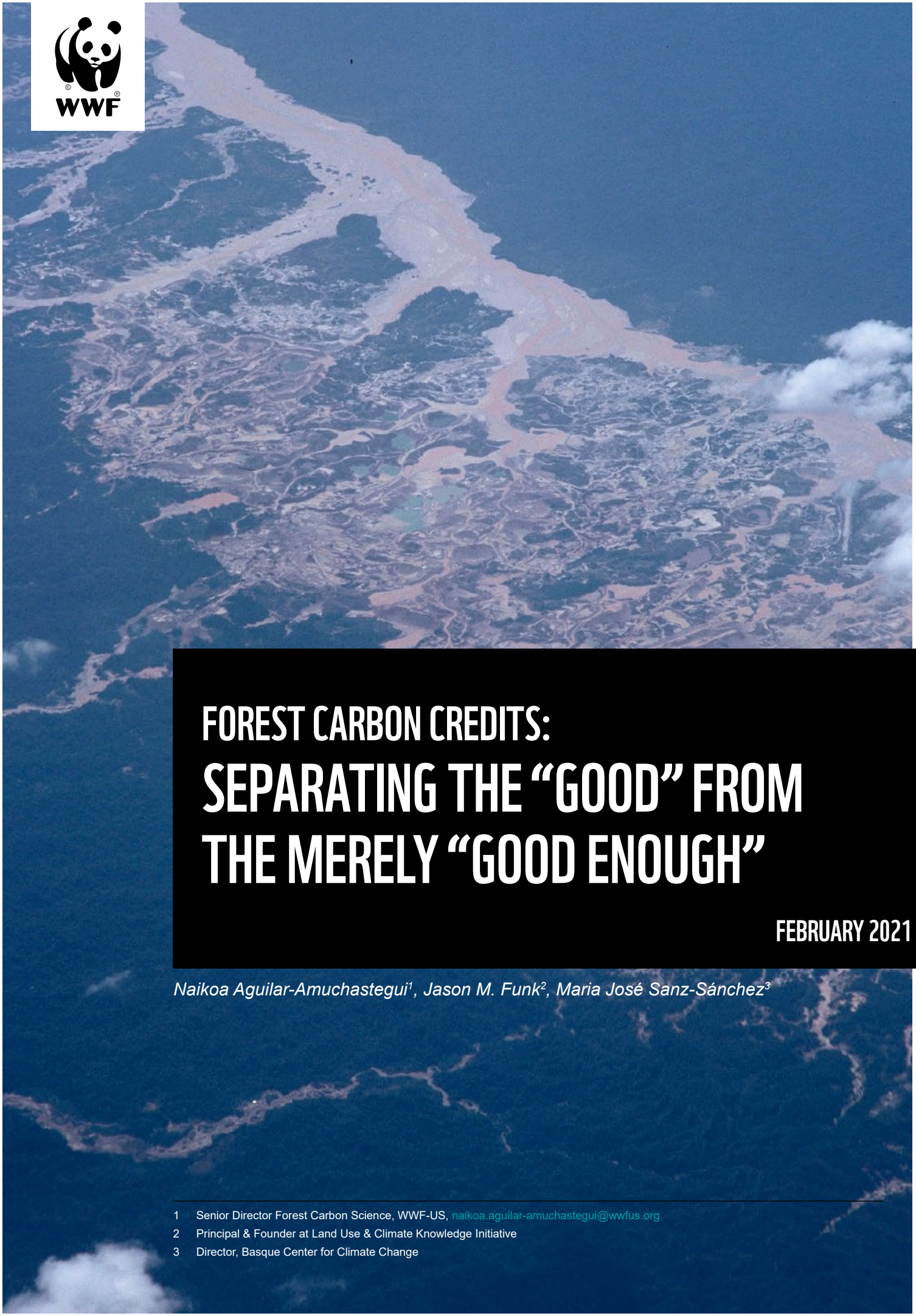

FOREST CARBON CREDITS:
SEPARATING THE "GOOD" FROM THE MERELY "GOOD ENOUGH"

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A DECADES OLD DISCUSSION

A recent publication by Chagas et al. (2020)[4], entitled "A close look at the quality of REDD+ carbon credits," combined with a spike in interest from the private sector seeking to deliver on carbon neutrality commitments, has stirred up the debate of what constitutes a "good forest carbon credit" or, from a broader perspective, what constitutes a real or credible emission reduction/removal (ER/R) from the forest sector.

These contributions are just the latest in a round of discussions that have been taking place among academics, politicians, decision makers, NGOs, supporting agencies, interested parties, implementing parties, and standard developers for more than a decade – discussions that have yielded surprisingly little consensus on fundamental questions. The aim of these discussions has been not only to figure out what constitutes a "good" credit but also to determine how these credits are to be delivered.

HOW CREDITS ARE BEING ASSESSED

To date, most of the criteria developed to assess forest carbon credits[4, 5] seek to identify or determine what constitutes a good carbon credit or ER/R from a technical perspective. These criteria tend to center around the quantification of ER/R estimates, focusing on issues such as reference level setting, uncertainty, and the permanence of ER/R achieved. Their scope has included the question of how many REDD+ quantified ER/R are "good enough" to count alongside reductions in other sectors, or even to "offset" emissions in other sectors (whether other sectors' emissions estimates meet the same criteria is a matter for another discussion).

From this technical perspective, ER/R estimates have been defined by two primary issues: 1) the approach used to build the reference level, and 2) the quality of the estimates accounting for their uncertainty.[6] Yet these technical considerations have proven impossible to disentangle from other, more qualitative, factors.

4 Chagas et al. 2020. A close look at the quality of REDD+ carbon credits. Climate Focus.

5 WWF 2020. What makes a high-quality carbon credit? Phase 1 of the "Carbon Credit Guidance for Buyers" project: Definition of criteria for assessing the quality of carbon credits.

6 Uncertainty is composed of two components: random error and systematic error. The former is defined (IPCC, 2006) as the random variation above or below a mean value, it is the inverse of precision, it can usually be quantified, and it is related to measurement and estimation. The latter is defined (IPCC, 2006) as the lack of agreement between the true value and the mean value, it is the inverse of accuracy, it can rarely be quantified, and it is usually related to errors linked to conceptualizations (assumptions), models and inputs. The IPCC (2006) requires the former to be quantified and propagated, whereas the latter has to be prevented, yet it can have the most significant impacts on the overestimation of ER.

QUANTIFICATION AND ITS DISCONTENTS

What is a "good" reference level?

In the case of reference levels, discussions often stall on the question of what constitutes a level of emissions that represents a "business as usual scenario" (BAU[7]), — essentially, the emissions that would occur if there were no interventions to reduce them. The most common assertion is that **reference levels** should be based on a historical period of approximately 5-10+ years (examples include 4-19 years), making the implicit assumption that the past is the best predictor of the future. However, in its purest form, this approach excludes contextual information and a series of underlying assumptions that could deliver a reference level that offers a better means of incentivizing actions to deliver real results.

To claim ER/R, projects or programs must make the case for their own **additionality**: that is, that the actions proposed constitute such a change of direction from a BAU scenario that the ER/R would not have occurred without them. The idea here is that interventions deliver measurable results against a reference level (the BAU scenario) that has been agreed upon by donors and project implementers. In most instances, this reference level is the result of a balancing act between technical considerations based on the available information and political considerations, which are often driven by a lack of trust and long-term vision.

Because of this balancing act, implementation activities have been split into two general categories. "Safe area" activities, the most common to date, occur in low-threat areas at relatively low cost, with little effect on reducing pressure from the drivers of deforestation at work in high-threat areas, such as at the forest frontier. "Safe area" activities can play a role in securing stable forest areas, but they likely have little impact on the atmosphere, since the forest will most likely remain there without the activities.[8] "High risk area" activities occur in high-threat areas, where they can have high impact. These activities tend to have higher costs, since in order to succeed, they often need to address complex socio-economic scenarios that are not only driven by local pressures. Therefore, actions in the "high risk areas" should most easily be able to demonstrate additionality because of the high threat to forests, even though they must be considered amidst a more complex set of local circumstances. However, such complexity and the increased costs result in driving implementation away from high impact areas. This is particularly relevant in considerations of the permanence of achieved ER/R (see below).

In the case of "safe area" activities, quantified additional emission reductions are less evident; therefore, reference levels are more open to interpretation. The subjectivity of the debate tends to erode the credibility of reference levels and estimated ER/R, as in some instances it can be considered speculative and not robust.

Some carbon credit standards seek to limit this speculation by, for example, requiring the use of historical averages with a limited tolerance for adjustments. While this increases the comparability of the data, it also removes the flexibility to accommodate relevant local and current contextual elements not reflected by data themselves. Thus, this approach limits the capacity to enable real, transformative impact by obscuring potential actions in data averages. There is no silver bullet approach to setting reference levels since, in many instances, data alone cannot determine what might be considered a fair and accurate baseline. Most importantly, efforts to restrict flexibility often have the effect of ruling out more long-term transformative visions.

Are ER/R to be considered permanent?

When dealing with forest mitigation in developing countries, donors and potential buyers of forest carbon credits look for guarantees that reported ER/R are "permanent" -- meaning that the risk of reversals (carbon being re-released into the atmosphere after it has been sequestered or secured) is low. As companies seek to deliver on their commitments towards carbon neutrality, they look for implementation programs that can easily attribute their involvement and, in some instances, generate additional revenues (often known as "bankable projects"). This has tended to steer them towards afforestation/reforestation (A/R) projects, where performance is easier to measure with relatively low uncertainty, and additionality and outcomes are easier to attribute to those involved in their implementation.

However, **permanence** is a challenge for A/R projects, since carbon removed by the project is also at risk of reversals, which results in the material loss of the newly sequestered carbon. Such reversals can occur not

7 BAU represent the set of conditions that would occur if the mitigation actions considered under an ER/R program are not implemented. What would happen if a change of direction resulting from the implementation of the program does/did not happen.

8 Funk, Aguilar-Amuchastegui, et. al. 2019. Securing the climate benefits of stable forests. Climate Policy.

only due to mismanagement, but also because of circumstances beyond managers' control, such as wildfires, disease, and natural disasters. In some cases, carbon is lost due to increased vulnerability caused by climate change, as was the case for the beetle attacks in Canada (which contributed to Canada's decision to withdraw from the Kyoto Protocol) or the more recent cases of catastrophic forest fires in California and Australia.

For many of these phenomena, climate change itself is becoming a risk multiplier. Thus, the emissions that the buyer seeks to offset are, in fact, increasing the risk of impermanence of the sequestered forest carbon they are purchasing. Furthermore, some types of projects – such as monoculture plantations often with fast-growing exotic species – are more vulnerable to climate change impacts than others, which is another layer of risk not often accounted for. The feedback loop between emissions and forest projects and the heterogeneity of impacts means that some aspects of these problems cannot be simplified.

Forest mitigation activities will require careful consideration of the context in which they will be implemented, accounting for whether they increase the resilience of the resulting ecosystems. Increasing resilience is fundamental to ensuring permanence, while it could also provide other tangible and non-tangible benefits to the communities living in or depending on forests. New concepts such as "natural insurance" can also play a role.[9] Overall, carefully designed mitigation actions in the forest sector can help improve health, safety, wellbeing, and quality of life of communities living in and from the forest, alongside ER/R.

In the case of ER/R from reductions in deforestation and forest degradation, what is considered a reversal is also a matter of discussion. Some consider any lack of performance that follows a performing period (e.g. a year with emissions below the reference level followed by one with emissions above the reference level) as a reversal that needs to be compensated or "insured." Most standards, such as VCS-VERRA and ART/TREES, seek to accomplish this by allocating a share of the emission reductions in the performing year to a buffer. Subsequently, in the event of reversals, reductions from the buffer pool can be withdrawn to compensate for the "reversal" and ensure that the buyer is "made whole," in terms of carbon accounting. However, buyers are responsible in part for the reversal risk, and they could also self-insure their investments through option contracts to backstop their potential liabilities for reversals, without passing the burden onto ER/R producers.

Such approaches may be redundant at the jurisdictional level, since proper accounting can ensure that ER/R achieved may be considered permanent, as is the case in other sectors,[10],[11] because most reporting periods are currently set on an annual or biannual basis. Thus, as long as jurisdictional emissions in any given year are below the performance benchmark set for that year, the resulting ER/R delivers permanent climate benefits. If jurisdictional emissions later rise above the benchmark, they would be accounted for based on that timeframe and therefore would not invalidate the previous performance. Ideally, performance periods will be extended from annual or biannual terms into longer terms, as accumulated ER/R are more indicative of progress , making the use of buffer pools or other insurance mechanisms unnecessary.

Furthermore, there is no definition of permanence under the Paris Agreement that can be applied to ER/R. The concept of permanence may not be applicable to jurisdictional level efforts, since it was developed for the specific context of the Clean Development Mechanism (CDM) and voluntary standards to account for the possibility that project-level emission reductions would be used to offset emissions from other activities. Within the UNFCCC, permanence was discussed in the Clean Development Mechanism in relation to accounting for net carbon stock accumulation in project activities related to afforestation and reforestation (AR-CDM). For the Kyoto Protocol (KP), regarding activities under Articles 3.3[12] and 3.4, obligations for Parties to provide annual greenhouse gas (GHG) inventories, reporting, and accounting of ongoing activities were considered sufficient to address the issue of permanence.

Is the uncertainty of estimates low enough?

Another stumbling block for forest carbon has been **uncertainty** in the estimates in both reference levels and reported ER/R performance against them. Uncertainties in estimates — i.e., the lack of knowledge of their true, quantified value— arise from the combined effect of bias (systematic error) and lack of precision in estimated emissions (random error). For quantifying both reference levels and performance, the quest has been centered around enhanced precision which, in statistics, translates into increasingly narrow confidence intervals. The narrower the confidence interval, the more "trustworthy" the estimate is considered, and therefore the lower the uncertainty of the estimate. Potential methods to achieve lower uncertainties include increasing the number of samples or improving the methods used to collect the emissions data (e.g. change

9 See Quaasa, Baumgärtner, De Lara (2019) for a definition

10 Federici, S. Lee, D and Herold, M. 2017. Forest Mitigation: A Permanent Contribution to the Paris Agreement?

11 Espejo, A. Becerra-Leal, M.C. and Aguilar-Amuchastegui, N. 2020. A Comparison of Environmental integrity of Emission Reductions from REDD Programs and Renewable Energy projects. Forests

12 Article 3.3, namely afforestation, reforestation, and deforestation that occurred since 1990, is mandatory.

detection methods used in remote sensing, develop better national forest inventories, use better allometric equations, engage in better sample processing, use more high-resolution data, etc.).

However, neither increasing sample numbers nor improving methods prove to be simple solutions. In the case of activity data, deforestation is often the smallest portion of the landscape, which makes it hard to map, and any omission (i.e. any deforestation that failed to be mapped) results in exaggerated impacts to uncertainty estimates under current approaches. These omissions are often beyond the control of implementing parties, and research is currently underway to develop sound approaches to limit impacts to estimated uncertainties. Furthermore, the impact of omissions in uncertainty estimates only increases as success in tackling deforestation makes it an even smaller portion of the landscape. Assessment of the location of omission errors clearly shows these are usually located near the areas subjected to deforestation, making it very difficult to eliminate them. (The figure below shows how density of omission errors is higher around those areas where deforestation has been detected.)

Increasing the number of samples also carries major logistical challenges. Regarding emissions factors, national forest inventories are massive undertakings: forests with the highest carbon content, which are the most difficult to replace, are also the most biodiverse and therefore the most difficult to produce estimates for. This has logistical as well as precision implications, since higher biodiversity translates into more variance and, in turn, larger confidence intervals (compare estimating the carbon content of 1 hectare of an even-aged eucalyptus plantation with that of a tropical rainforest with over 250 different woody species[13]). Inventorying biodiversity is often well beyond the level of countries' technical resources or commitments. As criteria currently stand for quantifying forest carbon, countries with limited technical capacity are penalized if precision is seen as the single most important criterion in creating "best estimates."

Have we made the "perfect" the enemy of the "good"?

In the case of deforestation and of forest degradation, many crediting standards have proposed applying discount factors to ER/R estimates based on the relative magnitude of confidence intervals to compensate for uncertainty.[14] This approach tries to avoid Type I errors (i.e. crediting ER/R that are not real) at the expense of Type II errors (i.e. failing to credit some emission reductions that really occurred). Reference levels are lowered and performance period estimates are increased, making the difference between the two smaller and therefore more "conservative." Simply put: the wider your intervals, the less ER/R there are to be recognized.

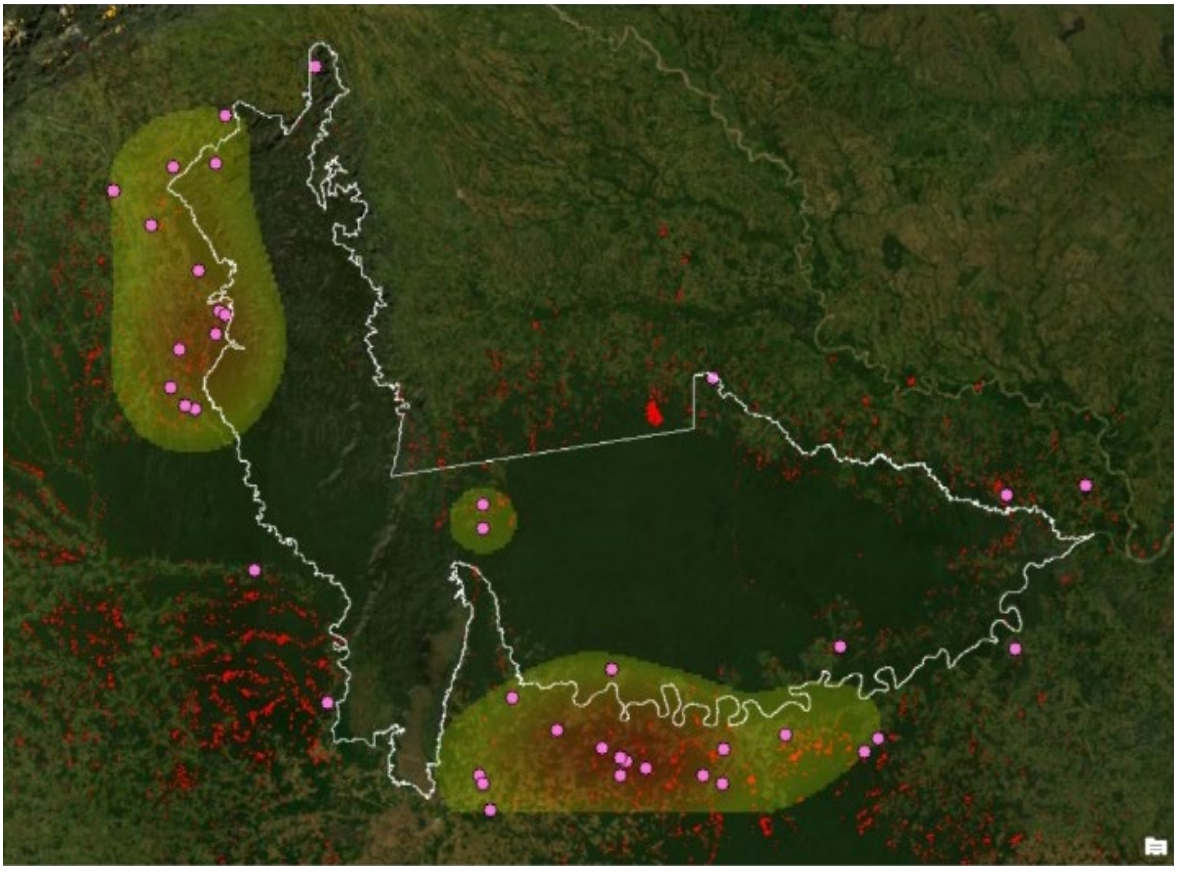

Figure 1. Example heat maps of omissions errors observed in an area of Colombia around Sierra de La Macarena national park (white polygon) during the period 2016-2019. The green areas are remaining forest, the red areas are deforested. Orange shadow areas indicate higher density of omissions. Pink dots represent validation samples classified as omissions. Source: IDEAM 2020.

13 Giles et al 2004. Why Do Some Tropical Forests Have So Many Species of Trees? Biotropica. Vol. 36, No. 4 (Dec 2004), pp. 447-473

14 See FCPF Methodological Framework criterion 22, ART TREES Crediting Level section 5.1.p.29

This "conservative" approach was initially proposed by the UNFCCC in the context of accounting adjustment to the reported estimates under Article 5.2 of the Kyoto Protocol and in the modalities for afforestation and reforestation project activities under the Clean Development Mechanism,[15] and then subsequently proposed in research papers for use under REDD+.[16,17,18] Under the UNFCCC reporting guidance, conservativeness was to be applied when countries failed to estimate and document their emissions, making it so reviewers had to cover the gaps making use of Tier 1 (default method)[19] estimates and apply the discounts to those estimates when moving into accounting. In the case of REDD+, Grassi et al. 2007[15], 2008[16] proposed that conservative discounts be applied to those estimates which may be assumed to be inherently more uncertain (i.e. when countries use IPCC Tier 1). However, no reference was made to the width of the estimated confidence intervals, which is more an indication of the source of the data than about their qualities. It is important to insist on the point that originally, conservativeness was not intended to be applied directly to estimates, but rather to the use of those estimates within predefined accounting rules and modalities. In essence, conservativeness was meant to incentivize countries in producing their own estimates (Tiers 2 and 3) and to provide quantities of tons to be used for accounting against pre-established targets that could be considered robust.

THE EASY WAY ISN'T ALWAYS THE BEST WAY

The implication of attribution

As a result of these challenging quantification issues, donors, buyers, and different initiatives look to standards as a means to incentivize countries or project implementers to design better interventions and deliver better, more comparable estimates, while at the same time attempting to broaden the participation in crediting schemes to enhance the quantity and perceived quality of ER/R supply. The recent increase of commitments towards carbon neutrality by companies, along with initiatives like the Bonn Challenge and 1t.org, has piqued interest in restoration and enhancement of carbon stocks, as opposed to tackling of deforestation and forest degradation. Financiers often seek to attribute the achieved ER/R singularly to their support, which is difficult if not impossible to do.

In the case of reducing deforestation and forest degradation, ER/R are difficult to attribute. It is often impossible to define which specific hectares were not cleared or which specific intervention was responsible for reduced deforestation, making it very difficult to certify that a given ER/R was specifically the result of the contributions of a given actor, for the same reasons that make quantification difficult: namely, the difficulties that arise from developing or ensuring reference levels, additionality, permanence, and uncertainties, among others.

Recent interest in afforestation/restoration projects and its implications

For financiers, A/R projects seem like low-hanging fruit. When ER/Rs result from the implementation of A/R projects, causal relationships can be established more definitively, and ER/R (from net removals) can be attributed more directly. Additionally, reforestation projects usually involve a limited number of factors that have been quantified more robustly than other types of interventions, such as the use of a limited number of species, easily determined stand ages, and more precise biomass estimates, all of which make estimates easier to produce, with narrower confidence intervals.

In the case of afforestation, the carbon benefit is likely to come from fast-growing plantations -- usually monospecific, even-aged ones, with low heterogeneity. Such projects can yield precise estimates of removals, based on decades of data from timber production, but they are also subject to higher risks like reversals by reducing the complexity of the ecosystems, which often results in trees that are less resilient to natural disturbances and impacts from climate changes. Additionally, where to locate these plantations is a

15 CDM - see paragraph 47, 50 and annex III, SBSTA Decision -/CP.9 Technical guidance on methodologies for adjustments under Article 5, paragraph 2, of the Kyoto Protocol

16 Grassi et al 2007, REDD estimates: do we need accuracy or conservativeness? SBSTA 26 side-event Enhancing participation in REDD (Bonn, Germany).

17 Grassi et al 2008. Applying the conservativeness principle to REDD to deal with the uncertainties of the estimates. Environ. Res. Lett. 3 035005

18 Grassi et al. 2012. Implementing conservativeness in REDD+ is realistic and useful to address the most uncertain estimates. Climatic Change volume 119, pages 269–275 (2013)

19 Making use of default emissions factors included in the IPCC 2006 guidelines.

difficult choice to make, as we have learned from recent studies on restoration potential[20] and the resulting debate.[21,22,23,24]

Many such plantations encroach into non-forested ecosystems or seek to replace natural forest loss with low-quality forests of questionable long-term viability. Rather than delivering no-regrets benefits for the climate, these projects might actually represent a threat to other ecosystem services, such as biodiversity. Furthermore, the carbon contained by the trees in these plantations may be harvested, either as a means to improve the financial performance of the project or due to project abandonment, in which case the true amount of ER/R in the long term will actually be lower than the estimates predicted for a forest that is left standing. The resulting outcome is a forest stand of limited diversity and lower resilience than a restored, ecologically functional forest. In exchange for higher quantities of ER/R and a deeper—but false—sense of certainty about the estimates, we run the risk of trading away the opportunity to foster more resilient, higher quality forests.

When financiers shift their attention to A/R projects, the result is a low level of implementation in high-risk/high-impact areas. These are the areas where deforestation is active, where most forest-related emissions are occurring, and from which large, resilient carbon stocks are being lost to the atmosphere at alarming rates. In 2019 alone, the world lost forests at a rate of thirty football pitches every minute. In the case of deforestation and forest degradation, this means that many ER/R come from low-risk areas, away from the forefront of deforestation, where the likelihood of "reversals" is lower, historical average emissions are low, and reference levels need alternative scenarios that present the appearance of larger performance potential to compensate for the lack of actual room for performance.[25,26] While these areas may be attractive due to lower implementation costs, they also tend to feature large confidence intervals, subsequent discounts in the ER/R estimates for payments, and generally low carbon prices, which result in low returns on investment. Projects sometimes try to compensate for these shortcomings by moving from historical towards trend—or model—based reference levels, further eroding confidence in ER/R activities. What can we do to stop this vicious cycle?

THE POSSIBLE WAY FORWARD

No solution will work unless it tackles a few key issues: the underlying risk aversion from donors and buyers; the short-term nature of targets and goals, with donors and buyers expecting programs to deliver ER/R in less than a decade with no commitment for support beyond that timeframe; and a lack of impact, as compliant programs can only deliver limited amount of quality ER/R under the standards. One possibility is in introducing an overarching **criterion for impact**, which would allow donors, buyers. and programs themselves to understand what would really constitute strategic impact in the quest for tackling deforestation. Simply put: are programs and projects being implemented in the same areas as active deforestation and forest degradation?

Actions intended to meet the urgency of deforestation and its contribution to the climate crisis cannot succeed unless they begin to address "high-risk areas" more systematically. Yet doing so will require a reformulation of acceptable risk, uncertainties, and permanence, particularly when considering the short-term commitment preferences of donors. So, how to move forward? The answer may lie in:

1. **Time horizon of the commitments for support and their performance assessments.** Moving from short-term targets and goals towards long-term investment in diversified portfolios of interventions may be the way to deliver large amounts of ER/R that will increase when adequate timeframes are used. Performance should be assessed on similar timeframes as the reference period: shifting towards accumulated emissions and allowing for intervention actions to deliver actual

20 Bastin et al. 2019. The global tree restoration potential. Science 05 Jul 2019:Vol. 365, Issue 6448, pp. 76-79

21 See Weldman et al 2019. Comment on "The global tree restoration potential" Science 18 Oct 2019: Vol. 366, Issue 6463, eaay7976

22 Lewis et al 2019, Comment on "The global tree restoration potential". Science 18 Oct 2019:Vol. 366, Issue 6463, eaaz038

23 Bastin et al 2019b. Response to Comments on "The global tree restoration potential". Science 18 Oct 2019

24 Bastin et al 2019c. Erratum for the Report: "The global tree restoration potential" by J.-F. Bastin, Y. Finegold, C. Garcia, D. Mollicone, M. Rezende, D. Routh, C. M. Zohner, T. W. Crowther and for the Technical Response "Response to Comments on 'The global tree restoration potential'" by J.-F. Bastin, Y. Finegold, C. Garcia, N. Gellie, A. Lowe, D. Mollicone, M. Rezende, D. Routh, M. Sacande, B. Sparrow, C. M. Zohner, T. W. Crowther. Science 29 May 2020:Vol. 368, Issue 6494, eabc8905

25 West *et al* 2020. Overstated carbon emission reductions from voluntary REDD+ projects in the Brazilian Amazon. NAS September 29, 2020 117 (39) 24188-24194.

26 Scott et al. 2016. The 'Virtual Economy' of REDD Projects: Does Private Certification of REDD Projects Ensure Their Environmental Integrity? International Forestry Review, 18(2):261-263 (2016).

results. This also will help to control for yearly fluctuations resulting from management schemes or natural variation.

2. **Commitments as true partnerships.** Rather than a typical buyer-seller relationship, high-impact implementation requires partnerships in which upfront investments or collaborative work between buyers (e.g. companies) and implementers are required for the implementation of measures that will come to fruition in the middle to long term. Of course, this would entail modifying current performance-based payment agreements into something new.
3. **An impact-based modifier for the assessment of already existing criteria.** We need to push towards implementation where it matters. Yet, as things stand, any program attempting implementation in a "high-risk area" immediately finds itself at a disadvantage, not only in terms of assessment criteria, but also cost of implementation, time horizon for delivery, and marginal return on investment. Such high yield/high risk endeavors can benefit from the right assessment of permanence for ER/R, which should compensate for both level of risk and uncertainty discounts. Implementation could be based on deforestation risk maps, calibrated based on underlying enabling conditions. Deforestation risk estimates have been proposed to be used for subnational performance baseline setting[27] as well as for balanced benefit sharing, and these could also be used for priority allocation of efforts.
4. **A price that truly motivates and reflects the cost for implementation**. Since the 2009 Amazon fund, performance-based payments have used a standard pricing of $5 per tCO2eq. It has been proven time and again that this price does not cover the cost of achieving ER/R, nor will Norway's recent increase to $10 per tCO2eq under the ART TREES framework.[28] Insufficient revenues from low price is an issue in "high risk areas" in particular and, as such, the **criterion for impact** will need be considered in these circumstances. Some standards like ART are considering giving special consideration for ER/R from High Forest-Low Deforestation countries. These stable forests have long been the object of special attention because of the need to preserve their large carbon stocks, yet that attention may have put implementation of high impact actions in highly dynamic areas at a disadvantage. One lesson learnt is that the reward cannot come only from the price of the ton of carbon – commitment of long-term investments as well as good planning and partnerships should be considered as well – and yet the prices must be higher than a few dollars. Simply put, high impact ER/R as assessed with a criterion for impact should be assigned higher prices because of such impact, co-benefits, and cost of implementation.
5. **A blended business approach.** So far, the approach to implementation has largely been focused on discrete activities, rather than a holistic approach that embraces all activities (i.e. reductions, afforestation, restoration, conservation, etc.) that increase resilience to threats like climate change and reduce risks. The combined impact of all activities will deliver a higher likelihood of success as well as multiply the level of impact. This should be supported by blended finance that seeks to tackle emissions as well as risks.

What all this can deliver is a higher volume of ER/R with real performance, providing the necessary impact to make a difference in the climate crisis. If companies and donors want a significant volume of ER/R over longer periods of time, there will need to be serious commitment and investment into generating those ER/R that result from actual delivery on the ground. Continuing to focus implementation in "safe areas" will not deliver at the scale needed either to meet company demands or, more importantly, to sufficiently contribute to climate change mitigation.

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27 Cano. J. 2020. Options to allocate the FREL. Draft report. Support to the development of an updated Forest Reference Level and develop options to allocate the FRL at multiple spatial scales for REDD+ implementation in Cambodia.

28 https://news.mongabay.com/2020/12/norway-bumps-rate-to-protect-rainforests-amid-anticipated-u-s-climate-return/