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CONSERVATION

Forest carbon offsets are failing

Analysis reveals emission reductions from forest conservation have been overestimated

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Conserving tropical forests is of utmost importance for the future of humanity and biodiversity. Changes in land use, mostly deforestation in the tropics, emits 5 billion metric tons of carbon dioxide annually; second only to fossil fuel use which emits 35 billion tons *(1)*. Driving both sources of emissions down to net zero is needed to stabilize global temperatures *(2)*. One controversial approach taken to tackle fossil-fuel emissions from private companies, individuals, and governments has been to 'offset' them, by investing in projects to either stop emissions that would have otherwise occurred, such as by reducing deforestation, or by investing in carbon uptake projects, such as forest restoration. On page XXX of this issue, West *et al. (3)* show that the former-- offsetting through paying projects to reduce emissions through avoiding tropical deforestation-- is not reducing deforestation as claimed, and therefore it is worsening climate change.

West *et al.* studied 26 projects spanning six countries across three continents. These projects issued REDD+ (Reducing Emissions from Deforestation and Degradation) credits to the voluntary carbon market. Each credit equates to one metric ton of carbon dioxide that has not been emitted, because of the existence of the project, which conducts activities to lower deforestation in the project area. The credits studied by West *et al.*, were issued under the Verified Carbon Standard, the largest crediting program in the voluntary market for forestry and land-use carbon credits, with an estimated value of USD $1.3 billion.

West *et al.* found that most projects did not substantially reduce deforestation, while the few that did, reduced it much less than had been claimed. Furthermore, for a subset of 18 projects where publicly available information was available, the credits have been used to offset almost three times more carbon dioxide emissions than were avoided by the projects. A further 47 million misleading credits exist and may be sold as 'offsets' in the future.

West et al. use the Synthetic Control Method *(4)* to robustly estimate how much the REDD+ projects reduced deforestation. They compared this to the predictions made using the Verified Carbon Standard methods, that is the basis upon which the number of credits was sold. Measuring deforestation is relatively straightforward using satellite technology, however, calculating the extent to which REDD+ projects have decreased deforestation is more complicated. It relies on estimating an inherently unknowable counterfactual *(5)*: how much deforestation would have occurred in the absence of the project.

For each REDD+ project, West et al. identified a set of potential control areas of a similar size and with similar characteristics as the project area and constructed a 'synthetic control'. This is a weighted average of potential controls, chosen to be as similar as possible in terms of both predictors of deforestation and, crucially, in trends in deforestation before the project started. The projects' outcome is calculated as the difference in deforestation between the 'synthetic' REDD+ project control and the actual REDD+ project, during the years the project was active. As well as calculating the effect of individual projects on deforestation, they also estimate the average treatment effect for all the projects in a country or region and vary how they select potential controls. These extensive robustness checks provide additional confidence in the core result.

Why have the methods used by REDD+ projects failed to produce credible estimates of avoided deforestation? The Verified Carbon Standard provides flexibility in how projects estimate a 'baseline' (usually based on extrapolation of historical deforestation) against which deforestation in REDD+ projects is compared and credits issued. West *et al.,* note that this flexibility, together with a tendency to locate projects in areas with low background deforestation *(6)*, has resulted in a situation where projects tend to predict higher deforestation than in practice would have occurred in the project area. This makes REDD+ projects appear more successful at reducing deforestation than they were.

The implications of West *et al.*'s findings are far reaching. Misleading offsets carry negative consequences for the climate because they are not offsetting the emissions released; for forest conservation, because they are not reducing deforestation as much as claimed; and for the future finance of forest conservation, because the reputational risks of being tainted by accusations of greenwash, (i.e., misleading or deceptive environmental claims) may deter future investments *(7)*. Because of the importance of nature-based solutions to stabilizing the climate, by for example, reducing tropical deforestation *(8)*, the conclusions of West et al. have serious consequences for global temperatures.

Some argue that offsets which use avoided emissions are a flawed approach to tackling the climate crisis *(9)*, because balancing fossil fuel emissions with those from land-use change does not achieve the cuts needed to stabilize the climate system *(10)*. Furthermore, offsetting reinforces global inequalities because high-income individuals and companies continue to pollute, whereas low-income individuals and countries bear the costs associated with reducing emissions.

On the narrower question of the credibility of the voluntary carbon market, the study of West *et al.* shows that major changes are needed in the way credits are calculated. Yet, this alone will not protect tropical forests. Deforestation is primarily driven by demand for land to produce agricultural commodities *(11)*. This demand can be reduced by reducing food waste from farm to fork; increasing yields on existing agricultural lands; and reducing demand for meat and dairy by high-consumers, because animal-produced food uses land inefficiently *(12)*. Companies would also need to be regulated to ensure deforestation-free commodity supply chains *(13)*. Additionally, if the income from agriculture is to be foregone then countries and communities will require income from land that remains forest, which will need to come from both private and public sources. With a concerted effort it should be possible to halt tropical deforestation, and their concomitant carbon emissions. Regardless of future developments in policy, independent tests of carbon accounting methods will be needed to evaluate the efficacy of approaches to forest conservation, as West *et al.* clearly demonstrate.

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