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# What is REDD+ achieving on the ground?

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The Paris Climate Agreement recognizes the importance of the mechanism to Reduce Emissions from Deforestation and forest Degradation, and enhance carbon stocks (REDD+). We reviewed 45 articles from the recent scientific literature to understand the outcomes of REDD+ interventions on the ground, in terms of local participation in REDD+, and its carbon and non-carbon (e.g. tenure, well-being, biodiversity) goals. Our review finds few studies that use a counterfactual scenario to measure REDD+ impacts, and relatively little attention to carbon (versus non-carbon) outcomes. The few studies focused on carbon/land use outcomes show moderately encouraging results, while the more numerous studies on non-carbon outcomes (especially well-being) highlight small or insignificant results. To enhance REDD+ performance, these studies recommend improved engagement with local communities, increased funding to bolster interventions on the ground, and more attention to both carbon and non-carbon outcomes in implementation and evaluation

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## Introduction

The Paris Climate Agreement recognizes forests as a key part of the solution to the climate change challenge. Better land stewardship may provide 37% of the cost-effective climate change mitigation needed to keep

global warming below 2 °C by 2030, with reforestation, avoided deforestation and natural forest management activities contributing to nearly two-thirds of this potential [1<sup>\*\*</sup>]. Given this importance, over 50 countries have initiated national strategies for REDD+ (reducing emissions from deforestation and forest degradation, and enhancing carbon stocks) [2], subnational governments are experimenting with jurisdictional REDD+ programs [3,4], and more than 350 localized REDD+ projects were being implemented across the tropics as of early 2018 [5].

REDD+ has evolved remarkably since it was introduced at the UNFCCC Conference of Parties in Bali in 2007. Most importantly, REDD+ was to play an integral role in a global cap-and-trade carbon market, which never materialized adequately, creating serious funding constraints [6]. Instead, funding for REDD+ at national and subnational levels has come through multilateral and bilateral donors in a form of results-based aid [7]. While most REDD+ projects intended to sell credits to the voluntary carbon market, only one-third had done so as of early 2018 [5]. Most projects are largely outgrowths of integrated conservation and development projects (ICDPs), with relatively few applying locally the conditional incentives that were originally considered the core innovation of REDD+ [8]. Implementers of these initiatives are instead applying intervention packages that in customized ways combine enabling measures, disincentives and incentives with the aim of achieving better protection of forests [9<sup>\*</sup>].

The aim of this review is to document the early outcomes of REDD+ interventions on the ground, in terms of local participation in REDD+ and its carbon and non-carbon goals, and to identify recommendations for enhanced performance.

## Methods

To document REDD+ interventions being implemented and evaluated, we scrutinized English-language peer-reviewed articles published in the 2015–2017 period. This period was chosen to abide by the manuscript guidelines of *Current Opinion in Environmental Sustainability*, which request that reviews focus on recent articles (with emphasis on those published in the previous two years), while also increasing our chances of capturing more meaningful outcome measures given the relatively short lifespan of REDD+. We identified articles that included *ex post* assessment of interventions with the main stated objective of reducing emissions from

deforestation and forest degradation, improving forest conservation or management, or enhancing forest carbon sequestration. These interventions were explicitly labeled as REDD, REDD+, forest carbon, or afforestation/reforestation, including in the Clean Development Mechanism. Additional criteria for studies included in the review were: clear aims; clear and repeatable methods; outcomes measured accurately and reliably; consistency among methods applied, empirical data, and findings; and a focus on non-Annex I countries.

In September 2017, we applied the following search string in Web of Science: (REDD OR REDD+ OR 'compensated reduction' OR (forest\$ AND 'climate change mitigation') OR 'afforestation reforestation' OR (forest\$ AND carbon AND payment) OR (forest\$ AND 'clean development mechanism') OR 'carbon forestry'). The search generated 3202 articles for all years, and 1078 for 2015–2017. Screening the 2015–2017 titles according to the above criteria, we excluded articles focused solely on international/national policy and finance, technical monitoring methods and biomass estimates with no clear link to interventions, *ex-ante* simulation or experimental approaches, readiness activities, impacts of deforestation on carbon emissions or biodiversity, and those located in Annex 1 countries. Of the 1078 more recent titles, 331 were selected for abstract screening, 110 articles for full paper review, and 45 articles ultimately met the inclusion criteria described above.

Although these inclusion criteria thus did not accommodate some notable *ex-post* REDD + impact evaluation studies published in the grey literature, in non-English languages, and/or prior to 2015 (e.g. [10]), our review provides a snapshot of recent peer-reviewed literature assessing early REDD + outcomes on the ground.

During full paper review, we compiled data on interventions, outcomes and recommendations included in each study. We classified the REDD + interventions described in the studies as information (e.g. environmental education), institutions (e.g. tenure clarification), or incentives (e.g. payments for environmental services). We documented indicators and methods used to measure outcomes, along with the main findings. Following Burivalova [11], we classified the methodological approach of each study as: 1) case report (i.e. assessing intervention outcomes without comparators) with qualitative or quantitative evidence based on trends but without inference or causality assessments; 2) case-control comparison (i.e. using a control area or comparison of before-after outcomes) without considering confounding variables; 3) case-control comparison with some confounders considered; 4) case-control comparison with rigorous selection of controls through pre-matching; 5) randomized control trial (RCT), or random assignment of treatment and control categories to eliminate selection bias; 6) meta-analysis or

systematic review (i.e. summary of quantitative and/or qualitative findings from multiple studies).

## Results and discussion

### General characteristics

Of the 45 peer-reviewed articles included for analysis, 29 focused on assessment of only one REDD + initiative, six compared 2–5 initiatives, one compared 6–14 initiatives, and nine focused on 15 or more initiatives through primary research, or reviews of project documents or the scientific literature. While we were open to including studies that documented on-the-ground impacts of national-level REDD+ activities, all 45 selected studies focused on outcomes of subnational REDD+ projects or programs. We eliminated several studies on national readiness activities that were not yet implemented locally and, therefore, did not meet the *ex post* inclusion criterion. The countries with most studies were Indonesia (5), Tanzania (5), Kenya (4), Nepal (4), and Mexico (3). Initiatives from these countries were also included in several of the larger global comparative analyses. Notably, the geographical focus of these research articles does not mirror well the country distribution of global REDD+ projects being implemented as of early 2018, with Brazil having the most (48), followed by Colombia (33), Peru (26), Indonesia (21) and Kenya (21) [5].

Most articles focused on conservation initiatives to reduce emissions from deforestation and forest degradation (REDD), while only five focused exclusively on afforestation, reforestation, or revegetation (ARR) initiatives. The focus on REDD projects in the literature is interesting, since REDD and ARR projects are almost equally represented among the full set of REDD+ projects being implemented globally [5].

All articles included smallholders and communities among the primary actors targeted by the initiatives. This is not surprising, since REDD+ projects commonly focus on small-scale agents of deforestation even though the drivers of deforestation often operate at larger scales [12]. Smallholders are often perceived as having lower opportunity costs associated with deforestation [13], though REDD+ implementers may also see them as allies against cattle ranchers, loggers or oil palm companies that threaten to expand their actions into project areas. The bundles of REDD+ interventions described in the literature were highly diverse. In the articles, interventions classified as information consisted primarily of REDD+ awareness-raising and capacity-building activities for local communities, including trainings in sustainable land-use practices. Interventions focused on institutions fell into three categories: restricting forest access/deforestation by regulation, land tenure clarification, and strengthening/creating local governance institutions. Incentives included cash or in-kind payments conditioned on pre-determined sustainable land-use behaviors

and non-conditional livelihood enhancements. In studies where conditional payments were applied, benefits either went directly to households, to community development projects (e.g. school, wells, educational funds), or both. Only two studies [9,14] examined the effects of different types of interventions being applied at the same sites.

Notably, only 12 studies examined the supposed main goal of REDD+ — changes in forest carbon/land use outcomes — while 26 assessed non-carbon outcomes. The focus on non-carbon (especially well-being and tenure) outcomes may reflect ample international attention given to social safeguards in REDD+ [15]. Eight of these studies included some measure of both carbon/land use and non-carbon outcomes. Local participation was addressed in more than half of the articles (23), with 13 focusing exclusively on participation. The vast majority of articles were case reports based on qualitative evidence, especially those that addressed non-carbon and participation outcomes. One article was a randomized control trial (RCT) [16] and four used a quasi-experimental (before-after/control-intervention — BACI) approach [9,14,17,18] (Figure 1). Although RCT and BACI approaches conveniently allow for attribution of observed outcomes to a given intervention through the use of a counterfactual, they should preferably be used as part of broader story-telling efforts that leverage different sources and contradictory evidence (see [19]), especially when dealing with interventions as heterogeneous as REDD+.

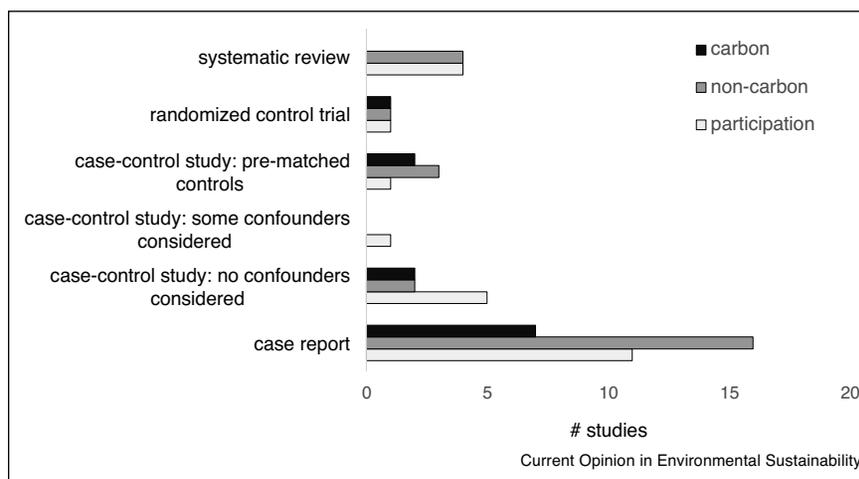
**Participation**

Of the 23 studies that focused on participation in REDD+, most (14) focused on Free Prior Informed Consent (FPIC) and local engagement in project activities. Nine of these were case reports, three were systematic reviews,

and two were case-control comparative studies. Two of the reviews highlighted limited information sharing with local communities [20,21] with two case reports from Guyana and Indonesia supporting these findings [22,23]. Two case reports from Tanzania found that despite the prevalence of information-focused interventions, awareness was uneven, with women and poorer villagers less informed about project activities [24,25]. A global case-control comparison study with pre-matched controls, along with the third review paper, highlighted limited participation in REDD+ project decision-making [9,26]. Yet, interestingly, a case report from Kenya showed how a REDD+ project involved local communities in decision making more effectively than ICDPs in the area [27]. Two case reports from Indonesia and Brazil focused on the social learning and trust that were built through local engagement in REDD+ activities [28,29], and another case report from Kenya and case-control comparison study (without considering confounders) from Nepal showed that women’s participation in village decision-making was enhanced by REDD+ [30,31].

Six articles — one RCT in Uganda, four case-comparison studies with controls (not pre-matched) in Mozambique, Cameroon, Mexico and Nepal, and one case report in Madagascar — scrutinized which household characteristics determined REDD+ participation. Low project participation (32%) in Uganda was mostly due to lack of information, complex enrollment logistics, and fears of land grabbing [16]. Similarly, low participation in an ARR project in Mozambique (30%) was related to high charcoal extraction, as well as low trust, education, and cash income levels [32]. In Cameroon, participation was enhanced by positive local perceptions of a new protected area associated with the REDD+ project [33]. In an ARR project in Mexico, participation was positively influenced

Figure 1



Classification of study components assessing carbon and non-carbon outcomes, and local participation in REDD+.

by formal land ownership, labor availability, and returns from agroforestry, along with an intrinsic desire for engaging in collaborative work groups [34]. This finding was echoed in a study from Nepal where participation was based on higher education levels, and larger agricultural land holdings and family sizes, but not on payments [35]. In Madagascar, household selection for compensation increased with household membership and decision-making power in community forest user groups, along with greater food security and easier accessibility [36].

Finally, three articles focused on the social and technical outcomes of participatory monitoring and mapping. A review of participatory monitoring highlighted its importance in enabling greater local participation in REDD+, but noted that community participation was often limited to data gathering [37]. A case report from Mexico stressed the inequalities between technicians and community members in participatory mapping that can affect its effectiveness [38]. A case report from Tanzania highlighted better performance (in terms of accuracy, costs, local equity and local legitimacy) of carbon monitoring methods that leveraged higher-resolution data and involved local people in the process [39].

Recommendations for increasing participation in REDD+ projects included improving implementers' outreach [16<sup>••</sup>,24], mapping locations of potential beneficiaries [36], and cultivating trust throughout the process [32]. Others stressed the importance of giving community members opportunities for meaningful engagement [33], engaging with institutions that local communities see as fair [27], and allowing for incremental engagement over time [40].

### Carbon/land use outcomes

Of the 12 studies that addressed changes in forest carbon/land use outcomes, two used remotely sensed data [16<sup>••</sup>,17<sup>••</sup>], while two others included plot-based on-the-ground biomass estimates [41,42]. Four used household-level survey data to assess changes in self-reported forest clearing [9<sup>•</sup>,43], perceptions of assets that affect forest protection [44], and local use of fallow lands [45]. Four based their studies on reviews of project documents (including third party certification assessments) and interviews with key stakeholders to assess achievement of mitigation outcomes [31,46,47<sup>•</sup>,48].

The studies based on remotely sensed and biomass measurements highlighted relatively positive impacts of REDD+ interventions on carbon/land-use. The only RCT study in the review showed that trial payments to villagers for forest conservation and tree planting in Uganda led to considerably less net tree loss in the treatment group (relative to the control) over a two-year

period, with highest program effects for those who would have deforested most. Self-reported tree cutting also declined among treated households, while local land monitoring was strengthened [16<sup>••</sup>]. A quasi-experimental study of 23 REDD+ projects and programs in six countries found small early impacts of these initiatives in reducing tree-cover loss, though somewhat stronger at the disaggregated village level [17<sup>••</sup>]. Biomass measurements at a REDD+ site in Nepal, through a case report, showed average carbon stocks increasing by 5.1 MgC/ha/yr, likely because improved cooking stoves curbed fuelwood consumption [41]. Another case report in India showed that biomass increased in areas of active reforestation, with the REDD+ project reducing the average area of forest fire [42].

The studies based on household-level data reported both positive and negative outcomes. In a quasi-experimental study of 130 villages and 4000 households in six countries at two points in time, disincentives (i.e. regulatory restrictions on forest clearing) were more effective than other types of interventions in reducing reported forest clearing over time [9<sup>•</sup>]. At one of the Indonesian sites included in this global study, there was also case report evidence of decreased forest clearing in REDD+ villages [43]. A case report from a REDD+ site in Kenya showed that limited access to water and land among poorer households raised pressure on protected forests [44]. In Costa Rica, a case-control comparison (without attention to confounders) highlighted the steady conversion of fallow lands to plantain cropping by farmers who were not bound by the project rules, with participating farmers reporting that they would not re-sign the contract to not forgo future farming opportunities [45].

Of the four studies based on interviews with key stakeholders and secondary data, three case reports highlighted that — despite mixed outcomes — carbon effectiveness of REDD+ projects was limited by not adequately addressing drivers of degradation [46,47<sup>•</sup>,48] or mitigation dimensions more broadly than simply carbon losses in forests [47<sup>•</sup>]. A fourth case-control comparison from Nepal noted that an increase in carbon stocks in REDD+ communities was not due to the payments, but rather to REDD+ bolstering ongoing community forest management activities [31].

Recommendations for enhancing carbon performance included broadening the currently heavy focus on smallholders to other agents of deforestation [17<sup>••</sup>,43], along with leveraging more funding for REDD+ to increase an often light treatment intensity on the ground [17<sup>••</sup>,26]. There was also strong emphasis in several studies on the importance of a pro-poor approach to REDD+ to enhance carbon effectiveness and to promote equity and social co-benefits [41,44,47<sup>•</sup>].

### Non-carbon outcomes

The 26 articles that included an assessment of non-carbon outcomes of REDD+ focused on well-being, tenure/rights, biodiversity and adaptation, with several addressing more than one aspect. Studies that assessed well-being outcomes were the most common (19 studies) with specific attention to impacts on: income or livelihoods (10); perceived projects benefits/costs (5); perceived well-being change (2); distributive equity (1); and social capital (1). Eleven studies included tenure/rights outcomes through analyzing changes in customary land use/access rights (5), tenure security (3), or incidence of conflict (2), along with one that examined procedural equity. Only two studies examined biodiversity: one through a review of 80 REDD+ projects and their self-reported impacts on biodiversity, and the other through a quasi-experimental approach that examined REDD+ project impacts on tree cover loss as a proxy. Two others focused on adaptation: one on social, ecological and agricultural adaptation, and the other on climate variability.

The overall research focus on well-being and tenure outcomes may be due to early concerns that REDD+ posed a risk to local rights and welfare. A quasi-experimental study at 22 REDD+ sites in six countries found that REDD+ had minimal impact on perceptions of well-being or income sufficiency [14]. At a subset of 17 of these sites, where both village-level and household-level data were collected, intervention types seemingly affected outcomes: forest restrictions negatively affected households' perceived tenure security and well-being; while mixed restriction-incentive packages cushioned that negative well-being effect [9<sup>\*</sup>]. Another quasi-experimental study from Indonesia used publicly available secondary data on tenure and well-being indicators in 2242 villages at 18 REDD+ project sites [18<sup>\*</sup>]. The authors found relatively positive outcomes for tenure, but potentially negative effects on welfare. In the RCT study in Uganda, there were positive carbon outcomes, but welfare impacts were insignificant vis-à-vis control households [16<sup>\*\*</sup>]. The study from Kenya used a case-control approach to assess non-carbon outcomes, highlighting how REDD+ positively impacted livelihoods assets (at village and household levels), yet REDD+ recipients still perceived the costs of forest restrictions to outweigh benefits [44].

One review called attention to negative effects on local livelihoods due to REDD+ [20]. Examples of such effects were highlighted in case reports from Nigeria and Vietnam where restrictions on forest access and clearing reportedly compromised livelihoods [46,49], and from Indonesia and Tanzania where land use practices being promoted were not financially sustainable for local communities [50,51]. Two case reports from Nepal and Tanzania showed some positive benefits for local people [52,53], yet another emphasized how Tanzanian REDD+ projects did not succeed in creating long-term alternative livelihood opportunities [48]. Finally, two reviews and multiple case reports emphasized

that land tenure is still considered a major challenge for REDD+. The lack of tenure clarity at REDD+ project sites [21,26] is a legacy of historical tenure arrangements that result in inequitable benefit distribution [54], challenges in documenting customary land rights [25,55], resource conflicts that can arise when local people aren't involved in REDD+ decision making [56], and the fact that tenure security may not promote REDD+ goals [57].

REDD+ may provide an opportunity to conserve biodiversity, but studies on biodiversity outcomes are scarce. Panfil and Harvey [58<sup>\*</sup>] highlight how REDD+ projects' self-reported impacts on biodiversity are limited to indirect measures. For instance, nine ARR projects in this review reported numbers of native trees established, while six REDD projects reported greater forest area conserved and two reported that communities were trained in conservation; all claiming benefits for biodiversity. On the other hand, Jagger and Rana [18<sup>\*</sup>] found that REDD+ projects were positively correlated with tree cover loss in Indonesia, and by relationship may have had a neutral or negative effect on biodiversity.

Recommendations for enhancing the social performance of REDD+ include recognizing community rights [21], promoting equity through making small cash transfers to poor, non-forest-owning individuals in the community [16<sup>\*\*</sup>], better combining mitigation and adaptation goals [47<sup>\*</sup>,49], and including REDD+-relevant questions in ongoing national socioeconomic surveys to monitor the social impacts of REDD+ [18<sup>\*</sup>]. Recommendations for improving biodiversity outcomes focus on matching interventions to biodiversity threats and goals (i.e. species/ecosystems to be conserved and time-bound targets), and monitoring for adaptive management [58<sup>\*</sup>].

### Conclusion

REDD+ on the ground is a customized basket of integrated interventions, including information, institutions and incentives. Unsurprisingly, its effects are thus highly diverse. Heterogeneous treatments pose a challenge to any rigorous impact evaluation, because it is hard to account for all treatment components, while also controlling for all major confounders. Many measured impacts are small and/or statistically insignificant, reflecting also the pilot stage of REDD+ and low financing flows, with correspondingly low treatment intensities.

There is far too little carbon outcome measurement to understand REDD+ effectiveness; yet what little there is so far paints a moderately encouraging picture, especially at the local level of focused interventions (e.g. [16<sup>\*\*</sup>,17<sup>\*\*</sup>]). Measurements of well-being outcomes, though more numerous than those of carbon outcomes, do not yet yield an adequate evaluation of REDD+ performance. Welfare effects appear to be small, with mixed sign — but more likely to be positive when incentive components are

included. In general, findings highlight the need to boost local participation in REDD+ to achieve both carbon and non-carbon benefits. There are not enough studies focused on biodiversity outcomes to draw any firm conclusions. Though REDD+ has clearly been in trouble in recent years, it has served as an important testing ground for multiple approaches to addressing the problem of deforestation and forest degradation [59].

The conclusion is inescapable that recent research has not yet measured up to the importance of REDD+ in terms of scope, depth, and analytic sophistication. While research on related governance instruments is useful, there is notably a lack of studies that use a counterfactual scenario to assure attribution of outcomes to REDD+, and the research foci neither geographically nor topically mirror well REDD+ implementation on the ground. Some studies are arguably ‘hitching a ride on REDD+’ – that is, are profoundly featuring other questions than REDD+ impacts, but are using the term REDD+ as a timely hook of wider current societal interest for publishing their results. While research should not follow a pre-set agenda, certain biases may limit our ability to show a consolidated picture of REDD+, including through reducing the external validity of, for example, meta-analyses/systematic reviews. As forest-rich countries refine their climate action plans post 2020, there is an urgent need for more reliable evidence on the impacts of REDD+ to date to guide their choices.

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