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Gender lessons for climate initiatives: A comparative study of REDD+ impacts on subjective wellbeing

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ABSTRACT

Although REDD+ is primarily a mechanism for reducing carbon emissions from forests, concerns regarding social benefits, wellbeing and gender are increasingly part of its mandate. This is consistent with the Paris Declaration as well as SDG 5 on gender equality and women's empowerment. Critics have argued, however, that REDD+ design, both in policy and projects, does not take gender into account effectively, rather marginalizing women from decision making processes and exacerbating inequalities. Most of that research has been site specific or on single countries. This article uses data from a longitudinal study of subnational REDD+ initiatives in six countries to analyze their gendered impact on perceived wellbeing. Comparative research on subjective wellbeing was conducted at 62 villages participating in 16 REDD+ initiatives and 61 control villages at two periods in time, using a before-after-control-intervention (BACI) design. Focus groups with villagers (68% male) and women (100% female) permit a gendered comparison of definitions of wellbeing and outcomes of initiatives. The results highlight that while definitions of wellbeing overlapped between the two groups, almost half of the women's focus groups thought that having their own source of income was important. Outcomes regarding wellbeing change suggest that perceived wellbeing decreased in REDD+ villages both for villagers as a whole and for women, relative to control villages, but the decrease was much worse for women – a decrease that is significantly associated with living in a REDD+ village. These declines may be due to unrealized expectations for REDD+, combined with little attention to gender in REDD+ initiatives, in spite of an important portion (46%) of specific interventions that women view positively. These interventions provide insights into potential ways forward. Overall, however, REDD+ initiatives appear to be repeating past mistakes, with insufficient attention to gender equality and safeguarding women's rights. More effort needs to be paid to ensuring that gender is an integral part of future initiatives to combat climate change in rural communities.

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1. Introduction

Reducing Emissions from Deforestation and Degradation (REDD+) is one approach for implementing the Paris Agreement to mitigate climate change through the land use sector. Like the various solutions for addressing global problems, there is much to learn from the experience of first generation REDD+ initiatives that is relevant for future implementation of REDD+, as well as of other community-level mitigation initiatives that follow, at national and subnational levels. This is particularly true because of the resemblance of early REDD+ initiatives to prior conservation approaches (Angelsen et al., 2017), and the hope that such policies and programs can at least avoid similar errors and, ideally, break new ground.

Although the primary goal of REDD+ is to maintain and enhance forest carbon stocks, much of the framework surrounding REDD+ not only promotes but also requires attention to community

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wellbeing. For example, UNFCCC Cancun safeguard (e) refers to social benefits, and under the Warsaw Framework, countries will be required to have a national social and environmental safeguard information system in place, and regularly report on impacts, to be eligible for results-based payments (UNFCCC, 2014; Duchelle et al., 2017).

Women's wellbeing, in particular, has been emphasized in recent climate agreements, through the emphasis on a gender-responsive climate policy, including in the Paris accord (UNFCCC, 2016a)[1], and the 2016 Decision 21/CP.22 on Gender and Climate Change (UNFCCC, 2016b). In addition, goal 5 of the Sustainable Development Goals is to "achieve gender equity and empower all women and girls" (United Nations, 2015). These broad commitments remind us that gender should be an integral part of any global initiative.

Current research on gender and REDD+, mostly from case studies, demonstrates a failure to address gender in REDD+ policy and/or a negative impact of REDD+ on gender equity. Through comparative research across 16 initiatives in 6 countries, this article contributes to and goes beyond that research, examining whether these findings present a wider phenomenon. It analyzes the gendered impact of REDD+ initiatives on perceived wellbeing and uses detailed data on wellbeing and specific interventions to analyze shortcomings and propose alternatives. The findings presented here are based on the Center for International Forestry Research (CIFOR) Global Comparative Study on REDD+ (GCS REDD+; http://www.cifor.org/gcs/). The research used a before-after-control-intervention research design, which permits clearer attribution of results to REDD+ (Sills et al., 2017). It is based primarily on the analysis of wellbeing change over time, comparing "village" focus groups (FG), which were 68% male, with women's focus groups (100% female) in 62 REDD+ intervention villages and 61 "control" villages (outside of REDD+ sites), at two different moments in time (2010/11 and 2013/14). Wellbeing, for the purpose of this article, is measured by self-perceptions, and is based on definitions of wellbeing developed at the time by the focus group participants themselves.

Analysis of definitions of subjective wellbeing in the study villages, such as good health, education and sufficient food to eat, suggest important overlap between the two types of focus groups, but there are also a few important differences, such as the importance of women's empowerment and income to the women's focus groups, and also "unity" and "harmony".

The most striking results, however, emerge from the assessment of changes in wellbeing over time. We find, in REDD+ sites, that although there are some positive wellbeing changes, on average both types of focus groups see people as worse off in the period after initiative implementation. In contrast, the perception in control sites was of no net change or of improvement in wellbeing over the same period. Also, a larger number of women's FGs see women overall as worse off in comparison to the village FGs' perception of wellbeing. A regression model based on information from the focus groups and village averages finds that living in a REDD+ intervention village is significantly associated with the decline in women's perception of wellbeing.

With regard to the specific forest-related interventions implemented in REDD+ villages, women perceived almost half to have no effect on their wellbeing; nevertheless a similar portion was seen to have overall positive effects. Although this may appear contradictory, a single project intervention is only one of many things affecting overall wellbeing, and only one specific activity undertaken under the umbrella of a broader initiative. The results suggest that current attention to gender in REDD+ initiatives is insufficient for addressing gender equality and safeguarding women's rights, but greater attention to wellbeing perceptions and the positive experiences of specific interventions may suggest a path forward.

2. Gender responsiveness and climate policy

Since 2007, when REDD was adopted in the Bali Action Plan, increasing attention has been given to gender in climate policy, related negotiations and other important global commitments. By 2015, the COP21 Paris agreement included the statement that "Parties should when taking action to address climate change, respect, promote and consider their respective obligations on ... gender equality [and] empowerment of women..." The specific emphasis of this policy was on participation in UNFCCC processes and "increasing awareness and support for the development and effective implementation of gender-responsive climate policy at the regional, national and local levels" (UNFCCC, 2016a).

The UNFCCC Women and Gender Constituency has built a strong coalition to support women's rights.[2] The Lima work programme on gender, established at COP20, was extended for three years at COP22 in Marrakech, and called for strengthening "gender-responsive climate policy" in all climate-related decisions, activities and implementation (UNFCCC, 2016b).

Gender responsiveness goes beyond being gender sensitive, or the "do no harm" principle, emphasizing instead the importance of overcoming historical biases (Aguilar, 2016: xxviii). With regard to climate and forests, gender-responsive activities should promote gender equality, women's empowerment, inclusion and equal opportunities for men and women to obtain benefits (Aguilar, 2016).[3] Similarly, Kabeer (2010: 108) explains that "gender-transformative" interventions "ensure that women capture meaningful benefits and are empowered by the intervention process," going beyond those that are "gender-blind" or only "gender-aware."

Arguably, as a global initiative aimed at climate mitigation in the 21st century, REDD+ should be contributing to the transformational change advocated by the Sustainable Development Goals (called "Transforming Our World") and affirmed by the Paris agreement. Yet implementers of early REDD+ projects and programs appear to have repeated the mistakes of prior conservation and development initiatives that sideline gender. There are not many gender analyses of national REDD+ readiness activities and subnational REDD+ initiatives to date, but so far the results are not heartening. The existing literature can be divided into two sets, those that focus more on national REDD+ policy processes and those that focus more on the impact of REDD+ initiatives on gender equality, although these sometimes overlap (for example, women's participation is relevant to both).

The policy studies have found little participation of women in meaningful ways and little understanding or capacity to develop gender strategies. In a study of national REDD+ policy in three countries in the Congo Basin (Cameroon, Democratic Republic of Congo and Central African Republic), Peach Brown (2011) found that women had little participation in discussions on climate change or REDD+, including in the development of early policy documents. Nevertheless, in the DRC's Readiness Plan, there was assurance that gender dimensions would be addressed in future decisions related to community forest management and benefit distribution.

Pham, Mai, Moeliono, and Brockhaus (2016) studied the factors that influence women's participation in national decision making

[1] See also http://unfccc.int/gender_and_climate_change/items/9619.php.

[2] See http://womengenderclimate.org/.

[3] See also http://genderandenvironment.org/2015/08/stop-being-so-sensitive-the-shift-from-gender-sensitive-to-gender-responsive-action/.

processes on REDD+ in Vietnam. They found that large numbers of women participated in national-level REDD+ meetings, yet they were rarely in leadership positions or involved in REDD+ working groups. The authors argued that there was little capacity to implement gender strategies or even concern for gender issues among the national organizations working on REDD+. In Burkina Faso, Westholm and Arora-Jonsson (2015) found that the national REDD+ policy process appeared to perpetuate gendered divisions of labor, noted in the contrast between higher level, formal decision making and the responsibility and the burden on the ground of related labor.

In their study of both national REDD+ policy and pilot project implementation in Nepal, Khadka, Karki, Karky, Kotru, and Darjee (2014) found that explicit inclusion of women in REDD+ national program discussions was insufficient for addressing underlying power dynamics and, hence, gender imbalances; and government and project implementers had neither responsibilities nor strategies for applying gender equitable initiatives.

The literature examining gendered impacts of REDD+ initiatives found, again, little women's participation, as well as the predominance of stereotypes. In two projects studied in the DRC, Stiem and Krause (2016) found REDD+ impacts on gender had not been sufficiently addressed, despite high levels of rural gender inequality in the country. They found that women spend as much time in the forests as men but that men's activities are much more highly valued. "This systematic devaluation of women's work, and their knowledge about the forest, legitimizes men's dominance in forest governance" (Stiem & Krause, 2016).

In the implementation of the national program in Burkina Faso, women were targeted in projects aimed at forest conservation through the promotion of trade in non-timber forest products based on essentialist assumptions about how men and women use the forest (Westholm, 2016). In Kenya, a comparative analysis of three conservation schemes found that the REDD+ project fared better than two Payments for Environmental Services (PES) projects: the REDD+ scheme used gender targeting and mainstreamed "minimum standards" (p.444), although none of the three had an "explicit gender project" (p.437), and all failed to address underlying inequalities (Kariuki & Birner, 2016).

In a comparative study of 20 early subnational REDD+ projects and programs (including the same initiatives studied three years later in this article), Larson et al. (2015) found that women were much less informed and knowledgeable about REDD+ and the initiatives starting up in their villages than the men in the same villages. For example, only 41% of women's focus groups demonstrated a basic understanding of REDD+ compared to 67% of village (male-dominated) groups. This was true even in villages where women believed they had a strong voice in village decisions, when they used forest resources as much or more than men, and when the initiatives had explicitly stated that fair benefits to women was an equity goal.

By the time of a second round of research on these early REDD+ initiatives three years later, implementers appeared to have rectified some aspects of women's participation. For example, focus groups with women (91%) were now found to be equally aware of the REDD+ initiatives in their villages as male-dominated focus groups (92%); however, there was still a 24% gap between the groups in participation in design and implementation (Larson et al., forthcoming).

It is disappointing yet not particularly surprising to find that most of the schemes discussed above have failed to address gender adequately. For example, a review of 200 references of PES projects found that "less than 5% dealt with gender-related aspects or impacts of PES" (Ravnborg, Damsgaard, & Raben, 2017:17). As summarized by IUCN (2012) "Despite the introduction of tools for gender and forestry analysis in the 1990s, it is rare today to find evidence of clear strategies linking gender and forest management for decision makers. . .. [T]here is generally an institutional 'gender blindness' that renders women's participation and contributions invisible and allows forest management to be incorrectly treated as 'gender neutral.'" The authors conclude that "gender equality and women's empowerment must be at the heart of REDD+ policy design and implementation."

Nevertheless, in many REDD+ initiatives, Westholm (2016) argues that approaches to gender are "simplistic"; Bee and Basnett (2016) argue that gender considerations in REDD+ safeguards are narrowly interpreted as a "bureaucratic obligation." Women's empowerment cannot be a technocratic exercise, as genuine empowerment involves changing power relations; participation requires not only opportunities but also assets (Esquivel, 2016; Chant & Sweetman, 2012). As argued by Meinzen-Dick et al. (2011), gender-responsive development should ensure control over assets that can be used "to improve livelihoods, well-being, and bargaining power within . . . households and communities." These ideas present a challenge to present and future climate initiatives in forest communities.

3. Data and methods

As a part of GCS REDD+, data was collected during focus group (FG) interviews in 87 villages participating in 22 subnational REDD + initiatives in Brazil, Cameroon, Indonesia, Peru, Tanzania and Vietnam, at two periods of time: before REDD+ implementation (Phase 1, 2010–11) and after implementation began (Phase 2, 2013–14). We call these "intervention villages". Likewise, data was collected in 63 control villages (outside REDD+ sites) for comparison purposes, selected through matching, for a total of 150 villages. The matching process used comparison factors representing (1) deforestation pressures, (2) experience with forest conservation NGOs, (3) forest tenure, (4) village institutions, (5) population, (6) forest cover, (7) forest dependence, and (8) distance to main road (see also Sills et al., 2017). Households in study villages were randomly sampled for interviews with a total of 3920 households interviewed (2118 in intervention villages and 1842 in control villages) in Phase 2. The sites studied here are not intended to be representative of the countries in which they are located; rather, the original sample of 22 initiatives has been demonstrated to be reasonably representative of REDD+ initiatives across the tropics (see Sunderlin et al., 2016 for details).

For the analysis in this article, we eliminated 25 intervention villages from the total dataset. These included 7 initiatives that had intervention but not control villages, thus eliminating the potential bias for before-after-control-intervention (BACI), or "difference in difference," analysis, that could result from having a larger intervention group (Sills et al., 2017). Likewise, we dropped two control villages from the analysis because they did not have data from both Phase 1 and Phase 2. Therefore, this paper concentrates the analysis on 62 intervention and 61 control villages that are part of the "intensive" GCS REDD+ research sites and included the complete set of data (Sunderlin et al., 2016). Table 1 summarizes the number of villages sampled by country. A map of the REDD+ initiatives involved in this article is presented in Appendix 1.

3.1. Study context: the (gendered) importance of forests across sites

Forests are not often among the main occupations of villagers, but multiple forest products are used across the study villages (see also Larson et al., 2015, Sills et al., 2014). This outcome may mask the importance of forests for women, who heavily use forests products but do not often consider harvesting them as a primary

Table 1
Number of REDD+ initiatives and villages sampled, by country.

Country	Initiatives	Control	Intervention	Total
Brazil	4	16	16	32
Peru	2	8	8	16
Cameroon	2	7	6	13
Tanzania	2	6	7	13
Indonesia	5	20	21	41
Vietnam	1	4	4	8
Total	16	61	62	123

source of livelihood. For example, in over half the villages (53%, 55% of which are intervention villages and 45% control), less than 10% of households had at least one adult (16 or older) household member who count forest-related activities as his or her primary or secondary occupation; and in only 11% of villages do more than half of households do so (half intervention, half control). These figures are much lower if we focus only on occupations of adult female household members: in most (90%) of villages, forest activities were in the top two occupations for a female in less than 10% of all households (and for 82% of these, the response was zero); it was in the top two occupations for a woman in more than half of households in only 2% of the villages (70% intervention, 30% control). In contrast, a broader picture shows that forests are important for fuel and food security. For example, "about half" to "many to all" women harvest firewood in 50% of villages, fruit in 37%, fish in 29%, vegetables in 28%, medicinal plants in 20%, and so on. See Figs. 1 and 2 for the frequency of mentions of different types of forest use by women and men by country.

3.2. Wellbeing data: definitions, wellbeing status and movement between phases

In terms of wellbeing, the first question we examine is how wellbeing is defined locally, followed by the second, asking how wellbeing changed in the two years prior to the interviews. We focus on two sets of data comparing responses from mixed-gender village FGs (on average, 72% male in Phase 1 and 68% in Phase 2) and women's FGs (100% female), exploring definitions of wellbeing and changes in wellbeing from Phase 1 to Phase 2.

For definitions of wellbeing, the FGs were asked an open–ended question to define the characteristics of wellbeing. The specific question in Phase 2 for the women's FG was: In this village, what are the characteristics of a woman who has high wellbeing? The specific question in Phase 2 for the mixed-gender FG was: In this village, what are the characteristics of a household with high wellbeing?[4] On average, each group provided five to six answers to these questions, which were coded into 133 distinct responses post-fieldwork.

To measure wellbeing status over time, in both Phase 1 and Phase 2, each focus group was asked to evaluate its perception of wellbeing as compared to two years prior to the survey. The specific question for the women's FGs was: In comparison to two years ago, what proportion of women in the village have experienced overall improvement in their wellbeing, what proportion are the same, and what proportion are worse off? The specific question for the village FGs was: In comparison to two years ago, what proportion of households in the village have experienced overall improvement in their wellbeing, what proportion are the same, and what proportion are overall worse off? We therefore define a change of wellbeing status as a shift in the proportions reported between Phase 1 and Phase 2.

The proportions were pre-coded in the following ranges: 0–20% (none or very few), 21–40% (some), 41–60% (about half), 61–80% (many) and 81–100% (very many to all). It was expected that the sum of these categories would be approximately 100% to allow comparison across the focus groups and over time.[5] In this paper, we concentrate our analysis only on the improvement category because we wanted to know how the REDD+ initiative had improved women's wellbeing relative to village wellbeing as a whole. Graph 1 summarizes the improvement category answers for intervention and control villages for the women's focus group for phase 1. The largest number of villages falls in the proportion 81–100% and the second, largest, 0–20%.

In phase 2, villages concentrate in the 0–20% proportion, followed by 61–80% (see Graph 2). These graphs show changes in the distribution of women's perceived wellbeing improvement between the two phases, but we need to know which villages moved up (increase proportion), moved down (reduce proportion), or stayed the same (no movement).

We constructed a transition matrix (see Fig. 3) to track the proportion of women (women's FGs), or of villagers (village FG), in each improvement category between the two research phases for each village. This method allows us to identify which villages experienced positive, negative or no wellbeing movement. Villages experiencing a positive movement in perceived wellbeing are those reporting that a higher proportion (of women or households) were better off in Phase 2 than in Phase 1 (light gray area in Fig. 3). Conversely, villages experiencing negative movement are those with a lower proportion better off in Phase 2 compared to Phase 1 (dark grey area in Fig. 3). Villages experiencing no movement are those with the same proportion in the two phases (white area in Fig. 3).

Thus each village can be categorized according to the change in perceived wellbeing status between Phase 1 and Phase 2. We used this data to compare control and intervention villages and women's and village FGs. (A detailed description of the construction of the transition matrix is presented in Appendix 2). It is important to note that because the emphasis is on the average *change between phases*, wellbeing may still be perceived as improving in Phase 2 but represent a decline relative to Phase 1.

3.3. Reasons for wellbeing change

The third question we asked is what factors are driving changes in subjective wellbeing. The first way in which we address this is through analysis of the responses to a direct question to the focus groups. After asking for the proportions of households whose wellbeing had improved, the respondents were asked to provide the three main reasons for improvement; in REDD+ intervention villages, they were specifically asked to state whether any of these

[4] In phase 1 the questions were stated as "better than average wellbeing". We chose not to include Phase 1 definitions here due to space limitations, as the answers were similar and offered no meaningful contribution to the analysis.

[5] Interviewers were instructed to pay attention to these proportions, and inconsistencies were only found in 7 villages, which were resolved through consultation with the researcher and/or by proportionally adjusting the numbers.

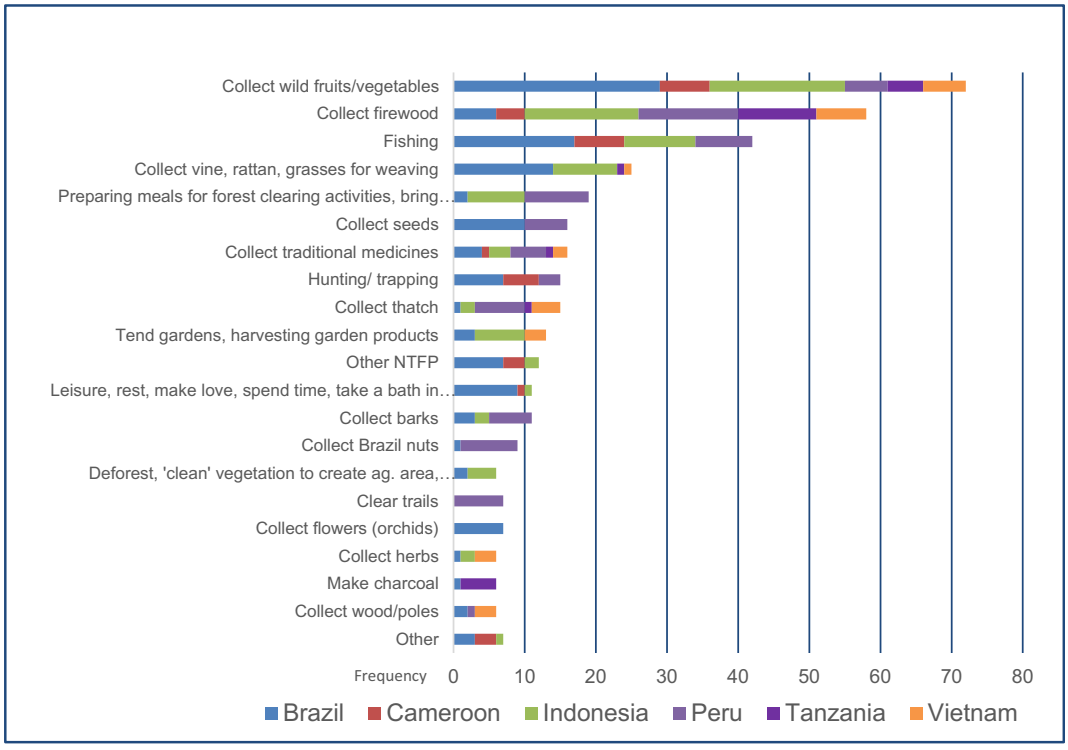


Fig. 1. Women's activities in the forest-Phase 2.

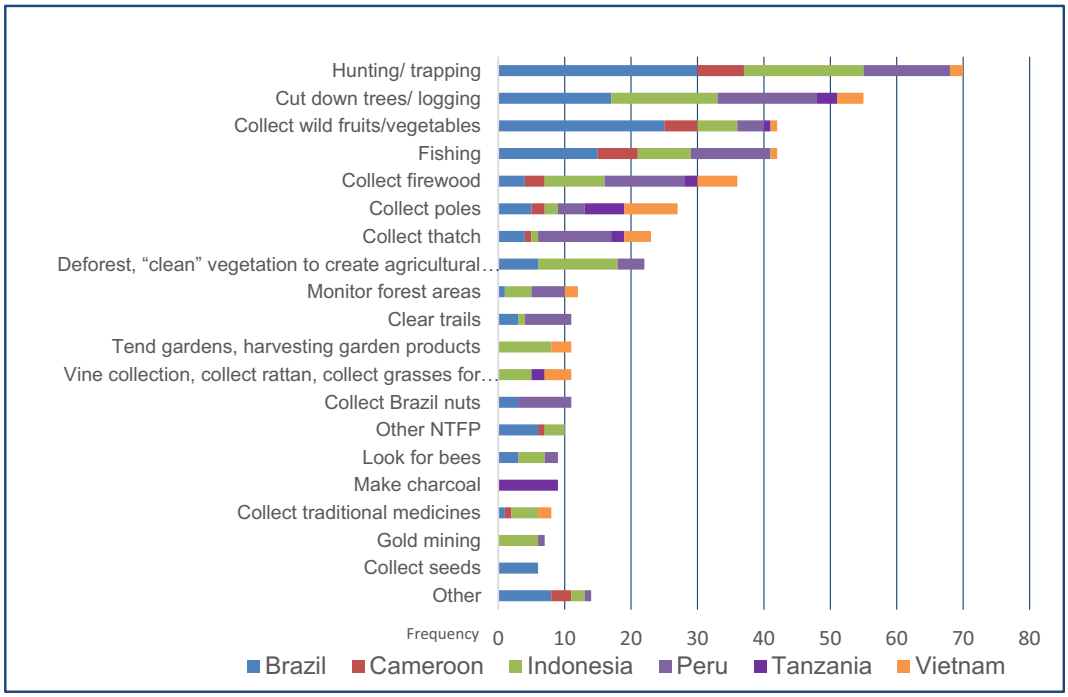
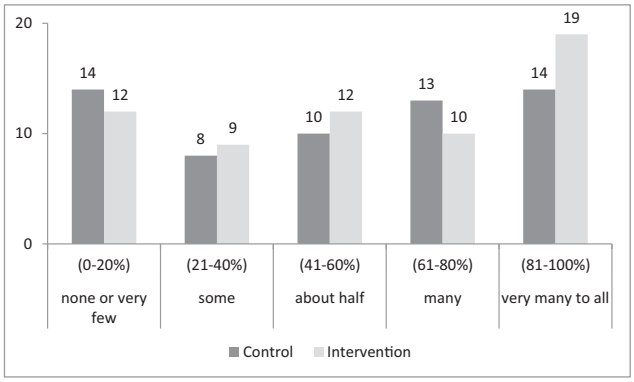


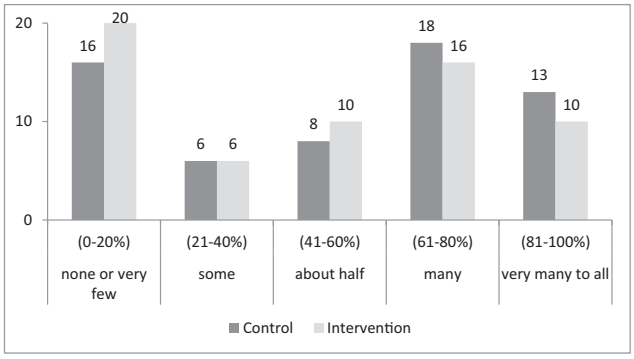
Fig. 2. Men's activities in the forest-Phase 2.

reasons were related to the REDD+ initiative. Similarly, when discussing the proportions for whom wellbeing declined, we asked for the reasons, and whether they were related to the REDD+ initiative.

The second way in which we address this question is through an interval regression model. We use a combination of FG and village data to model perceived wellbeing and compare results for intervention and control villages; we produce one model for the women's FG and one for the village FG. We statistically model the relationship between changes in perceived wellbeing improvement and variables related to village context, characteristics of the household and household head, and focus group characteristics, in Phase 2. The statistical model was implemented at the village level. Hence, to include household variables, we calculated the mean of



Graph 1. Distribution of improved subjective wellbeing of Women's FG – Phase 1.



Graph 2. Distribution of improved subjective wellbeing of Women's FG – Phase 2.

continuous variables and percentage for dummy variables at the village level. For instance, we computed the mean of household size for each village. Then, we use this average in the regression model as an independent variable. Likewise, we computed the percentage for female heads of household at village level and used this variable as an independent variable.

The dependent variable is the proportion of women, or villagers, in each village who are in the wellbeing improvement category in Phase 2. As previously stated, this variable was gathered in five intervals from 0% to 100% (See Graph 1). Given this particular feature of the dependent variable, the interval regression approach[6] is suited for our bounded dependent variable. The interval regression follows the same assumptions that the typical Ordinary Least Square (OLS) regression. The model is as follows:

$$(WP_{LB}, WP_{UB}) = \alpha_0 + \delta T + \sum_{i=1}^{n} \alpha_i \; Village \;\; variable_i + \sum_{j=1}^{n} \beta_j HH \;\; variable_j + \sum_{k=1}^{n} \gamma_k FG \;\; variable_k + e$$

$$(P_{LB,g}, \; P_{UB,g}) = \alpha_g + \beta_g \cdot (V + HH + FG) + e_g$$

where dependent variable P is the proportion of people relevant for each focus group g (women or villagers) whose wellbeing improved between Phase 1 and Phase 2. P is bounded by a lower bound (LB) and upper bound (UB) (e.g., LB = 0% and UB = 20%). Explanatory variables are taken from Phase 2 data, comprised of: (a) V = village variables (intervention village dummy variable, population, village area, cellphone service, health center, elementary school, secondary school, distance from the village to the road, and distance from the village to the market; (b) HH = household variables averaged at the village level (characteristics of head of household, household income by different economic activities, household income from government or NGO, land area managed by households, house condition index[7], and utility index[8]); and (c) FG = focus group variables (average age, number of participants). Appendix 3 contains descriptive statistics for these variables. In addition, α is a constant term, β is a vector of coefficients for each variable, and e is the error term. Village and household variables are common across the focus groups (women or village), whereas FG variables vary depending on the group. We included a fixed effect by country to control for idiosyncratic country differences, and used White's variance-covariance estimator.

3.4. Gender in REDD+, specific interventions and women's perceptions

Finally, we examine from a gender perspective the goals of the REDD+ initiatives and the specific interventions applied. In interviews with REDD+ implementers in Phase 1, we asked them to define their goals, objectives and target groups for each initiative. Before Phase 2, we conducted a survey of village interventions, with REDD+ implementers and other key informants, to characterize all forest-related interventions that were being applied in intervention and control villages. Since the same intervention can be implemented in multiple villages, the unit of analysis is incidence of intervention, which is an intervention implemented in a given village. Interventions were grouped by type as follows: restrictions on forest access or conversion; non-conditional livelihood enhancements; conditional livelihood enhancements; forest enhancement; environmental education; tenure clarification; and other (see Sunderlin et al., 2016). We use the descriptions of each specific intervention to see how many mentioned "women" or "gender."

We then leverage data from the women's focus groups where we asked their perception of the net effect of each specific intervention on the wellbeing of women in the village on a Likert scale of very negative, negative, no effect, positive, or very positive. In some instances, the focus groups could not reach a consensus on whether the effect was more positive or more negative ("undecided") or did not know enough about the intervention to make informed decisions ("don't know"). We refer to incidence of interventions rated using the Likert scale as rated interventions, while those that resulted in "undecided" or "don't know" are referred to as not rated. We also asked focus group participants to describe the reason that each intervention produced the given effect(s). For this part of the analysis we only use the results from REDD+ villages.

4. Results

4.1. Definitions of wellbeing

This section presents the most frequently mentioned definitions of the characteristics of high wellbeing from Phase 2, derived from women and village focus groups in intervention and control vil-

[6] This statistical model was run in STATA 13 with the routine "intreg".

[7] This index represents household access to utilities (water, toilet and electricity). Each variable indicates the following relative value: water (stream, river, pond, common faucet or well = low, own well or reservoir = medium and piped water = high); toilet (stream, river, pond, field, or shared latrine = low, own latrine = medium, own flush toilet with piped water = high); electricity (no electricity = low, through unpaid connection to grid or village system = medium, and through paid connection to grid or own generator = high). The relative value are 1 = low, 2 = medium, and 3 = high. This gives an index with minimum value 3 (low) and maximum value 9 (high).

[8] This index represents house conditions of roof, wall, and floor. Each variable indicates the relative value (on a village scale) of the main material used in the construction of the roof, walls or floor. The relative values are: 1 = low, 2 = medium and 3 = high. This gives an index with minimum value 3 (low) and maximum value 9 (high).

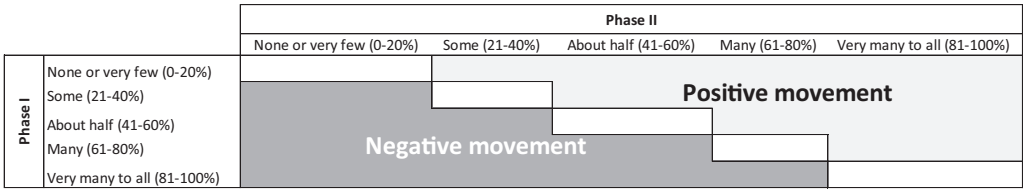
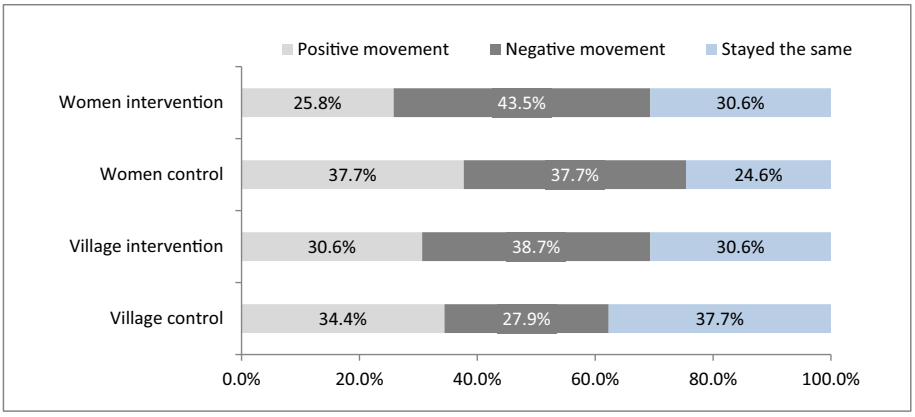


Fig. 3. Matrix used to calculate movement in wellbeing status by village between Phase 1 and Phase 2.

Table 2
Definitions of wellbeing (frequency of mentions).

Definition description	Women		Village	
	Intervention	Control	Intervention	Control
Good health	36	43	36	39
Good education	36	34	43	39
Sufficient food to eat	28	30	26	27
Good quality house construction material	26	21	25	22
Own source of income	24	29	0	0
Self-sufficiency (no need for outside employment)	0	0	15	13
Access to electricity	17	11	24	16
Ownership of transport items (boats, motorbikes, cars)	3	5	18	16
Tranquil/peaceful/harmonious/happy life	16	13	14	17
Unity in family	13	16	8	8
Husband who provides for the family	9	10	0	0
Unity among people in community	7	10	2	6

Note: shaded numbers represent the five most frequent answers per group.



Graph 3. Movement in perceived wellbeing status between Phase 1 and Phase 2, for women and village FGs in control and intervention sites.

lages (Table 2). We include all responses that have at least 10 mentions in at least one focus group. They are presented roughly in descending order by frequency.

Data presented here show general patterns across the four categories, without implying statistical significance. Overall, the main differences in definitions of wellbeing are between village and women's groups, rather than between intervention and control villages. The most common responses for all groups were good health, good education, and sufficient food to eat (top 3 for all categories), as well as good quality house construction material (ranked 4th for both village and women's focus groups in intervention villages, and 5th for women focus groups in control villages). Another important characteristic with equal importance across the four categories was "Tranquil/peaceful/harmonious/happy life", with a similar number of mentions (13–17).

One of the top 5 definitions of wellbeing commonly used in women's focus groups that was *not* mentioned in village focus groups was "Own source of income". It was mentioned by 53 women's focus groups (43%). Other responses that were much more frequently mentioned in women's compared to village focus groups were: unity in the family, a husband who provides for the family and unity among people in the community.

The village FGs more frequently mentioned access to electricity and ownership of transport items. The village response of "self-sufficiency" is probably comparable to the women's response on "own source of income", but the latter was mentioned almost twice as frequently. Some definitions that diverge between the focus groups but were not mentioned frequently enough to be included in the above table include women's FG references to religious faith and having a large number of children, and the village FGs' mention of ownership of livestock.

4.2. Movement in perceived wellbeing status

Using the transition matrix (Fig. 3), we categorized the movement in perceived wellbeing status across phases for each village studied into three groups: villages with positive change (higher proportion of women better off), negative change (lower proportion of women better off) or stayed the same (no change in proportion of women better off). In Graph 3, we present these results

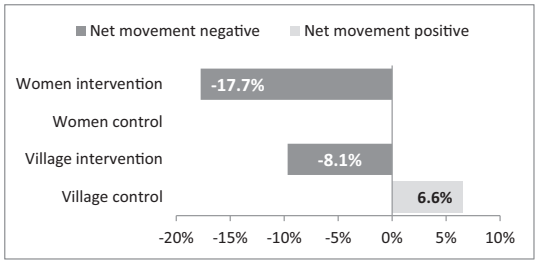
expressed as a percentage of the study sample. In REDD+ intervention villages, 27 women's focus groups (43.5%) demonstrated negative movement in perceived wellbeing status. These figures are higher compared to FG's outside of REDD+ intervention sites, where 23 women's focus groups (37.7%) demonstrated negative movement. Hence, more women's FGs in REDD+ sites perceived negative change than those in the control sites.

More important for the gendered analysis in this article, however, is the comparison of the women and village FGs in the REDD+ intervention sites. In this case, again, more women's FGs demonstrate negative movement between the two phases, and fewer demonstrate positive movement, compared to the village FGs; in both groups 31% stayed the same.

By giving a score of +1 for positive movement, 0 for no movement, and −1 for negative movement, we calculate the net change in perceived wellbeing for each group, as shown in Graph 4. The results show a net positive movement in wellbeing for control groups and net negative movement in REDD+ intervention sites. Among the four categories of villages, the village FGs in control sites is the only group with a net positive movement. Women FGs in the intervention sites had the highest net negative movement. Women in the control sites perceive no net movement over time.

The results suggest that, as a whole, women living in sampled REDD+ intervention villages perceive their wellbeing has negatively changed, in comparison to women in non-REDD+ villages and in comparison to the village as a whole in REDD+ sites. We explore the possible explanatory variables for these findings in the next sections.

As part of the analysis, we present disaggregated results by country. Table 3 shows the number of villages in each of the three categories of wellbeing movement, in control and intervention sites, based on the transition matrix. The final column presents the net positive change in wellbeing movement (number of villages better off minus worse off) by country. We acknowledge this is an imperfect measure of overall wellbeing change, since increased wellbeing status in one village does not compensate for reduced wellbeing in another village. Nevertheless, it allows for a consistent comparison of wellbeing outcomes across countries and between intervention and control villages.



Graph 4. Net movement in perceived wellbeing status by type of focus group.

The results show net negative movement in Brazil and Peru for intervention and control villages. There are no changes, on average, for women in intervention villages in Tanzania, Indonesia and Vietnam, compared to positive net movement in the control sites. Only in Cameroon is there a similar, net positive movement in both intervention and control villages.

In Table 4, we present the same results for the village FG. Similar to the women's FG, Peru and Brazil have more intervention villages that are worse off; control villages are also worse off overall in Peru, but there is a net positive result in Brazil. Tanzania and Indonesia have net positive results for both control and intervention villages. And in Cameroon net intervention results are positive and control results negative, whereas the reverse is true in Vietnam.

4.3. Stated reasons for overall subjective wellbeing change

In this section, we explore the reported reasons behind the change in women's perceived wellbeing, using data from Phase 2. Table 5 shows the top five reasons given for wellbeing improvement in the women's and village FGs for intervention and control villages.

From Table 5, having improved or stable agricultural income is the most frequent reason mentioned by both intervention groups and even more frequently by the village FGs. For women, the other, equally important reason is gender equity or women's empowerment. The next three refer to government services, new housing or improved house conditions and increased or secure income or savings. For the village FGs, the top five include these same three plus improved utilities.

The emphasis in the control groups is quite different, with the introduction of or improved infrastructure as the most frequent answer for women and new employment and work opportunities for the village FGs. The top five overlapped for all four groups on agricultural income, and for women, on gender equity and empowerment. But infrastructure, income from animal husbandry, new work or income opportunities and improved economic or business conditions were in the top five for the control but not the intervention groups.

Additionally, the women and village FG facilitators were asked to identify if any reasons for improvement could be related to REDD+ in the intervention villages. The specific indication for interviewers was: "Check [box] if respondents volunteer that the reason was at least partly related to the REDD+ initiative". In the women's FGs, only three reasons were checked as related to the REDD+ initiative. These are improvements related to additional income from REDD+ projects, additional income from many income-generating activities for women and incentives for women to be involved in agricultural activities (vegetable garden). Notably, all three are mentioned in two villages with overall positive wellbeing change. For village FGs, ten reasons were checked as related to REDD+ initiatives. These reasons are related to increasing income from the improvement of agriculture productivity, more

Table 3
Perceived movement in women's wellbeing by country (# of villages).

Country	Positive movement		Negative movement		No movement		Net change	
	Control	Intervention	Control	Intervention	Control	Intervention	Control	Intervention
Brazil	4	2	6	8	6	6	−2	−6
Peru	1	1	6	7	1	0	−5	−6
Cameroon	3	2	2	1	2	3	1	1
Tanzania	4	3	2	3	0	1	2	0
Indonesia	9	7	7	7	4	7	2	0
Vietnam	2	1	0	1	2	2	2	0
Total	23	16	23	27	15	19	0	−11

Table 4
Perceived movement in village wellbeing by country (# of villages).

Country	Positive movement		Negative movement		No movement		Net change	
	Control	Intervention	Control	Intervention	Control	Intervention	Control	Intervention
Brazil	5	3	4	7	7	6	1	−4
Peru	1	0	5	8	2	0	−4	−8
Cameroon	2	3	5	1	0	2	−3	2
Tanzania	3	5	1	1	2	1	2	4
Indonesia	9	6	2	4	9	11	7	2
Vietnam	1	1	0	3	3	0	1	−2
Total	21	18	17	24	23	20	4	−6

Table 5
Reasons for wellbeing improvement (frequency of mentions).

Reason description (Top five for each group)	Women		Village	
	Intervention	Control	Intervention	Control
Good/increased/stable income from agriculture	13	13	22	12
Gender equity/women's empowerment	13	11	0	1
Good/increased service or support from government	9	10	10	6
Able to buy/build own house or improve condition of house or housing	9	5	12	8
Income, assets, savings, capital are adequate or increased or secure	9	3	11	9
Good/improved economic/business conditions	7	11	8	8
Introduction of or improved utilities (water, electricity, gas)	7	6	10	5
Got (new/additional/different) employment or income/increased work opportunities	6	11	7	16
Good/increased/stable income from animal husbandry	3	6	6	10
Introduction of or improved infrastructure (roads, bridges, waterways, irrigation)	3	15	7	12

Note: dark grey shading highlights the most frequent response by group; light grey highlights the others in the top five.

access to income (more people involved in the project), project activities, agricultural and housing investment and better product processing.

Focus groups were also asked about reasons for declines in wellbeing. The results are in Table 6. The top five are similar (insufficient or decreased income, old age and problems in the community) but there is also variation: there is more emphasis on agricultural prices and low income opportunities in the village control group, on infrastructure problems in both intervention groups and on illness in the family in the women's control group. Nevertheless, the total number of responses is quite small, and hence it is difficult to establish patterns. The women's FG did not note that any declines were related to REDD+, but the village focus group noted three, referring to government restriction on crops, lack of alternatives to forest products and being forced to move due to a protected area.

4.4. Reasons for change: Women's wellbeing perception model

Table 7 shows the results of the interval regression for women's perceived wellbeing improvement. The dependent variable is the proportion of women perceived to be better off in Phase 2. Independent variables related to income and village area were divided by 1000 to avoid the scale effect in the coefficients. In Table 7, we display only the variables that are statistically significant at least at the 10% level. The full model is found in Appendix 4.

According to our results, the treatment variable – living in a REDD+ intervention site – has a negative coefficient and is statistically significant at 90%. The share of women that have improved wellbeing in the last two years is about 9% lower than in non-REDD+ villages.

Similar negative coefficients are observed for variables related to household characteristics averaged at the village level. An extra year in the average education of household heads in a village reduces the estimated proportion of women who are better off by 5%.

The variable related to forest land under control of household shows a negative coefficient and is statically significant at 99%. The result implies that one additional hectare of forest land in the village mean reduces the improvement of wellbeing perception, but the magnitude of the effect is very small, at around −0.26%. Cellphone service and total village area are also significantly associated with negative wellbeing perception. It is important to highlight that variables related to income generation (farming, off farm or forest) are not statistically significant in explaining women's wellbeing perception, including external income from the government or PES.

For comparison purposes, we ran the same interval regression model for the village focus groups. The dependent variable is the proportion of households in the wellbeing improvement category in Phase 2. Table 8 shows the result of the village wellbeing perception model for statistically significant variables. In contrast to the women's results, the treatment variable is not statistically significant for the village focus groups. It means on average villagers' perceived well-being was not affected, positively or negatively, by living in a REDD+ site.

With regard to other variables, infrastructure for education affected perceived wellbeing. Hence, the availability of elementary schools in the village increased the wellbeing perception around 17.8%. Curiously, the reverse happens with a secondary school in the village, which reduced perceived wellbeing by around 14.9%.

Distance to the market from the village also had a significant effect, with villages located in remote areas having lower perceived wellbeing. Our result indicates that one additional kilometer of distance from the villages to the market reduced perceived wellbeing by 0.08%. For instance, if the village is located 100 km away from the market, perceived wellbeing is reduced by 8%.

An additional thousand dollars in the village annual mean in off-farm income increased perceived wellbeing by 3.75%. In contrast, agriculture and forest incomes had no significant effect. Variables related to house condition index and utility index positively correlated to improvements in perceived wellbeing of the village FGs. Hence, when house condition index increased by one point

Table 6
Reasons for wellbeing decline (frequency of mentions).

Reason description (Top five for each group)	Women		Village	
	Intervention	Control	Intervention	Control
Old age and reduced productivity	8	9	7	6
Insufficient/decreased/unstable income, assets, or savings	6	10	6	6
Absence of/decreased safety, security, stability, morality, and cohesion in the community	8	3	6	6
Illness in family	4	10	1	3
Low/decreased/unstable income from agriculture	5	7	6	6
Absent/inadequate/worsening infrastructure (roads, bridges, waterways, irrigation)	5	2	6	4
Low/decreased/unstable prices of agricultural product(s)	1	0	2	7
Low/decreased employment/income opportunities	3	4	4	7

Note: dark grey shading highlights the most frequent response by group; light grey highlights the others in the top five.

Table 7
Women's wellbeing perception model – interval regression.

Variable	Units	Coefficient	Standard error
Intervention	Dummy (REDD+ village = 1)	−8.656	(5.196)*
Village total area	Thousand hectares	−0.089	(0.020)***
Cellphone service in the village	Dummy (available = 1)	−13.576	(7.861)*
Average years of education of sampled household head	Years (Village average)	−4.591	(2.756)*
Average area of forest land controlled by sampled household	Hectares (village average)	−0.265	(0.099)***
Observations		110	

*$p < 0.1$; **$p < 0.05$; ***$p < 0.01$.

Table 8
Village wellbeing perception model – interval regression.

Variable	Units	Coefficient	Standard error
Intervention	Dummy (REDD+ village = 1)	−1.122	(4.299)
Elementary school	Dummy (Available = 1)	17.837	(9.934)*
Secondary school	Dummy (Available = 1)	−14.96	(5.386)***
Distance to road	km	0.182	(0.049)***
Distance to market	km	−0.083	(0.028)***
Off farm income	US $ (mean at village)	3.751	(2.260)*
Agriculture land	Has (mean at village)	0.566	(0.343)*
Forest cleared by HH	Has (mean at village)	24.181	(8.162)***
Payment for Environmental Service Income	US $ (mean at village)	123.047	(70.905)*
Utility Index	Index (mean at village)	11.297	(2.700)***
House condition index	Index (mean at village)	6.371	(3.355)*
Observations		110	

*$p < 0.1$; **$p < 0.05$; ***$p < 0.01$.

in the village mean, perceived wellbeing improved by 0.3%. The effect of the utility index increased perceived wellbeing by 11.3%.

Another striking result for the village FGs is related to hectares of forest reportedly cleared by household, which had a positive coefficient and was statistically significant at 99%. This result indicates that one additional hectare of cleared forest in the village mean increased perceived wellbeing by 24.1%. It implies that wellbeing perception of village members is in the opposite direction of REDD+ project objectives.

4.5. Gender, REDD+ and perceptions of specific interventions

Of the 16 initiatives analyzed here, none listed women as a stakeholder group; three (one each in Peru, Cameroon and Vietnam) stated that providing fair benefits to women was an equity goal (Larson et al., 2015); and one in Tanzania specifically emphasized targeting rural women as part of their overall objective (Putri & Kweka, 2014). Four initiatives in Indonesia mentioned women but only vaguely or more in relation to specific interventions (Atmadja, Indriatmoko, Utomo, Komalasari, & Ekaputri, 2014; Indriatmoko, Atmadja, Utomo, Ekaputri, & Komalasari, 2014; Intarini, Resosudarmo, Komalasari, Ekapurti, & Agustavia, 2014; Anandi, Resosudarmo, Komalasari, Ekaputri, & Intarini, 2014).

With regard to the specific interventions, a word search of the narrative descriptions of over 600 interventions applied in study villages found only 8 interventions across 12 villages (10 REDD+ and 2 control villages) that mentioned women. The 10 REDD+ villages were in three sites (one in Brazil, one in Peru and one in Indonesia), and only two of those villages demonstrated overall wellbeing improvements between the phases. To summarize these results, only four of the 16 REDD+ initiatives studied mentioned women in their overall goals; outside of those four, five others mentioned women in some way in relation to at least one intervention.

To further understand the relation of REDD+ to women's wellbeing, we examined which types of specific interventions women perceived favorably and unfavorably. The data in general is mixed but promising: across the global sample almost half (47%) of the rated incidences of intervention (i.e., excluding "don't know" or "undecided") in REDD+ villages were perceived to have no effect,

Table 9
Women's perception by number and type of all rated interventions in REDD+ villages.

Type of intervention	Women's perception of interventions (#, %)			Total (#, % of total)
	Negative	No effect	Positive	
Conditional Livelihood Enhancements	1 (3%)	7 (23%)	22 (73%)	30 (11%)
Environmental Education	1 (2%)	19 (46%)	21 (51%)	41 (15%)
Forest Enhancements	1 (3%)	11 (37%)	18 (60%)	30 (11%)
Non-conditional Livelihood Enhancements	12 (13%)	42 (44%)	42 (44%)	96 (34%)
Other Interventions	0 (0%)	13 (62%)	8 (38%)	21 (7%)
Restricted Forest Access and Conversion	5 (11%)	28 (64%)	11 (25%)	44 (16%)
Tenure Clarification	0 (0%)	13 (65%)	7 (35%)	20 (7%)
Total	20 (7%)	133 (47%)	129 (46%)	282 (100%)

while most of the remainder (46%) were viewed positively (Table 9). The perception of no effect, according to the women's comments, is mainly because women were not involved, the project did not meet its goals or because interventions were still incipient. Notably, of the 14 total incidences of interventions in REDD+ villages that did mention women specifically, almost half still had no effect (6, and 5 had a positive effect, 2 negative, and 1 "undecided"), according to women.

Women found that conditional livelihood enhancements (such as payments for environmental services) had the most visible effects, and were mostly positive (73%; only 3% negative), although this type of intervention comprises only 11% of the total rated interventions in REDD+ villages. The main reasons for the overall positive perceptions were that conditional livelihood enhancements contributed directly to women's incomes and helped conserve local forests. In seven villages in Brazil and one in Cameroon, where women were undecided on whether the effects of conditional livelihood enhancements were positive or negative, the reasons given were primarily due to perceptions that the expected benefits may not materialize, was not or will not be distributed fairly, or that the payment value was low.

Most concern about REDD+ interventions relates to those that restrict forest access and conversion, due to potential impacts on livelihoods. These comprise 16% of the total rated instances of interventions. We found that among the 44 rated instances of such restrictions, 5 were considered to have negative and 11 positive effects. The 5 instances of restrictions viewed negatively were due to detrimental livelihood impacts of environmental policing in Brazil (2 instances), regulations on the use of Brazil nut concessions in Peru (2 instances), and bans on wild meat hunting in Cameroon (1 instance). Interestingly, there are 4 instances where these same interventions were viewed positively in other villages, due to reduced deforestation, reduced presence of illegal loggers or outsiders, and clarified rules of how land and forests can be used. The other 7 that were viewed positively were for similar reasons, such as forest patrol activities or restrictions on clearing and burning.

This intervention type had the highest level of "undecided" (both negative and positive effects) responses compared to other types of interventions in our study: 14 undecided, compared to 44 rated incidences. They were found in Brazil (11), Peru (2), and Cameroon (1). The positive elements focused on environmental and health benefits of less deforestation and burning in Brazil, improved tenure security in Peru, and improved protected area management in Cameroon. The negative elements include the feeling of fear and insecurity, lack of alternatives, reduced farming opportunities, heavy fees, no effect in reducing deforestation, and lack of training in managing the forest.

The largest proportion (34%) of the interventions rated by women in REDD+ villages were non-conditional livelihood enhancements. These interventions were also the most diverse, ranging from reforestation and alternative energy, to sustainable agriculture activities. While incidences of these interventions were mainly rated as positive (42% or 44 incidences), 12 were rated as negative. While women often focused on the positive aspects of this intervention in terms of support for local livelihoods, reasons for negative effects largely focused on the interventions' failures to improve livelihoods, either due to premature suspension, lack of technical assistance, or inappropriateness of the intervention to the local context. In many incidences of non-conditional livelihood enhancements (16), women were undecided on how to rate the interventions because the perceived benefits had negative tradeoffs, were not received by some, or did not perform as expected.

5. Discussion

The results presented here suggest some reasons for concern regarding REDD+ and gender, as well as potential ways forward. Changes in wellbeing, as perceived by women's focus groups in intervention villages, show positive movement between the two phases of research in only 26% of villages, declines in 44% and no change in 31%. In comparison, village focus groups also perceive more declines (39%) than improvements (29%), but on average their wellbeing perceptions are better than those of women. In the control groups, women's FGs perceived no net change overall, whereas village FGs perceived net improvements. The BACI analysis shows that REDD+ villages have fared worse than control villages with regard to perceived wellbeing during the same period, and that women specifically have fared worse than the village as a whole.

The regression model presented here was designed to explore this question systematically for women, as well as for the village FGs for comparison. The regression model for women found that living in a REDD+ site significantly affected perceived wellbeing status in Phase 2 across the sample. Although there was a similar large difference in village wellbeing in intervention compared to control villages, living in a REDD+ site was not found to be significant for the village sample.

Although the results suggest that REDD+ may be partly responsible for the decline in women's perception of wellbeing relative to the control groups, it is important to explore this further, as well as to try to understand what factors might improve the gendered outcomes of REDD+ and similar, future initiatives. One important point is that overall wellbeing is undoubtedly affected by many things besides a REDD+ initiative in a village, or a single intervention. This is supported by the fact that women's many positive opinions of single interventions do not demonstrate any correlation with overall wellbeing changes.

Also, there was only a 3-year period between the phases of research, and even in Phase 2 many REDD+ initiatives were still getting started: enhanced wellbeing outcomes are not likely to be found in such a short time period. In addition, being located in a REDD+ village may have resulted in higher expectations, which

then were not realized, and may have contributed to the decreases in subjective wellbeing, for both women and village, between the two research phases.

Country-level changes, or sometimes regional dynamics, between the two phases of research are also worth noting, even if they do not always explain differences between control and intervention or women and village FGs. For example, in Brazil, while government-led restrictions on smallholders were effective in limiting forest clearing, they also negatively affected perceived wellbeing (Duchelle et al., 2017). Interestingly, women's perceptions on this intervention type in Brazil reflect the negative implications of such heavy-handed interventions on livelihoods, but also highlight some positive aspects that might not be expected. In Indonesia, overall net wellbeing improvement, seen especially in control villages, could potentially be related to observed increases in infrastructure development in most study villages (e.g., roads, cellphone access). There may also have been optimism associated with the 2013 constitutional court decision on the recognition of customary (adat) lands (Myers & Muhajir, 2015), although little progress on their actual formalization has been made to date. Net improvements in Tanzania could possibly be related to a changing interpretation of the law on village lands (Kijazi et al., 2017). In Peru, which had the worst net wellbeing declines in the sample across all four groups, villages in one of the two regions had suffered terrible flooding the year before (Rodriguez-Ward & Paredes del Aguila, 2014).

5.1. Wellbeing, perceptions of change and expectations

Is it possible that women have different priorities than the majority-male village focus groups? Perhaps REDD+ initiatives are more likely to provide what men are looking for and neglect the factors that women consider important for wellbeing.

The analysis of definitions of wellbeing suggests that differences are larger between women and village FGs than between control and intervention villages, but also that the top definitions were very similar: four of the top five for all groups were good health, good education, sufficient food to eat and good quality housing material. The most important difference was women's emphasis on their "own source of income." Women also placed more emphasis on unity in the family and in the community. The village focus group prioritized owning transport vehicles.

When asked specifically about reasons for wellbeing improvements, larger differences in responses were found between intervention and control villages than between women and village FGs. The control groups referred most frequently to infrastructure improvements and job opportunities, whereas the intervention villages referred to agricultural incomes. The largest gender difference is that women in both control and intervention villages referred to equity and empowerment for women. In intervention villages, village FGs in comparison to women's FGs noted that reasons for improvements were due to REDD+ initiatives three times as often (10 versus 3).

Although the more general definitions of wellbeing, such as good health, do not demonstrate a direct relation to the most important reasons given for improvement, the results still suggest some general conclusions. First, wellbeing improvements for women more likely need to be tied to specific interventions that support women's employment, economic conditions and empowerment. Related to this, the reason for interventions to be rated positively or negatively by women is predominantly related to how well they provide income/monetary benefits. Although it seems odd, then, that the regression model did not show income generation to be significant, it may be because there was not enough information to include women's direct income in the model. Second, it is possible that interventions that bring some economic benefit to the village, or even to their spouses, are likely to be seen more critically by women, for example if they increase tensions or conflict in the home or the community. Because of this, women often rate interventions according to how benefits are distributed. Third, one explanation of the better net wellbeing results in control as compared to intervention villages may be related to infrastructure improvements in control villages.

Another important factor in the comparison of control and intervention village results is the role of expectations in affecting perceptions. For example, REDD+ implementers may have introduced their initiatives in Phase 1, or shortly thereafter, as an opportunity to improve wellbeing. If these expectations were raised but not met, this could be detrimental to perceived wellbeing and bias the comparison between intervention and control villages. Indeed, we found that one of the common reasons for women's negative and "no effect" ratings for specific interventions is that benefits are not delivered as initially expected. Still, it is not clear why the wellbeing decline reported in the intervention village focus group results would be so much less than the women's (and not associated with living in a REDD+ village). We considered that women might be more frustrated if they are left out of more interventions; however, the village FG reported a similar number of "no effect" ratings.

5.2. Explanations from the regression models

In the women's regression model, living in a REDD+ intervention village along with several other variables were statistically significant in affecting women's perception of wellbeing improvement. They include: education level of the household head; household forest area; the presence of cellphone service; and the size (total area) of the village. Although one would normally expect improved wellbeing to be associated with a higher level of education, the relationship in this case was the opposite; nevertheless, since the dependent variable is *perceived* wellbeing, it is possible that women in villages who have better-educated household heads may have higher wellbeing standards, or are more critical about women's conditions in their village. Village size and cellphone service may be related to potential sources of disharmony from the perspective of women.

As stated previously, area of forest as associated with a decline in wellbeing perception flies in the face of REDD+ goals, but it is not a surprising result; it parallels the result regarding forest clearing in the village regression model. Greater forest area is associated with lower perceived wellbeing for women and more forest clearing is associated with higher wellbeing for the village FG.

Many more variables turned out to be significant in affecting the village FGs' perception of wellbeing improvement, relative to the women's model. These include household condition, distance to markets, two income variables (off farm and PES), access to utilities and agricultural land area, among others.

Perhaps most relevant for this article is to understand why none of these variables were found to be significant in the model of women's perceived wellbeing. This may represent women's lower direct market participation, less direct control over agricultural land, lower opportunities for off farm income and less control over income from PES. Perhaps the results would have been different if it were possible to include a variable specifically focused on women's income apart from household income, based on the women FGs' emphasis on the importance of women's equity, empowerment and own income sources. This highlights the importance of collecting intra-household gender-disaggregated data for income analysis (e.g. as done in Sunderland et al., 2014).

5.3. REDD+ initiatives and women

The analysis of the REDD+ initiatives and specific interventions does not provide a clear explanation of wellbeing results but does provide some clues. Few of the REDD+ implementers mentioned women early on as a goal of their initiatives; and, importantly, the four that did have women's equity among their goals do not appear to correlate any better with overall wellbeing improvement for women than the other initiatives. Similarly, only a third of the specific interventions mentioning women were assessed as having a positive effect on women. The village FGs mentioned the REDD+ initiative three times more often in association with wellbeing improvements (and women only a handful of times), but at the same time women never associated wellbeing decline with the REDD+ initiative (the village FG did). In addition, there are a number of specific interventions that were viewed positively by women and far fewer that were viewed negatively.

The apparent conclusion is that REDD+ initiatives have not done a very good job addressing gender concerns, even if women view many specific interventions positively. There may be two exceptions. The two villages in which women associated wellbeing improvement with REDD+ (for a total of three reasons for improvement) did, in fact, also demonstrate an overall improvement in women's wellbeing between the two phases of research. These two villages, both in Indonesia in different REDD+ sites, stand out in some ways. In one of the two villages, the initiative is credited with supporting seven different specific interventions, more than twice the other villages in the same site; six are said to have positive effects for women, with an emphasis on direct payments received for women's labor and enhanced security of livelihood assets. The other village also has six distinct interventions from the REDD+ initiative, but in this case this number is similar to the other villages in the site; however, only in this village are any of them noted as having "very positive" effects (three, compared to none elsewhere). Here the emphasis is on direct, extra income.

Stereotypes and assumptions regarding women and forests may play a role in the limited attention given to gender in most REDD+ initiatives (in addition, of course, to more general gender biases and assumptions which are beyond the scope of our data or this article). As described in the data on forest use, it is rare for women to count forest-based livelihoods among their top two occupations, which may generate misunderstanding or bias against their importance or relevance to women; yet it is common for women (and men) to use forests for fuelwood, food security and/or other needs. There is large variation between countries and villages. Even more importantly perhaps, an initiative such as REDD+ that is likely to affect resource use, income generation and community decision-making risks reinforcing inequities.

In light of the literature and of the positive interventions found in the sample, the analysis of the data discussed here may provide some suggestions regarding ways forward. First, the comparison of overall wellbeing change with the 16 REDD+ initiatives and 282 specific interventions in REDD+ villages rated by women suggests that no single initiative or intervention type determines the wellbeing outcomes for women between the two research phases. That is, results vary across villages, sites and countries. In the two exceptional cases above, for example, the wellbeing (and specific intervention) results are not similar across the four villages in the same REDD+ site, although they all fell under the same general policies and goals of the initiative. A detailed analysis across all of the countries in this dataset would require a village-level understanding that is not possible at this time. But it is apparent that factors affecting women's wellbeing are complex, varied and site specific; and change likely requires a longer period than this study measured.

Second, women's wellbeing definitions and the analysis of reasons for change, together with the reasons given for positive opinions of specific interventions, suggest important clues for initiatives to respond better to gender concerns. These refer to women having their own source of income, women's empowerment, community harmony and family unity, equitable benefit distribution, enhanced livelihood benefits or security and positive environmental outcomes, although the latter are problematic if they include livelihoods restrictions. Since women and men often use forests differently, understanding how is important to understanding livelihood impacts of initiatives – another issue related to site specificity.

Finally, there is no evidence that any of the initiatives took the kind of approach to gender that the literature would suggest is needed. This would have involved incorporating gender concerns from the planning stages in more substantive ways. Villages should not be approached with preset notions of gender roles and interests. "Gender" should not solely mean calling for women's participation without considering underlying inequities that might limit meaningful participation. The variety of outcomes found in this research calls for site-level reflection and analysis that allow for the design and implementation of initiatives in ways that adapt to each specific context. As argued elsewhere and as suggested by the regression results here, more needs to be done to avoid unintended, negative consequences for women's wellbeing in REDD+ .

6. Conclusion

As the global community moves forward on efforts to address climate change, the findings presented here should give pause. There is broad concern across the climate community regarding the importance of fully engaging women in climate decisions, initiatives and goals and promoting solutions that support SDG goal #5, to achieve gender equity and empower women and girls. The results suggest, however, that current attention to gender in REDD+ initiatives is insufficient for addressing gender equality or safeguarding women's rights, calling for reflection on how to ensure that gender is fully integrated into policies, programs and projects, for REDD+ and beyond.

The results highlight the importance of asking sex-differentiated questions related to wellbeing. Comparative research, across multiple countries and sites and using before-aft er-control-intervention methods, is crucial for understanding the gendered risks and opportunities associated with such initiatives, and to help identify vulnerabilities and potential ways forward.

The findings highlight the importance of conducting detailed, local-level gendered analysis for REDD+ and similar initiatives. They identify a need for women's participation that is meaningful and empowering, while also managing expectations. While men and women clearly share many wellbeing goals, women emphasize having their own source of income and women's equity and empowerment. Livelihood concerns may be different than men's and require understanding gendered forest use, as well as "the social processes that determine who is responsible for creating forest use rules, who actually does the work, and what contestations result" (Bee & Basnett, 2016:8). In summary, women should be fully engaged in the design, implementation and decision making associated with initiatives to fight climate change in rural communities; and explicit strategies should be included to empower women, increase their control over assets and safeguard their rights.

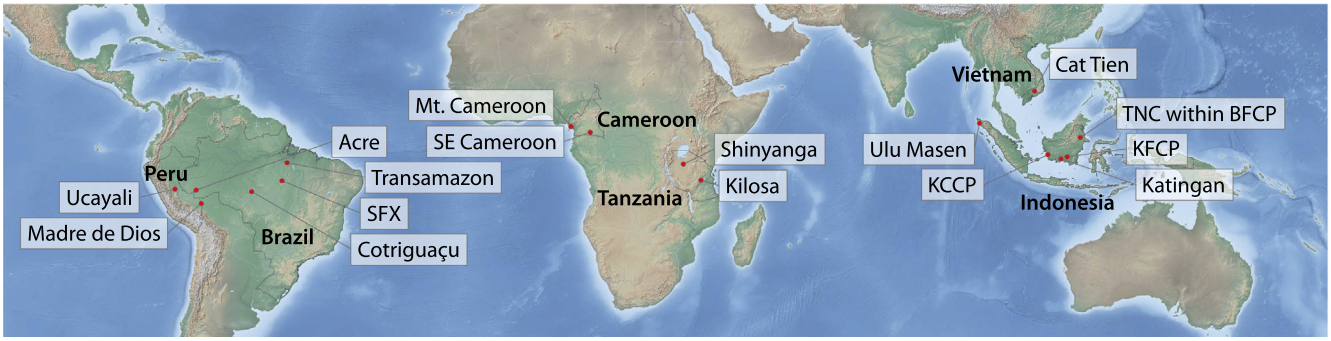
Conflicts of interest statement

We wish to confirm that there are no known conflicts of interest associated with this publication.

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Appendix 1: Map of study sites



Appendix 2: Transition matrix description process

The women's wellbeing perception transition matrix aims to identify the individual perception movement of each women's focus group from Phase 1 to Phase 2.

Step 1: Constructing panel data

The first step is identifying the women's focus groups in Phase 1 and Phase 2. Given that the focus group was carried out at the village level, we search for the same village names in Phase 1 and Phase 2. Therefore, only villages with information in both phases are included in the analysis.

Step 2: Generating the transition matrix

For each panel village identified in step 1, we identify the portion of women in Phase 1 and Phase 2 who indicated wellbeing improvement. Given that this a two-way table, each women's focus group has only one entry (it will be one frequency) in one of 25 possible combinations. The table below provides a graphic illustration:

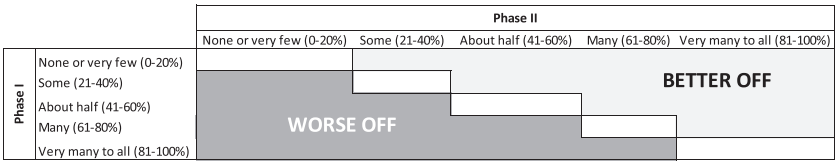
		Phase II				
		None or very few (0-20%)	Some (21-40%)	About half (41-60%)	Many (61-80%)	Very many to all (81-100%)
Phase I	None or very few (0-20%)					
	Some (21-40%)					
	About half (41-60%)					
	Many (61-80%)					
	Very many to all (81-100%)					

Step 3: Identifying transition movements

To define the transition movements, we note the direction of movement (up or down). Hence, for wellbeing improvement, we define each movement from a lower position in Phase 1 to a higher position in Phase 2 to be positive (better off) and each movement from a higher position In Phase 1 to lower position in Phase 2 to be a negative movement (worse off).

It is important to highlight that instances that are invariant between Phase 1 and Phase 2 (elements in the diagonal) will not be considered as a transition movement. Likewise, the answers that respondents do not know (RDNK) will not be included. The illustration below shows an example of this step for wellbeing improvement.

Example: Wellbeing improvement



Step 4: Aggregating transition movements

Finally, we aggregate the frequencies at global, country and site level for each transition movement (better off or worse off). Given that elements in the diagonal (same status between periods) and answer (respondent does not know) will not be considered in the transition movements, the addition of better off and worse off will not equal 100%.

Appendix 3: Descriptive statistics

Variable	Freq	Mean	Standard Deviation
Population	113	1074.5	1184.5
Total area (ha)	123	26,551.9	84,674.5
Cellphone service (%)	123	68.3%	46.7%
Health center (%)	123	53.7%	50.1%
Elementary school (%)	123	82.9%	37.8%
Secondary School (%)	123	37.4%	48.6%
Distance to road (km)	121	8.8	32.7
Distance to market (km)	122	35.2	56.6
Wage female (US$ daily)	123	8.6	6.9

Source: Village survey of Global Comparative Study of REDD+ projects.

Appendix 4: Interval regression results for wellbeing improvement perception

Type	Variable	Unit	Women	Village
Village information	Treatment	Dummy (REDD+ = yes)	−8.656	−1.122
			(5.196)*	(4.299)
	Population		0.004	0.004
			(0.003)	(0.003)
	Village area	Has	−0.089	0.003
			(0.020)***	(0.011)
	Cellphone	Dummy (1 = yes)	−13.576	5.388
			(7.861)*	(4.759)
	Health center	Dummy (1 = yes)	−1.363	−8.624
			(7.934)	(6.041)
	Elementary school	Dummy (1 = yes)	−0.571	17.837
			(11.376)	(9.934)*
	Secondary school	Dummy (1 = yes)	−6.932	−14.96
			(7.618)	(5.386)***
	Distance to the road	Average	0.017	0.182
			(0.096)	(0.049)***
	Distance to market	Average	0.056	−0.083
			(0.035)	(0.028)***
	Female wage (daily)	Average	−0.025	−0.628
			(1.237)	(0.746)
Household information	Gender of head	Dummy (1 = female)	20.177	−15.366
			(35.059)	(33.849)
	Years of education of head	Average	−4.591	−4.1
			(2.756)*	(3.05)

Appendix 4: Interval regression results for wellbeing improvement perception (*continued*)

Type	Variable	Unit	Women	Village
	Size	Average	−0.045	0.038
			(3.784)	(3.46)
	Ethnic of head	Dummy (1 = local)	−0.415	−24.992
			(19.207)	(17.63)
	Forest income (annual)	Average (US $)	−6.085	6.148
			(8.823)	−4.274
	Off farming income (annual)	Average (US $)	3.84	3.751
			(3.04)	(2.260)*
	Farming income (annual)	Average (US $)	0.487	0.711
			(1.363)	(1.106)
	Wealth	Average (US $)	0.355	−0.039
			(0.886)	(0.65)
	Assests	Average (US $)	0	−0.001
			(0.002)	(0.002)
	Agriculture land	Has	−0.632	0.566
			(0.558)	(0.343)*
	Forest land	Has	−0.265	−0.101
			(0.099)***	(0.089)
	Land used by Household	Has	1.565	−0.761
			(1.561)	(1.271)
	Land cleared by household	Has	18.803	24.181
			(12.956)	(8.162)***
	PES income (annual)	Average (US $)	−149.188	123.047
			(152.006)	(70.905)*
	NGSO support income (annual)	Average (US $)	−0.029	−0.024
			(0.059)	(0.045)
	Government support income (annual)	Average (US $)	−0.006	0.006
			(0.007)	(0.004)
	Utilities index		3.91	11.297
			(3.377)	(2.700)***
	House condition index		6.814	6.371
FG information			(4.729)	(3.355)*
	Age		−0.826	0.663
			(0.617)	(0.484)
	Size		−0.086	−0.157
			(0.387)	(0.24)
	Observations		110	110

*p<0.1; **p<0.05; ***p<0.01.

Note: Standard errors in parenthesis.

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