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Incentive-based conservation in Peru: Assessing the state of six ongoing PES and REDD+ initiatives

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ABSTRACT

Incentive-based conservation has gained ample notoriety over recent decades, particularly across Latin America where targeted incentives feature prominently in environmental services initiatives, such as for carbon storage or watershed regulation. Here we first develop an analytical framework for assessing the Peruvian initiatives of conservation incentives. We then identify six ongoing interventions that have introduced incentives conditional upon compliance with voluntary environmental commitments. We collected information from secondary sources and conducted semi-structured interviews with thirty national- and local-level stakeholders. We scrutinized the extent to which such initiatives featured impact-oriented design and implementation elements, as typically recommended in the state-of-the-art literature on Payment for Environmental Services (PES) and Reducing Emissions from Deforestation and forest Degradation (REDD+). We found only limited adoption of such recommendations, including spatial targeting, payment differentiation, enforced conditionality, and customized measures nurturing locally perceived equity and transparency. We argue, supported by a still incipient rigorous evidence from impact evaluations, that suboptimal design and implementation choices probably have influenced outcomes towards limiting the sought-for environmental and welfare impacts. We discuss three critical aspects for upscaling: overcoming financial and legal constraints, strategic involvement of non-government stakeholders, and more impact-oriented design of the interventions.

1. Introduction

Command-and-control regulatory approaches have traditionally dominated conservation policies, often implying negative social consequences for local populations, such as the eviction of communities due to the establishment of protected areas (Brockington and Igoe, 2006). To boost effectiveness and better reconcile environmental conservation with development goals, local participation, incentives, and benefit sharing have been increasingly seen as essential features of desirable conservation practices over recent decades, thus deviating from an exclusionary 'fencing' approach (Wells & Brandon, 1992). Ensuring local buy-in and benefits from sustainable resource management interventions is thus recognized as a significant priority for conservation initiatives (Wali et al., 2017).

Providing incentives is viewed as a promising way to deal with social issues arising from the uneven distribution of costs from the implementation of conservation initiatives (TEEB, 2010). These costs generally affect vulnerable populations in economically marginal yet environmentally sensitive areas. In this sense, a first generation of incentive-based initiatives, labeled as Integrated Conservation and Development Projects (ICDPs), emerged especially in protected area management since late 1980's, and were implemented *"to stabilize land use outside protected boundaries and to increase local incomes, in order to reduce the pressure for further exploitation of natural resources in the protected area"* (Wells and Brandon, 1992, p. 3). However, the first generation of project experiences revealed problems affecting their implementation, including difficulties in addressing fundamental tradeoffs between conservation and development objectives (Brandon and Wells, 1992; Wells and McShane, 2004).

A second generation of conservation incentive-based initiatives emerged in response to the problems encountered by ICDPs, involving conditional direct payments to compensate for foregone incomes and

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added costs incurred by land managers that provide environmental / ecosystem services (ES) (Ferraro and Kiss, 2002). The key concept here has been Payment for Environmental Services (PES). Theoretically, the greatest innovation differentiating this generation of conservation initiatives from the previous one is that payments or rewards are to happen only conditionally, i.e. as a *quid pro quo* for the provision of ES (Wunder, 2015). On the international climate agenda, this groundbreaking conditionality approach to incentivize ES provision was also reflected in the global initiative known as Reducing Emissions from Deforestation and forest Degradation, conservation of existing carbon stocks, sustainable forest management and enhancement of forest carbon stocks (REDD+). REDD+ was originally conceived as a result-based payment to countries for reducing their emissions of greenhouse gases (GHG) from deforestation (Angelsen, 2017). It was envisaged that these incentives from carbon markets to countries should be passed on to the land managers on the ground, in a type of multilevel PES scheme (Wertz--Kanounnikoff and Angelsen, 2009). However, including much smaller than anticipated REDD+ financing flows, coming so far mostly from bilateral donors, REDD+ has since evolved more towards a multi-objective set of policies addressing many connected concerns including rural poverty, biodiversity conservation, climate change adaptation, indigenous rights, and natural resource governance (Angelsen, 2017; Duchelle et al., 2018; Sunderlin and Sills, 2012; Wunder et al., 2020b).

Latin America has been one of the most fertile regions for the adoption of incentive-based conservation strategies such as PES and REDD+, given the typically large and resource-rich yet threatened nature of its forests, and a tradition for numerous development-oriented policies promoting natural resources exploitation (Balvanera et al., 2012; Ezzine de Blas et al., 2017). In addition to multiple local initiatives throughout the region, national PES programs in Costa Rica and Mexico are among the oldest worldwide, and have paved the way for other similar initiatives recently implemented elsewhere in the region, such as in Ecuador, Brazil, and Peru (Rosa da Conceição et al., 2015). As part of its climatic compromises within the frame of the Paris Agreement, Peru recently committed to unconditionally cut its GHG emissions by 30% until 2030, and an additional 10% cut conditioned by the availability of international support (Perú, 2020). Alongside the public National Forest Conservation Program (NFCP) and local REDD+ projects (Simonet et al., 2018), other parallel initiatives aligned with REDD+ goals have focused on implementing actions inside indigenous territories, covering jointly around 15% of the Peruvian Amazon (Espinoza Llanos and Feather, 2012). Furthermore, various local watershed-based PES-like incentive schemes (Tristán Febres, 2018) have also emerged over the last fifteen years.

Despite increasing adoption of incentive-based conservation initiatives during the last decades, only few country-level assessments exist in the literature (e.g. Suich et al. (2017); Pagiola et al. (2013)). Nevertheless, we know that contexts, including national-level finance, legislations and upscaling often matter a lot for appropriate incentive development (Börner et al., 2017). Hence, we aim to look for commonalities and differences among six ongoing Peruvian initiatives, scrutinizing to what extent their design and implementation has incorporated typical recommendations from the state-of-the-art conservation incentive literature (Engel, 2016; Wunder et al., 2018, 2020a). In Peru, an institutional milestone for replicating these initiatives was the enactment of Law No. 30215, "Law of Rewards for Ecosystems Services Mechanisms" in 2014, which formally introduced "*voluntary agreements that establish actions of conservation, recovery and sustainable use to ensure permanence of ecosystems*" as responsibility of the Peruvian State. We also discuss the role of the Peruvian State in the emergence and design choices of the analyzed initiatives. Our analysis may thus have relevance for other countries where nationwide legal frameworks for promotion of incentive-based conservation are either being designed (e.g. Brazil) or implemented (e.g. Colombia, Vietnam) (Jackson, 2018; To et al., 2012). We structured this paper as follows: in Section 2 we present the analytical framework. In Section 3 we describe the research methods, while the findings are presented in Section 4. Section 5 discusses the findings and presents concluding remarks.

2. The analytical framework

For the purpose of this paper, we define incentives as inducements aimed to make nature conservation (and ES provision associated with it) more valuable for land managers, as compared to degrading practices (Börner and Vosti, 2013; Emerton, 1999). The policy instruments that this definition covers include both positive financial and/or non-financial inducements (e.g. in-kind rewards consisting in training, equipment and agricultural inputs). Conversely, penalties and sanctions count as disincentives aimed to discourage nature degradation. These and other instruments may operate simultaneously in the form of 'policy mixes' customized to specific contexts (Bouma et al., 2019).

Given its wide adoption worldwide (Salzman et al., 2018), we are especially interested in the second generation of conservation incentives as described above, that is those featuring some level of conditional delivery of performance-based rewards. In the Peruvian context, this element is present in three types of interventions:

i. Rewards for Hydrological Ecosystems Services Mechanisms, term formally adopted to refer to local Payment for Watershed Services (PWS) initiatives;
ii. Local REDD+ type initiatives linked to voluntary carbon markets, where performance-based conditionality enters through market transactions (larger conserved forest areas trigger higher rewards); and
iii. Rewards to participant communities under the National Forest Conservation Program (NFCP) designed to be conditional upon compliance with environmental commitments (PNCBMCC, 2011).

Hence, throughout this paper we will use the term conditional conservation incentives (CCI) to generically refer to these initiatives. Typically, the performance conditionality that is contractually fixed and rewarded refers thus to *outcomes* (e.g. forest area conserved), rather than the longer-term ES *impacts* properly (forest carbon retained, stable water flows, etc.). Our analytical framework focuses on three aspects: (1) preconditions and enabling factors for CCI emergence; (2) design and implementation features potentially influencing their effectiveness; and (3) environmental and socioeconomic outcomes observed so far.

2.1. Preconditions and enabling factors for CCI emergence

The emergence of CCI is favored by the presence of certain economic preconditions, and institutional enablers (Wunder et al., 2020a). First, economic preconditions need to ensure that ES users (individual or collectively) are willing to pay enough to compensate land managers for mitigating their potentially ES damaging actions. Theoretically, this means that ES users' maximum willingness to pay (WTP) must meet at least ES providers' minimum willingness to accept (WTA) to make feasible the emergence of voluntary PES contracts. In practice, frequently this alleged *sine qua non* for PES is altered by both ES users' WTP and providers' WTA being also influenced by non-monetary values, agents' risk perceptions, expectations for volatile commodities prices, or existent land rights (Kosoy et al., 2007; Wunder, 2013). Although some studies using techniques derived from the economic theory aim to capture such parameters, real-world complexities often disconnect results from policy (Ferraro et al., 2011). Furthermore, upfront transaction costs needed for establishing CCI mechanisms may be unexpectedly high (Nantongo and Vatn, 2019; Rendón Thompson et al., 2013). In practice, ES users need to assume total or at least part of the costs to warrant ES provision, and ES providers need to be voluntarily enrolled in order to enable them to manifest their actual WTA.

Secondly, emergence of CCI also depends on the existence of adequate institutional structures. For instance, collective action is often required among both ES users and providers, so they need to be able to self-organize to act upon their aforementioned economic interests. Third actors (e.g. government agencies and local NGOs) typically play important mediating roles between ES recipients and providers, typically for fund management, monitoring and administrative functions. Frequently, these intermediaries also help assuming considerable CCI transaction costs, as it has been observed for many local REDD+ initiatives (Luttrell et al., 2017). Land tenure clarity is also an important institutional enabler, since ES providers must be able to exert exclusion rights into their enrolled areas vis-à-vis external actors (Wunder, 2013). Provision of more secure land tenure rights has sometimes been offered to ES providers as part of the reward packages (Montoya-Zumaeta et al., 2019; Suyanto, 2007).

2.2. CCI design and implementation features

Numerous contextual, design and implementation factors likely co-determine to what degree CCI produce successful outcomes (Börner et al., 2017; 2020). In line with the recent conservation incentive literature (Engel, 2016; Ezzine-de-Blas et al., 2016; Wunder et al., 2018), we focus on the identified key design and implementation choices – without dismissing the co-determinant role of other contextual, less manageable factors (e.g. climatic change, leakage displacement, etc.) for the attained outcomes. Accordingly, the recent CCI literature highlights the four critical design elements:

- *Spatial targeting,* which refers to prioritizing interventions on high-ES density areas (Wünscher et al., 2008) and/or those under major threat (Alix-Garcia et al., 2008), and doing so at different scales (national, project- or plot-level), when scarce funding makes enrollment of all willing landholders unrealistic.
- *Payment differentiation,* which implies landholders are paid variable rates, e.g. according to their levels and costs of ES provision. Varying payments is key for CCI efficiency when ES providers constitute a heterogeneous group (Engel, 2016).
- *Conditionality,* which as a key distinctive PES feature requires effective monitoring of compliance and sanctioning of non-compliance, the latter often being neglected (Sommerville et al., 2009; Tacconi, 2012; Wunder et al., 2018).
- *Customization of payment modalities*, e.g. cash vs. in-kind, collective community-based vs. individual landowner contracts, timing (*ex-ante* vs. *ex-post*) and duration of the contract (short vs. long) have all been claimed to influence environmental performance and socio-economic outcomes – including through feedback loops vis-à-vis perceived CCI equity and transparency (Engel, 2016; Pascual et al., 2014; Tacconi, 2012). Customization implies per definition that we cannot a priori say which design option is the most promising.

2.3. Outcomes and impacts

We also consider relevant to analyze the outcomes (and where possible, impacts) of CCI interventions, especially vis-à-vis conservation and wellbeing objectives. The key role that spatial targeting, price differentiation, and enforced conditionality have on environmental additionality (that is, the CCI bottom-line contribution to targeted ES provision, or at least forest-cover proxies) was empirically confirmed by meta-analyses of global PES datasets (Ezzine-de-Blas et al., 2016; Wunder et al., 2018). Furthermore, low perceived levels of equity and transparency in this type of initiatives can potentially erode participants' wellbeing (Hejnowicz et al., 2014; Maldonado et al., 2019).

The measurement of conservation impacts has arguably lagged behind that of policy interventions of other sectors such as education and health (Ferraro and Pattanayak, 2006), but has rapidly gained ground (Börner et al., 2017, 2020) Many rigorous PES impact evaluation studies using experimental or quasi-experimental methods show small but statistically significant levels of additional benefits for both conservation and wellbeing objectives (Börner et al., 2017; Duchelle et al., 2018; Snilsveit et al., 2019). Nevertheless, such studies have been much concentrated on few countries, principally Brazil, China, Costa Rica, and Mexico (Snilsveit et al., 2019).

3. Methods

3.1. Information sources

We rely on information from both primary and secondary sources. Thirty semi-structured interviews were conducted by the first author between February and March 2019 with CCI-related representatives at national and local levels (Table 1). We complement data from interviews with in-field information previously gathered by the first two authors during study missions.

Primary information was collected according to the following sequence: first, information from the Ministry of Environment (MINAM) and the National Superintendence of Sanitation Services (SUNASS) helped us preselect the case studies that are presented below. Then, local informants from each selected initiative were initially contacted via e-mail or telephone to explain the study context. Appointments were made with the understanding that interviews were voluntary, and information provided would be treated confidentiality. Face-to-face semi-structured interviews were conducted after formal prior informed consent was received following the Human Ethics Protocol 2018/435 of the Australian National University. Interview questions tackled aspects concerning CCI history, implementation, key actors, legal norms, rules, outcomes, and difficulties, among others. Simple descriptive statistics were estimated using MS-Excel to analyze interview responses. Also, we collected secondary information including journal articles, publicly available grey literature, and internal reports, including documents referred to us by our informants.

3.2. Selection of case studies

To select case studies for our analysis, firstly we elaborated an initial long list containing more than sixty CCI initiatives across the country in diverse implementation stages (Supplementary Data), based mainly on information provided by informants from MINAM and SUNASS. Currently, these two government organizations are the most prominent stakeholders promoting this type of initiatives nationwide. We complemented such information with available previous nationwide inventories of CCI, such as Entenmann (2012), Quintero and Pareja (2015), MINAM (2016), Tristán Febres (2018), and Simonet et al. (2018). From the long list, we picked initiatives meeting the following two requirements: (1) to-date evidence of continuous activities on the ground (at least three consecutive years of operations); and (2) sufficient availability of reliable secondary information about the local context in which the initiative emerged, as well as its design and implementation features. As result of this screening, the following six initiatives were

Table 1
Interviews conducted for this study.

Stakeholder	Place of interview		Total
	Headquarter	Local office or intervention area	
Ministry of Environment (MINAM)	4	–	**4**
National Superintendence of Sanitation Services (SUNASS)	2	1	**3**
Project/program implementers	3	9	**12**
ES provider representatives	–	8	**8**
Research centers	3	–	**3**
Total	**12**	**18**	**30**

selected (Fig. 1):

1) The National Forest Conservation Program (NFCP),
2) The Moyobamba Rewards for Hydrological Ecosystem Services Mechanism (MRHESM),
3) The Quiroz Water Fund (QWF),
4) The Ucayali Forest Management Project to Reduce Deforestation and Forest Degradation in Seven Indigenous Communities (REDD-U),
5) The Alto Mayo Conservation REDD+ Initiative (AMCI), and
6) The REDD+ Project in Brazil Nut Concessions of Madre de Dios (BN-REDD).

4. Findings

4.1. CCI overview, emergence preconditions and enablers

Firstly, we provide some general information about the six CCI initiatives analyzed here. Three of these are subnational REDD+ projects aiming to reduce forest threats arisen from multiple drivers, including construction and improvement of roads in Madre de Dios (Chávez et al., 2014; Naughton-Treves, 2004), San Martín (MINAM, 2010), and Ucayali (Ugarte-Guerra, 2009). Another two initiatives, QWF and MRHESM, use PES mechanisms to enhance the provision of hydrological services to farmers and potable water users by conserving targeted ecosystems in the northern departments of Piura (Andean *páramos*) and San Martín (cloudy rainforest), respectively (Quintero and Pareja, 2015). The NFCP, conceived as a upscaled PES program, aims to make contributions in reducing deforestation inside indigenous communities territories located across the Peruvian Amazon (Giudice et al., 2019). As of December 2017, 188 indigenous communities in nine departments (Cerro de Pasco, Loreto, Junín, Cusco, Amazonas, Ucayali, San Martín, Madre de Dios, and Huánuco) managing more than 1.8 millions of forest hectares were participating in the initiative (PNCBMCC, 2018). Intervention areas of selected REDD+ projects in Madre de Dios, San Martin, and Ucayali cover 308,000, 182,000 and 128,000 ha, respectively. QWF and MRHESM initially identified ecosystems with high potential to provide watershed regulation services, and sought to enroll only prioritized upstream zones; thus their intervention areas are both smaller by design (see Section 4.2.3).

The alleged economic preconditions for CCI emergence require ES recipients to be willing to pay (WTP) at least as much as ES providers are willing to accept (WTA) in compensation (see Section 2). Some empirical evidence shows moderate but still significant WTP from especially watershed ES users across the country to conserve the ecosystems providing these (Carbajal and Lucich, 2014; Lucich and Gonzales, 2015; Montoya-Zumaeta and Nolazco Cama, 2015). ES recipients in our six Peruvian cases include local water users, international carbon markets buyers, national taxpayers, private funders, and foreign governments (such as Germany and Norway) who catalyze development funding to the implementation of CCI. On the supply side, Börner et al. (2016) found in a study supporting PNCB implementation at the scale of the Peruvian Amazon that opportunity costs, an important proxy for ES providers' WTA, are quite heterogeneous, and influenced by multiple factors. Among our study cases we found that factors strongly reducing WTA are legal restrictions (MRHESM, AMCI, and BN-REDD), internal collective restrictions (NFCP, and REDD-U), and distance to markets (QWF). However, our interviews seemed to confirm that ES providers were enrolled voluntarily in all the six analyzed cases, either through individual agreements (as in the case of AMCI, MRHESM, and BN-RDD), or by obtaining collective acceptance from communities according their internal rules (in the case of NFCP, REDD-U, and QWF).

Meanwhile, implementers in the analyzed cases included a national private non-profit organization with expertize in carbon finance (REDD-U), an international non-government organization (AMCI), multi-actor platforms (QWF and MRHESM), a regional producer organization (BN-REDD), and a decentralized national government office within the

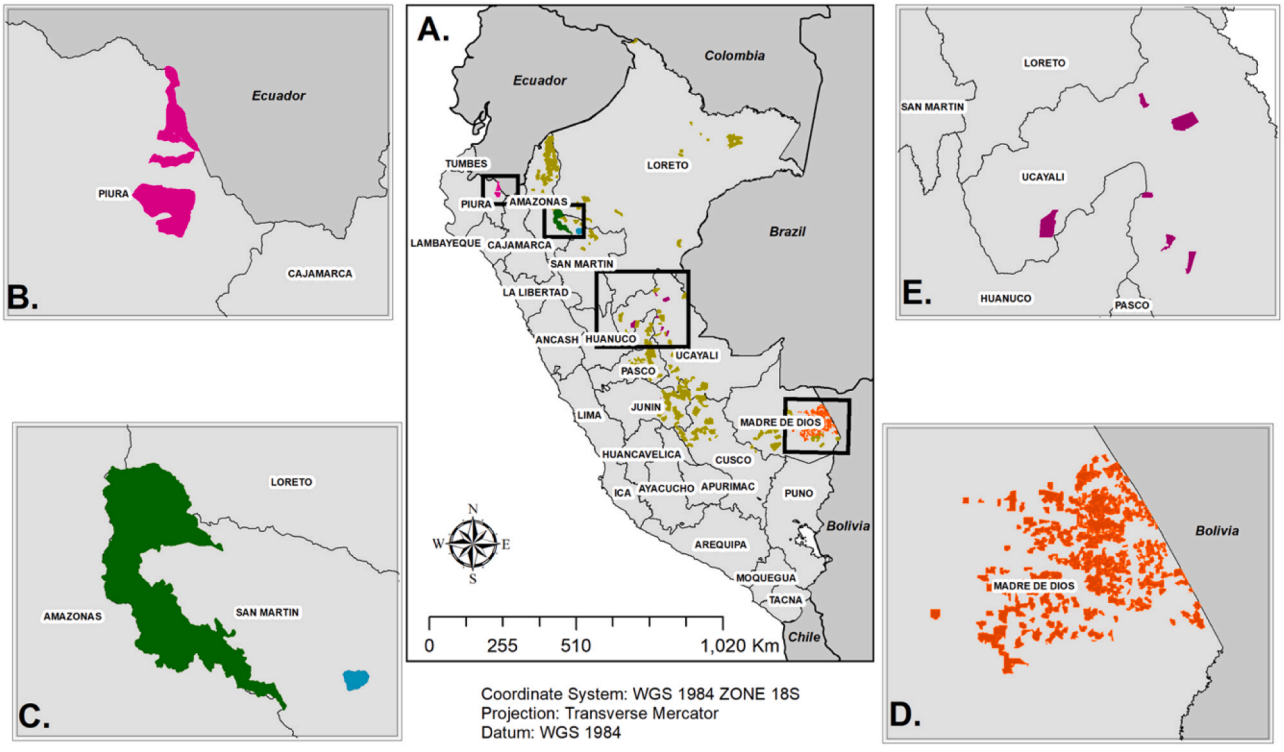

Fig. 1. Location of selected CCI. Panel A: Indigenous community territories enrolled into the NFCP across the Peruvian Amazon (olive green). Panel B: Intervention area of QWF in Department of Piura (fuchsia). Panel C: Alto Mayo Protection Forest (dark green) and Rumialba Ecological Conservation and Recovery Zone (blue), where AMCI and MRHESM are implemented, respectively. Panel D: Brazil nut concessions participating in the BN-REDD initiative in Department of Madre de Dios (orange). Panel E: Indigenous communities participating in the REDD-U initiative in the Department of Ucayali (purple).

Table 2
Overview, preconditions of emergence, and institutional enablers of initiatives.

	NFCP	*MRHESM*	*QWF*	*REDD-U*	*AMCI*	*BN-REDD*
Starting year	2010	2004	2012	2010	2008	2009
Focus on	Conserved forests / carbon.	Hydrological services	Hydrological services	Carbon	Carbon/ hydrological services	Carbon
Ecological region	Amazon region – nine departments (Dec. 2017).	Cloudy Amazon forest (San Martin).	Andean *páramos* and montane cloud forests (Piura)	Amazon lowlands (Ucayali)	Montane/ pre-montane native forests (San Martin), Alto Mayo watershed (San Martin, Amazonas, Loreto).	Amazon lowlands (Madre de Dios)
Enrolled areas (ha)	1821,635	2430	18,153	128,213	182,000	308,757
ES providers	8890 households in 188 indigenous communities (Dec. 2017).	65 households in and around conservation area "Rumialba".	578 households in two peasant communities and 11 villages.	553 households in seven indigenous communities	966 households in the Alto Mayo Protection Forest (AMPF) and its buffer zone	388 Brazil nut concessionaires, Madre de Dios
ES providers' enrollment	Voluntary after community acceptance.	Voluntary through temporary individual conservation agreements.	Voluntary after community acceptance.	Voluntary after community acceptance.	Voluntary through yearly renewable individual conservation agreements.	Voluntary through 30 years individual contract (disenrollment allowed).
ES buyers/ recipients	Bilateral donors (Germany, Norway) and Peruvian taxpayers.	Drinking water users in Moyobamba (~90,000 inhabitants) and Peruvian taxpayers (indirect users).	10,256 agrarian producers from San Lorenzo Water User Council, private funders.	Buyers in voluntary carbon markets, private funders.	Buyers in voluntary carbon markets, private funders.	Buyers in voluntary carbon markets, private funders.
Implementers	Ministry of Environment (MINAM) – specific executive unit (NFCP) with field offices	Management Committee comprised by representatives of both ES providers and recipients, as well as of some facilitators (Alto Mayo Special Project – PEAM, EPS Moyobamba, local NGOs).	Technical Secretariat of Quiroz Water Fund.	Association for Investigation and Integral Development (AIDER)	Conservation International (CI)	Federation of Madre de Dios Brazil nut Harvesters – FEPROCAMD (2011-current); Environmental Conservation and Development – CAMDE (2009–2013)
Other relevant facilitators	UNDP, UNEP, FAO, World Bank, Norad, KfW, GIZ.	GIZ, NGO Condesan, PEAM, EPS Moyobamba.	Naturaleza y Cultura Perú.	Althelia Funds, Ecosphere.	Sernanp, MINAM.	Bosques Amazónicos – BAM / Andean Crown investments group.
Unitary provision costs (in ha $year^{-1}$)[a,b]	PEN17.08 / US$5.17	PEN97.08 / US$29.42	PEN26.44 / US$8.01	PEN19.64 / US$5.95	PEN9.99 / US$3.02	PEN1.71 / US$0.52
Transaction costs (as share of total provision costs)[a]	~42%	84.6%	~10%	~20%	~10%	~10%
% of costs funded by ES user contributions[a]	84.51%	85.14%	77.27%	100%	100%	100%
Property rights	Forests enrolled in indigenous communal territories, officially recognized. Community rights to forest revenues explicitly recognized in Title 1, 4th Section, Law No. 29763 "Forestry and Wildlife Law".	Enrolled areas overlap with state-owned conservation area (Rumialba). Contracted households hold plots also in buffer zone, recognized *de facto* land users.	Legally state-recognized peasant communities, plus villages with *de facto* land right. Minor overlaps with mining concessions.	Indigenous state-recognized communal territories, with rights to forest revenues explicitly recognized in Title 1, 4th Section, Law No. 29763 "Forestry and Wildlife Law".	AMPF state-owned conservation area, since 2012 managed by CI. Contracted households, recognized by the State and CI as *de facto* land users, hold plots in AMPF and buffer zone.	Individual Brazil nut concessionaires, with rights to forest revenues explicitly recognized in Title 1, 4th Section, Law No. 29763 "Forestry and Wildlife Law".
Land tenure issues	Infrequent encroachment by loggers and colonist farmers. Some overlaps with rights awarded to implement conflicting land uses (mainly logging, mining, oil and gas extraction).	Infrequent encroachment by colonist farmers in Rumialba.	Infrequent encroachment by external herdsmen. Some overlaps with rights awarded to implement conflicting land uses (mining).	Infrequent encroachment by loggers and colonist farmers. Some overlaps with rights awarded to implement conflicting land uses (mainly logging and gas extraction).	Infrequent encroachment in AMPF by loggers and colonist farmers.	Infrequent encroachment by loggers and colonist farmers. Some overlaps with rights awarded to implement conflicting land uses (mining, logging), and other Brazil nut concessions.

[a] Estimations using data from internal reports provided by implementers and secondary sources (e.g. MINAM (2016), Simonet et al. (2018)).
[b] ES provision costs include transaction costs, protection cost (costs of actively monitoring third-party intrusion, typically being part of ES providers' contractual duties), and implementation costs (costs of delivered incentives such as trainings, technical assistance, among others). Exchange rate: PEN 3.33 per US$1.00 (January 2020).

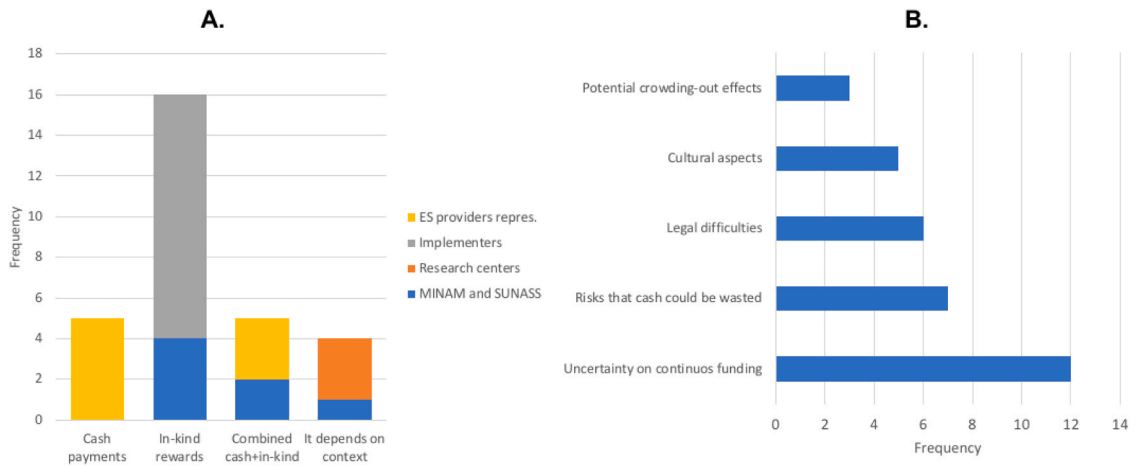

Fig. 2. Interviewees' perspectives on desirable type of incentives. Panel A (left): Interviewees' preferred type of incentives. Panel B (right): Five most cited reasons for implementers to prefer in-kind rewards.

MINAM (NFCP). Other facilitators included public sector bodies such as the Moyobamba EPS (Sanitation Services Provider Company), MINAM and the National Service of Protected Areas (Sernanp), province and district municipalities, the local non-government organization (NGO) Naturaleza y Cultura Perú, multilateral and bilateral agencies (World Bank, United Nations agencies FAO, UNEP, UNDP, the German Cooperation - GIZ), among others. We found that frequently these external actors have provided support in the form of financial and human resources to absorb considerable transaction and implementation costs, thus facilitating the emergence of such initiatives.

With regard to land tenure security as an institutional precondition, in four out of our six study cases ES providers have legal recognition of their rights, as the State has granted collective land rights to peasant and indigenous communities participating in QWF, NFCP, and REDD-U; as well as individual rights awarded to Brazil nut concession managers participating in BN-REDD. This recognition allows them to obtain economic benefits from forest ecosystem services as established by the Law 29763 "Forestry and Wildlife Law" enacted in 2011. Given that MRHESM and AMCI intervention sites overlap with state-owned conservation areas and their buffer zones, migrant farmers participating as ES providers in these are only recognized as *de facto* land users, with considerably limited usufruct land rights. Therefore, allegedly only land uses compatible with conservation objectives are allowed by the State in areas where both initiatives are being implemented (Kowler et al., 2016). The clarification of tenure aspects in the MRESHM which included the establishment of a conservation area substantially increased its transaction costs (Montoya-Zumaeta et al., 2019). Although some encroachments inside intervention areas as well as overlaps with conflicting land uses (logging, mining, oil and gas extraction) were reported during interviews, these are considered relatively infrequent, and are typically solved quickly with help from CCI implementers and facilitators. The aspects described in this section are presented in detail in Table 2.

4.2. Design and implementation features

4.2.1. Rewards vs. payments

In-kind rewards have been preferred to cash in compensating ES providers within the selected CCI cases, although the two modalities were in principle combined in both REDD-U and BN-REDD. The mostly discontinuously provided rewards have included financial and technical assistance for sustainable livelihoods (e.g. beekeeping, eco-tourism, sustainable forest management, cocoa and coffee agroforestry), sanitation infrastructure, seeds and other reforestation inputs. Yet, some rewards were still delivered annually according to scheduled contracts (MRHESM and AMCI), or through collective investments plans (QWF and NFCP). Interestingly, the preference for in-kind rewards lies strongly on the implementer side, while our small sample of consulted ES providers would prefer either cash or an in-kind with cash combination (Fig. 2A). BN-REDD and REDD-U contracts did include fixed profit shares from carbon credits sales that would be distributed to enrolled participants. Nevertheless, according to our informants in none of these projects cash payments have taken place so far, due to difficulties to obtain funds from voluntary carbon markets. In all the analyzed initiatives, implementers' preference for in-kind rewards respond also to uncertainties to establish a continuous flow of funding, and to a lesser extent their doubts about the capacity of cash payments to trigger sustainable local welfare gains (Fig. 2B). The existence of legal restrictions on the use of public funds for direct cash payments has influenced the in-kind choice in some initiatives, including the two mostly funded with public investments, NFCP and MRHESM (Quintero and Pareja, 2015).

4.2.2. Enforced conditionality

Contracts in four out of the six examined CCI cases (FNCP, MRHESM, AMCI and QWF) explicitly stated reward delivery to be conditional upon environmental compliance. Yet, another question is to what extent conditionality by design was also enforced in practice. We decomposed enforced conditionality into two elements: periodic compliance monitoring, and sanctioning incompliance. Remote sensing technologies are used to monitor land-cover changes in NFCP and the three REDD+ projects, given the relative simplicity to infer carbon storage dynamics from spatial analyses (Ferraro et al., 2015). For both watershed initiatives (QWF and MRHESM), land-cover changes were monitored, but focus here has mainly been on detecting farm-level land clearances, discharge of contaminated water, etc. More recently (and infrequently), direct measurements of water quality parameters have also been adopted by both initiatives.

In relation to sanctioning, Montoya-Zumaeta et al. (2019) report for MRHESM that at least one noncompliant participant was not only not rewarded, but also sentenced to a prison term due to clearance of forest enrolled into the initiative for coffee expansion, and existence of legal restrictions to his plot that went beyond the CCI conditionalities. Conversely, Giudice et al. (2019) report occasional non-sanctioned infractions against contracted environmental obligations, committed by communities enrolled into the NFCP pilot phase, although a graduated sanctioning system (which includes successive written warnings, partial reductions in rewards, and retirement from the initiative as a last resort) has been implemented more recently, according to our informants. A similar graduated sanctioning system is being applied in QWF and

Table 3
Design and implementation characteristics of selected CCI.

	NFCP	*MRHESM*	*QWF*	*REDD-U*	*AMCI*	*BN-REDD*
Payment/rewards	PEN10/US$ 3.33 per ha yr^{-1} of conserved forest, disbursed through communal investments plans. Contract duration: 3–5 years.	In-kind rewards: technical assistance, reforestation, sanitation infrastructure, shaded coffee systems, support for benign activities: beekeeping, sustainable tourism, handcrafts.	In-kind rewards: technical assistance, reforestation, support for sustainable activities (avocado and coffee production).	In-kind rewards: technical support, forest enrichment, training. Being considered: community cash payment of half of surplus above minimum carbon price (~US$1.5 per tCO_2) from carbon offsets in voluntary markets.	In-kind rewards: technical assistance for coffee, post-harvesting equipment, sanitation (ecological kitchen and toilets), small livestock (e.g. guinea pigs), and incomes from sustainable activities: birdwatching, communal tourism, and cultivation products (pitahaya, cupuassu).	In-kind rewards: technical-legal support, loans, forest enrichment, training. Being considered: infrastructure (two Brazil nut processor plants), and cash payments of 30% of total carbon offsets from voluntary markets to participant Brazil nut concessionaires.
Payment frequency	Yearly during the contract lifespan (maximum 5 years).	2012–15: rewards disbursed periodically to agreements signatories. Since 2015: rewards paid irregularly, depending on limited funds available.	Payments disbursed through communal investment plans during five-year agreement lifespan.	In-kind rewards during investment stage. Carbon payments depend on transaction in voluntary market: no carbon bonds had yet been sold by March 2019.	In-kind rewards are disbursed periodically to conservation agreements signatories. Schedule detailed in one-year renewable contracts.	In-kind rewards paid during investment stage. Payments from carbon sales depend on transaction concreted in voluntary market.
Enforced conditionality	Contracts state that delivery of rewards is conditional to environmental compliance. However, occasional non-sanctioned infractions (Giudice et al., 2019).	Contracts state that delivery of rewards is conditional upon environmental compliance. Infrequent monitoring but possibility to be sanctioned in case of non-compliance (Montoya-Zumaeta et al., 2019)	Contracts state that delivery of rewards is conditional to environmental compliance. Infrequent monitoring and also occasional non-sanctioned infractions.	Contracts don't explicitly stipulate conditionality in rewarding participants.	Contracts state that delivery of rewards is conditional upon environmental compliance. However, occasional non-sanctioned infractions.	Contracts don't explicitly stipulate conditionality in rewarding participants.
Spatial targeting	Enrolled non-threatened forests self-selected by indigenous communities during 2011–15 (Giudice et al., 2019). Some adjustments recently introduced in this regard.	Hydrological priority areas were pre-identified using Soil and Water Assessment Tool (SWAT). But then action included non-priority areas (e.g. Almendra watershed).	Hydrological priority areas were pre-identified using Soil and Water Assessment Tool (SWAT), but some identified areas are common-pool, and one nearby community could not be enrolled.	Focused on seven indigenous community territories in department of Ucayali, most of them with limited road access. Internal targeting is not applied.	Upper Alto Mayo watershed, deforestation hotspot with immigration waves since 1960s (road construction). Internal targeting is not applied.	Threatened forests alongside Southern Inter-Oceanic Highway. Internal targeting is not applied.
Payment differentiation	Rewards customized considering enrolled forest area and a flat payment equivalent to PEN10/US$3.33 per ha yr^{-1} of conserved forest.	Rewards for 2010–12 customized according to socioeconomic status of each participant.	Rewards customized according to each community's investment preferences.	Rewards customized according to each community's preferences and needs.	Rewards customized according to participants' socio-economic status and preferences.	Rewards customized according to each community's preferences and needs.
Decision-making process	Ruled by State norms, but some participative processes on the selection of communal forest for enrollment and customized rewards.	Management Committee has representatives of enrolled participants. But ZOCRE decisions are centralized with San Martin government's environmental division.	Decisions are made within Technical Secretariat, with participation of communal representatives.	Centralized by implementer. Communities are informed about decisions.	Centralized by implementer. Communities are informed about decisions.	Centralized by implementer. Zonal leaders periodically elected are consulted occasionally for few decisions.
Benefit distribution	Rewards negotiated with each community; agreements compiled in Communal Investment Plan.	Rewards negotiated with each household; agreements compiled in Communal Investment Plan. Leakage of some in-kind rewards	Reward negotiated with each community; agreements compiled in Communal Investment Plan.	Participation and (potential) benefits are discussed with each community. Carbon sales and disbursement towards communities still pending.	Rewards are negotiated with each household; agreements compiled in annual conservation contracts.	Participation and (potential) benefits were discussed with each concessionaire. Carbon sales and disbursement are still pending.

(*continued on next page*)

Table 3 (*continued*)

	NFCP	***MRHESM***	***QWF***	***REDD-U***	***AMCI***	***BN-REDD***
		(training, seeds) towards non-enrolled participants seemingly occurs.				
Transparency mechanisms	Financial and project information is continually uploaded to the initiative's website (bosques.gob.pe). Fluent communication between implementer and ES providers is reported.	Information is delivered to the Management Committee through periodic meetings. Externals can access to the initiative information by request.	Information is delivered to participants through periodic in-villages meetings. Fluent communication between implementer and ES providers is reported.	Technical information on its progress is accessible through public websites.[a] Other information can be provided by request.	Technical project information accessible through public websites.[a] Other information can be provided by request.	Technical project information accessible through public websites.[a] Other information can be provided by request.

[a] registry.vera.org; reddprojectsdatabase.org; serviciosecosistemicos.minam.gob.pe.

AMCI, although our informants also report that occasional non-sanctioned infractions have occurred in these.

4.2.3. *Spatial targeting*

Spatial targeting efforts usually focus on some combination of high ES levels, high threat/leverage, and low costs (Engel, 2016; Wunder et al., 2018). Most of our CCI cases are located in departments that over the last two decades have ranked high in term of their deforested areas, such as Madre de Dios, San Martin and Ucayali (MINAM, 2017). In Madre de Dios, the BN-REDD deliberately targeted threatened forests containing large volumes of carbon, located alongside the Southern Trans-Oceanic Highway (Naughton-Treves, 2004), yet its intervention area also entails no-road access forests. Likewise, in San Martin both AMCI and MRHESM intervention areas overlaps with vulnerable forests located near to the Fernando Belaunde Road, yet some areas with substantially less access were also preventively enrolled. Furthermore in MRHESM, the Soil and Water Assessment Tool have enabled implementers to identify which parts of the targeted watershed are most sensitive towards land-use changes and degradation (Quintero et al., 2009), nonetheless the Almendra micro-watershed that was not identified as a major potential contributor of sediments – the main ES focus – but being part of the local conservation area, it was included into the CCI initiative. In Ucayali, in the REDD-U most of the areas enrolled into the initiative are located in relatively low-threatened remote indigenous territories with quite limited road access.

Given its national scope, the NFCP have managed to enroll communities from departments containing more recent deforestation hotspots such as Huánuco and Loreto in addition to those mentioned above (MINAM, 2017), however its strategy was only imperfectly threat-targeted: several forest areas with very low deforestation risk were consciously enrolled in the program for the 2011–15 period, due to participant communities' own preferences and implementers' acceptance (Giudice et al., 2019). On the other hand, the intervention area in Piura where the QWF operates faces other type of threats, such as overgrazing and mining pollution (Albán Contreras, 2017). Like in MRHESM, remote sensing-based tools were also applied in QWF to identify areas with higher potential for provision of hydrological services during the CCI design phase (TWINLATIN, 2008). Nevertheless, a strategic upstream community of highest hydrological ES priority could not be enrolled into the initiative. In sum, some targeting in area enrollment is certainly applied across the six initiatives, but variably and imperfectly so as either the uneven spatial risk distribution is only lightly considered, or low-threatened zones are included even consciously.

4.2.4. *Reward differentiation*

A differentiation of payments/rewards is in conservation incentive schemes recommended so as to give priority to the enrollment of high-ES/high-additionality land areas, even when some of those are associated with higher landowner provision (incl. opportunity) costs (Engel, 2016; Wunder et al., 2018). Some implementers state to have customized in-kind rewards considering participant preferences (e.g. in investment plans of NFCP and QWF), and/or their socio-economic status (AMCI, MRHESM), seeking to achieve social improvements. However, customizations have been done using simple criteria such as the size of enrolled area such as in NFCP (Börner et al., 2016), or participants' preferred sustainable economic activities (in QWF), not the variable cost or quality of ES provision, as CCI theory would alleged (see above). Hence, within the six analyzed CCI efforts to differentiate prospective payments or rewards were not motivated by environmental additionality or cost efficiency. Based on informants' testimonies, we infer that the limited effort to differentiate payments for efficiency responds to two main reasons. Firstly, implementers may prioritize equitable rewards using fairness criteria (e.g. egalitarian, pro-poor) that outweigh environmental targets (Börner et al., 2016; Pascual et al., 2010). Secondly, implementers' underlying assumption is that poverty is a primary

driver of ecosystem degradation. Hence, by addressing participants' needs, allegedly they will support forest conservation.

4.2.5. Equity

In this subsection we analyze two elements closely related to perceived equity within CCI (McDermott et al., 2013): (1) participation of providers in decision-making processes, and (2) distribution of benefits. As to the former, top-down decision-making structures are predominant in our selected cases, sometimes generating strong discomfort to ES providers. For instance, non-consulted forthcoming changes in MRHESM implementation resulted in strongly negative household-stated perceived wellbeing (Montoya-Zumaeta et al., 2019).

Secondly, although in some cases (QWF, NFCP, MRHESM, and AMCI) benefits had been negotiated before participants' enrollment (or their communal representatives, for collective agreements), it is not clear to what extent they actually came to benefit. For instance, for MRHESM we identified spillover of some benefits toward non-enrolled participants like training and agricultural inputs that were consciously delivered beyond the group of conservation agreements signatories, as a political strategy to obtain greater acceptance in the intervention area, allegedly motivating broader participation. Likewise, in the BN-REDD project some CCI-contracted ES providers claim they received no benefits (such as technical support and training), while non-enrolled Brazil nut concessionaires participated instead.

4.2.6. Transparency

We can define transparency for our purposes as the timely and reliable provision of information to all relevant stakeholders (Kolstad and Wiig, 2009) involved with CCI initiatives. Transparency contributes to the sustainability of these initiatives; the inclusion of transparent strategies can avoid perceptions of corruption and make stakeholders' responsibilities publicly more accountable (Tacconi, 2012).

In this respect, all CCI initiatives have established communication channels between implementers and ES providers (Table 3). In NFCP and QWF, both consulted implementers and enrolled participants concur that fluent communication exists within such initiatives. However, in MRHESM and all the three REDD+ initiatives seemingly information about fund management and benefit distribution do not trickle easily through to the multiple stakeholders, including the proper ES providers. Here, interviewees' responses differ: while implementers consider that information is fluid, other consulted informants perceive that communication with implementers and facilitators is claimed to be infrequent and unclear, therefore causing ES providers' dissatisfaction towards the formers' role. Particularly for BN-REDD, this perception has seemingly raised some suspicions about mismanagement of carbon sales revenues.

4.3. Outcomes

4.3.1. Environmental additionality

Environmental additionality is the incremental contribution that an initiative achieves in terms of ES provision, compared with a counterfactual business-as-usual scenario (Tacconi, 2012). The assessment of counterfactuals – meaning "what would have happened without the intervention?" – is central to any quantitative environmental impact evaluation (Ferraro, 2009; Ferraro and Hanauer, 2014). Our primary sources here are quasi-experimental impact evaluations, such as was recently performed for NFCP and MRHESM. Giudice et al. (2019) reported small positive conservation effects from NFCP, surprisingly on non-contracted rather than contracted community forests, inside enrolled indigenous communities' territories (557 ha of forests conserved during 2011–15). The effects on contracted forest were negligible. Meanwhile, Montoya-Zumaeta et al. (2019) found that MRHESM conserved between 7.91 and 22.25 ha of primary forest into the ZOCRE Rumialba for the 2010–16 period, with at least one third of it being attributable solely to the CCI component. However, beyond of impacts on the land-use proxy of forest conserved, its actual contribution to the provision of targeted hydrological services per se has still not been rigorously assessed. A recent impact evaluation performed for BN-REDD did not find statistically significant effects of the CCI initiative on avoided deforestation and forest degradation for the 2012–2018 period (Montoya-Zumaeta, 2021).

For the remaining initiatives, only less rigorous information about their impacts is available, such as analysis funded by the same

Table 4
Environmental and socioeconomic outcomes of selected CCI.

	NFCP	***MRHESM***	***QWF***	***REDD-U***	***AMCI***	***BN-REDD***
Environmental additionality	557 ha conserved forests for 2011–15 period (Giudice et al., 2019).	Between 1.13 and 3.29 Ha of conserved forests per year in average inside the ZOCRE Rumialba for 2010–16 (Montoya-Zumaeta et al., 2019). Evaluation of hydrological impacts still pending	Rigorous counterfactual based impact evaluation still pending. 80 Ha were reforested with native species between 2014 and 2016 (Albán Contreras, 2017).	Rigorous counterfactual based impact evaluation still pending. Recently, a report elaborated by AIDER claim that the initiative has contributed to avoid deforestation of 4 856 Ha equivalent to a reduction of 2,8 millions of CO_{2e} tonnes for the 2013–2018 period (AIDER, 2019).	Rigorous counterfactual based impact evaluation still pending. Evaluation carried out by the implementer argue that the initiative has contributed to decrease deforestation in the Alto Mayo Protection Forest and surrounding areas by 24% for 2012–16 avoiding emission of 5.6 millions of CO_{2e} tonnes (CI, 2017).	Alleged conservation of about 20,000 forest hectares. A 2012–2018 counterfactual based impact evaluation of the initiative found no statistically significant effect of the initiative on avoided deforestation nor forest degraded areas (Montoya-Zumaeta, 2021).
Socio-economic and wellbeing impacts	Rigorous counterfactual-based impact evaluation still pending.Giudice et al. (2019) suggest a major participation in alternative economic activities (cocoa and coffee production, ecotourism, etc.) promoted in frame of the initiative.	Significant positive impacts on household incomes and assets. Negative significant effect on perceived wellbeing (Montoya-Zumaeta et al., 2019).	Rigorous counterfactual-based impact evaluation still pending. At least two alternative economic activities strategically introduced in the period 2014–2016 (Albán Contreras, 2017).	No significant effect on households' environmental incomes nor assets (Solis-Chavez, 2017).	Rigorous counterfactual-based impact evaluation still pending. Four alternative economic activities strategically introduced in the period 2012–2016 (CI, 2017).	Strengthening of the regional Brazil nut harvesters' organization. No significant effect on households' environmental income nor assets (Solis-Chavez, 2017). Negative significant effect on perceived wellbeing (Montoya-Zumaeta, 2021).

implementers. In relation to AMCI, an implementer-commissioned study found that the initiative had reduced deforestation by 24%, thus avoiding the emission of 5.6 millions of CO_{2e} tonnes during the 2012–16 period (CI, 2017). Similarly, a report prepared by the implementer of the REDD-U initiative claims that it contributed to the avoided deforestation of 4856 ha, equivalent to a reduction of 2.8 million tonnes of CO_{2e} in the 2013–2018 period (AIDER, 2019) – about one third of what the intervention originally planned to mitigate. Nevertheless, these estimates tend to overestimate actual CCI contributions since the effects of other policies and confounding factors (e.g. lower agriculture returns) are not properly controlled for (West et al., 2020). In QWF, 80 ha were reforested with native species between 2014 and 2016 (Albán Contreras, 2017). Although relatively small, this contribution would arguably not have happened without the initiative, as no other reforestation program or related policy is taking place in the same site.

4.3.2. Socioeconomic and wellbeing impacts

All our Peruvian CCI case studies featured participants' adoption of environmentally friendly economic activities. These included agroforestry coffee and cocoa production (NFCP, MRHESM, AMCI, REDD-U), community tourism (NFCP, MRHESM), reforestation with native species (QWF), and sustainable forest management (REDD-U, BN-REDD). Implementers made investments to promote adoption of such activities (see Section 5). Rigorous counterfactual based evidence about hoped-for positive effects on participants' incomes and livelihoods in our selected CCI cases is still inconclusive: indications exist for only three out of the six (Table 4). Montoya-Zumaeta et al. (2019) find significant positive effects of MRHESM in-kind rewards on households' incomes and assets, though recent self-reported wellbeing was strongly undermined by participants' unmet expectations. Also using a quasi-experimental approach, Solis-Chavez (2017) did not find statistically significant evidence that participation in REDD-U and BN-REDD had increased participating households' environmental incomes or assets. No welfare-oriented impact assessment exists for the NFCP, but Börner et al. (2016) using simulations find that the current design leads to an inequitable concentration of benefits in relatively few, land-abundant communities. Giudice et al. (2019) suggest ample adoption of alternative economic activities (cocoa and coffee production, ecotourism, etc.), though we do not know to what extent these have improved incomes. Likewise, similar interventions were introduced in QWF (Albán Contreras, 2017) and AMCI (CI, 2017) to mitigate land-cover threats in intervention areas; however, robust estimates for socioeconomic outcomes have not been reported so far.

5. Discussion and conclusion

As elsewhere in Latin America, in Peru the introduction of CCI initiatives to promote the sustainable provision of ES has attracted much attention by conservation practitioners. Yet, most of the 60+ Peruvian initiatives adopting CCI we list in Appendix 1 are still in very early implementation stages. According to our informants from MINAM and SUNASS, their limited progress is explained by some level of distrust from local actors, e.g. municipalities and drinking water companies: they still view performance-based payments with a certain skepticism. In that sense, the role of third parties (mainly NGOs) has been very important on contributing firstly to consolidate economic pre-conditions in some of these initiatives by, for example, gathering and disseminating information to ES users about the importance of targeted ecosystems (such as in both watershed-based CCIs) with the hope that these environmental consciousness campaigns could stimulate their WTP. Similarly, in some cases intermediary NGOs have also put some downward pressure on providers' WTA in MRHESM and AMCI, by enhancing enforcement of pre-existent legal land-use restrictions: a more credible local regulatory threat has reduced the business-as-usual profit potentials of land users, and thus curbed their conservation opportunity costs, making them ceteris paribus more willing to accept payment offers. Therefore, involvement of NGOs either as implementers or facilitators during early adoption of CCI trials seems to be key for their progress, including for shaping realistic expectations among the local actors. In all our case studies, NGOs typically backed by external donor funding assumed considerable CCI startup costs, and remained actively involved in QWF, AMCI and REDD-U, providing funds and legal-technical assistance in matters such as land-tenure issues (cf. Section 4).

Legal constraints and funding shortages seem to have a determinant role in some of implementers' design choices, such as vis-à-vis the type of rewards. For instance, legal restrictions determined that in-kind rewards (e.g. public investments) were provided, rather than continuous cash payments (NFCP and MRHESM). QFW, mostly funded privately, made temporary investments in communities aiming to generate lastingly positive environmental outcomes. Given the slow development of voluntary carbon markets (Ecosystem-Marketplace, 2019) with considerable declines in traded carbon volumes (dropping from 131.4 millions of CO_{2e} tonnes to 98.4 millions for the 2010–2018 period) and prices (peaking at US$6.20 per CO_{2e} tonne in 2011, then dropping to on average US$3.01 in 2018, though substantially lower prices were negotiated by some projects, as in the case of BN-REDD); alleged cheaper in-kind rewards in the form of technical assistance, reforestation and agroforestry inputs, promotion of sustainable economic activities have been also used as incentives in the analyzed REDD+ initiatives.

Hence, strong reliance on limited and discontinuous external funding mechanisms for CCI implementation (e.g. temporary public investment projects and/or donor funding) rather than actual ES recipients' payments jointly with implementers' doubts about cash payments have seemed to be crucial for design preferences in the analyzed initiatives. Where the often small offered per-hectare payments thus enough to cover local WTA? This depends on several contextual factors. If the enrolled areas were *de facto* little threatened, then opportunity costs would also be close to zero; hence even low payments are attractive. Furthermore, when large forest areas were enrolled simultaneously (e.g. for some indigenous lands in the PNCB), then even small per-hectare rates could add up to significant amounts, but creating both unequal and environmentally inefficient outcomes as "communities with large forest reserves and low population densities will receive the largest transfers" (Börner et al., 2016, p. 413). The same study makes the case that spatially well-targeted and differentiated payments mimicking local opportunity costs could 'buy out' much current deforestation in the Peruvian Amazon at moderate costs. This also constitutes an overall fairly optimistic outlook for CCI implementation, if only design and implementation could be improved.

Although in-kind rewards have been said to be preferable in situations with elite capture and local market constraints (Asquith et al., 2008), aspects regarding their divisibility, repeatability, and delivery costs can drag into the opposite direction (Engel, 2016). Moreover, in all our cases implementers noted in interviews that they preferred temporary over permanent rewards, due to difficulties to ensure a continued flow of funding (Fig. 2). This scenario would make investments in sustainable livelihoods alternatives a logical choice, if economic activities were clearly profitable and resolved 'permanently' the environmental externality problem (Engel, 2016). Nevertheless, further effort is required to generate rigorous evidence to support or challenge such strategies.

Furthermore, we think that in the analyzed cases environmental additionality could be boosted by incorporating spatial targeting and payment differentiation more decidedly in subsequent stages of analyzed CCI implementation, as our findings reveal that little application of these have taken place so far. These design features seem to be under-utilized due to administrative ease, coupled with challenges to implement differentiated payments considering implementers' equity perspectives. Adopting smaller but continuous payments (either in cash or in-kind), preferably coming from actual ES recipients rather than from temporary investment projects with multiples objectives, could create more realistic expectations. This should be possible especially in

relation to watershed payments, which in opinion of our MINAM and SUNASS informants currently represent the best economic opportunity in Peru to apply CCI to natural resource management: if there is a 'business case' for adapting upstream water management, the challenge would be to get water users to accept the payment of a premium to ES providers.

In addition, periodic compliance monitoring and sanctioning systems should also be adopted or refined. These two elements are critical for CCIs implementation, as their absence could imply a more systemic problem of moral hazard: that enrolled participants are rewarded yet defecting on their environmental commitments, thus undermining the credibility of the CCI mechanism at its foundation (Wunder et al., 2018). As demands to use increasingly scarce conservation funds in more efficient ways have grown over the past decade (Ferraro and Pattanayak, 2006), this aspect requires more attention. Eventually political pressures may set the bar higher in terms of CCI initiatives' effectiveness, as findings from impact evaluations are revealing many small or even negligible impacts as consequence of recurrent implementers' design choices, guided by practicalities rather than goal-oriented streamlining (Wunder et al., 2018).

Making decision processes more transparent is also an essential aspect that should be incorporated by implementers, donors, and facilitators, including so as to strengthen perceptions of procedural equity. As explained above, this matter was raised particularly for BN-REDD and MRHESM, where widespread distrust among actors relate respectively to low financial transparency and the introduction of new land-right arrangements. In line with Tacconi (2012), we argue that transparency is a highly relevant aspect to achieve and maintain sustainable CCI impacts, particularly those related with improved socioeconomic conditions. Specific strategies can include launching of participative spaces to inform stakeholders on management aspects of common interest (e.g. through periodic village workshops), and broadening communication beyond websites (e.g. periodic informative brochures, radio or/and television). These strategies have been used successfully in agricultural development programs (Basics Oliveira, 1993), and thus might be adapted for contexts where CCI are being implemented.

To conclude, the design of adequate incentives in conservation initiatives is complex, and some choices apparently prioritizing practicality and simplicity can eventually bring about important tradeoffs in attaining conservation and social objectives, thus potentially undermining environmental additionality and wellbeing impacts alike, as our analysis of Peruvian CCI cases has revealed. To some extent, these initiatives can also become broader politically motivated instruments, pushing environmental effectiveness and efficiency concerns somewhat into the background (Rosa da Conceição et al., 2015, 2018). In the above, we have flagged priority issues that, from our perspective, deserve consideration by stakeholders involved with the implementation and promotion of CCI initiatives. These could guide the implementation of subsequent phases of the selected cases, or during design stages of nascent similar initiatives in Peru and beyond.

CRediT authorship contribution statement

Javier Gustavo Montoya-Zumaeta and Sven Wunder have conceived the study. Javier Gustavo Montoya-Zumaeta acted as lead writer, Sven Wunder and Luca Tacconi supplemented.

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Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.landusepol.2021.105514.

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