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Implementation of REDD+ in the existing forest property rights: lessons from Berau, East Kalimantan Province, Indonesia

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Abstract. There is a little empirical evidence on how REDD+ can work through existing property rights that define Indonesian forests. This article focuses on assessing the effectiveness of existing forest property rights in local forest institutions within a REDD+ framework. The study focuses on two local forest institutions: Forest Management Unit (FMU) of Berau Barat, and Merabu Village Forest. Within these forest landscapes, households within three villages were selected for interview and household survey collection. This research first examines the bundle of rights allotted to households by examining the content of formal rules enacted for Forest Management Units and Village Forests. Specifically, these different forest property types were assessed for the ability of local forest institutions to control additionality, leakage, and permanence. The results of formal policy were then compared to data collected from households within the forest landscape of Berau, East Kalimantan. This comparison finds that Merabu Village Forest provides higher forest tenure security than the FMU of Berau Barat. Further, forest rights from Merabu Village Forest are more likely to promote REDD+ outcomes, indicated by the ability for local authority to control additionality, leakage, and permanence. Finally, this research finds increasing capacity to manage leakage, integrate national and local tenure efforts, include local knowledge, law enforcement capacity, and community awareness.

1. Introduction

There remain many challenges for REDD+ implementation in Indonesia, including governance, economics, as well as social barriers. Within the governance debates, some examples have been explained by [1], [2], and [3]. [1] finds that when interconnections between multilevel endeavours (global demands, national and sub national structures, local people's need and aspirations) are disregarded, REDD+ can fail. [2] argues that there are limited connections between clusters within REDD+ policy arena characterized by multiple clusters of densely connected organizations. [3] examines economic and social perspectives. Emission reduction is a model commodity, as it only has one characteristic (price). Thus, it can promote a pseudo market mechanism (single product quality, single price) for REDD+, potentially overcoming transaction cost barriers ([4]).

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In the social context, there are tenure and rights problems. REDD+ implementation faces high risks where land ownership problems exist. Therefore it is difficult to reward relevant entities without clear land titles and carbon ownership. From all these challenges, tenure and rights remain the biggest challenges. They will influence the stability of investment and determine forest governance improvements [5][6]. Countries with more secure land rights are expected to reap the greatest opportunities from REDD+ [3].

Forest property rights play an important role in REDD+ effectiveness to achieve outcomes beyond deforestation reduction. In this context, [7] called REDD+ effectiveness the difference between GHG emissions with and without REDD+. This analysis divides into three concerns: additionality (are the emission reductions additional to what would have occurred without REDD+?), leakage (would REDD+ interventions shift emissions elsewhere?), and permanence (are the emission reductions permanent?). These concepts are integral parts of a REDD+ and unique to traditional approaches of forest conservation ([8].

However, there are lack of studies concerning relationship of property rights and those contextual outcomes. [9], among others, connects property rights to deforestation reduction in REDD+. Studying Palawan Island, Philippines, it finds that nascent REDD+ policies can operate within state sanctioned tenure, customary tenure, and forest uses in changing livelihood contexts. This paper thus illustrates how complex and changing tenure structures, commodity markets and livelihood dynamics may influence how REDD+ interventions affect indigenous customary lands and forest use.

[10] and [11] support an argument on the importance of property right to REDD+, but they do not measure how effective property rights are in the particular case of REDD+. [10] focuses on how proponents are addressing tenure insecurity in light of: the forest tenure conditions at the project sites from the point of view of villagers, the actions have been taken by the proponent in relation to tenure issues, and the national factors affecting tenure security at project sites and how are the proponents addressing them. [11] and [12] review the role that land tenure and its associated-bundles of rights play in deforestation and degradation processes, and discuss the implications of tenure regimes and carbon rights for REDD+ design and implementation. However, these articles do not show the implication of property rights on the certain contextual outcome in REDD+.

[13] explores links between forest property rights and liability for different REDD+ policy options and their implications for permanence; it does not examine additionality and leakage. The authors use a policy approach to study carbon credit holders (such as government both national and regional, landowners, farmers, communities, and concessionaires) and liability for deforestation reduction. One of the strategies presented to address the permanence issue is policy innovation. Policy innovation is necessary to implicitly share liability between the state and individuals. For example, a co-management framework, in which state authorities and individuals share both the management of and the benefits from forest resources, could be combined with REDD+ payments.

[7] has a complete approach for analysing the link between tenure and REDD+ effectiveness using additionality, leakage, and permanence indicators. Specific definitions of REDD+ effectiveness uses the difference between GHG emissions with and without REDD+. This approach reveals that communities interested in REDD+ (either GHG emitters or non-GHG emitters) tend to have strong tenure rights and generate greater reductions in forest degradation and deforestation. Communities that are not interested in REDD+ tend to have low REDD+ ambiguous tenure rights and low REDD+ efficacy.

There is little empirical evidence of how REDD+ can work in the existing property rights of forests in Indonesia. A fundamental question is, to what extent the existing forest property rights enacted through local forest institutions support REDD+ outcomes? Thus, this paper assesses the effectiveness of existing forest property rights in local forest institutions within a REDD+ framework.

2. Methodology

2.1. Conceptual framework

This study uses a simple conceptual framework to understand how forest property rights in particular local forest institutions link to REDD+ outcomes in context. The framework is based on the premise that secure tenure will improve REDD+ effectiveness when forest institutions have ability to reduce deforestation and forest degradation through additionality, leakage, and permanence.

In this framework, forest tenure security is a proxy for the certainty of obtaining potential benefits and costs, and a congruence between formal and local rules (de jure and de facto bundle of rights). When the ability of forest institutions to control additionality, leakage, and permanence is strong and tenurial disputes are resolved (secure tenure in place of de jure-de facto bundle of rights), REDD+ project effectiveness will increase due to a reduction in carbon emissions. Figure 1 provides a diagram to easily demonstrate a simple linkages between forest tenure security and REDD+ effectiveness, as a modified framework from [7].

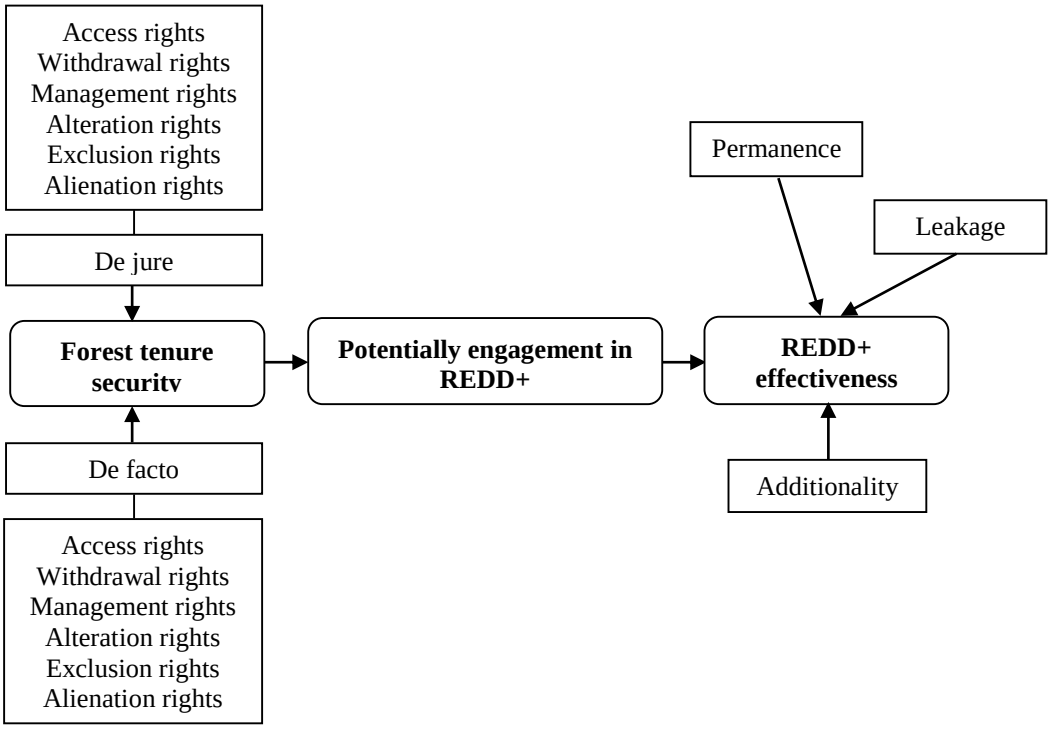

Figure 1. Conceptual framework in analyzing forest property rights for REDD+ effectiveness (modified from Resosudarmo et al., 2014)

Forest property rights refer to bundle of rights from [14] as a revised framework for [15]. [14] proposes a revision of the bundle of rights concept, adding the right to alter between management and exclusion. However, alteration rights is not a new term, as it was previously put forward by Furubotn and Pejovich since 1972 ([16]).

According to [14], the bundle of rights that comprise tenure include access (the right to enter a defined physical property), withdrawal (the right to obtain the products of a resource), management (the right to regulate internal use patterns and transform the resource by making improvements), alteration (the right to change the set of goods and services provided by a resource), exclusion (the right to determine who will have an access right, and how that right may be excluded), and alienation (the right to sell or lease some/all management, alteration, and exclusion rights). They argue that alteration rights are fundamentally different from management rights, in that the former involves a change in the flow of

goods and services associated with the resource, whereas the latter concerns the internal regulation and transformation within a particular resource. Alteration rights involve the complete transformation of a resource from its current state in ways that may be positive or negative depending on the perspective and the outcome of interest. For example, clearing a forested stand for agriculture, or planting trees on marginal pastureland. This new bundle of rights is relevant to the context of land use change in a REDD+ context.

REDD+ outcomes referred to in [7] consist of additionality, leakage, and permanence. Furthermore, this study revisits their specific definitions according to [8], [17], and [18]. Additionality is defined as carbon emission reductions that are additional to what would have occurred without the REDD+ mechanism. When attempting to determine whether activities are additional or not, the reference point or basis for measurement will be the business as usual or without project scenarios. Leakage is defined as the unanticipated decrease or increase in GHG benefits outside of the project's boundary as a result of project activities. In this study, leakage refers to primary leakage only, which is direct displacement of activities from one area to another (e.g. local communities using forest for subsistence in another area, or encroachment of logging/agribusiness in another area). Secondary leakage (or market effects) is not of concern, which occurs when forest conservation in one place indirectly creates incentives to deforest in other places. Meanwhile, permanence refers to how robust a project is to potential changes that could allow for stored carbon to be released at a future date. There are a number of possible risks of reversals that have been identified come from: natural/ecological risk (caused by natural events such as storm, drought, pests, or fire), inefficiencies in forest governance, and demand-side risk (see [19]).

2.2. Research site

Research was conducted in Berau District, East Kalimantan Province, Indonesia. It was choosen for the following reasons: (1) Berau is a conservation district that has high levels of forest area and biodiversity, (2) there are many programme initiatives related to REDD+ facilitated by various agencies in Berau, including the Central Government (Ministry of Forestry), The Nature Conservance (TNC), and Forclime, and (3) several problems remain that need conceptual and practical resolutions, such as: spatial planning, forest boundaries, encroachment, and overlapping of land permits.

This study was focused on two local forest institutions: the Forest Management Unit (FMU) of Berau Barat, and the Merabu Village Forest. Three villages were selected for in-depth interviews. Long Duhung Village and Merapun Village are within the FMU of Berau Barat, and Merabu Village manages a village forest.

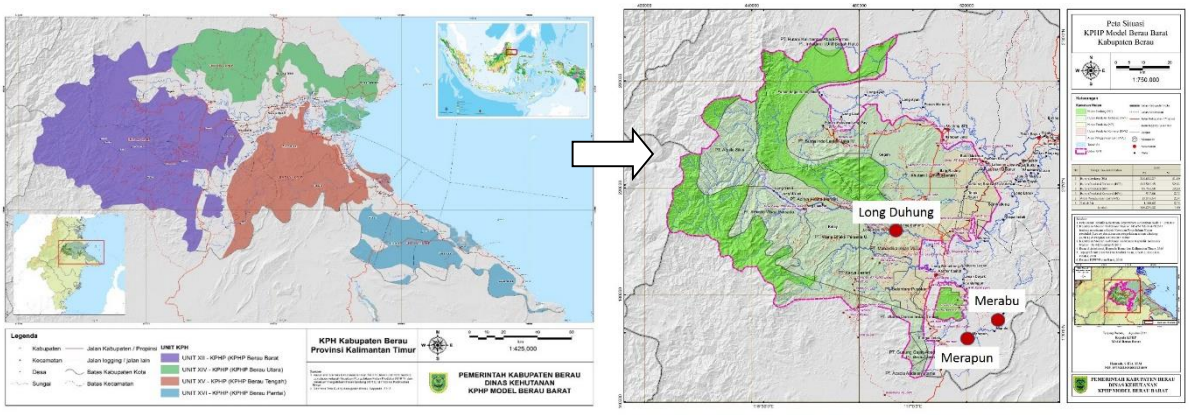

Figure 2. Research sites in Berau District, East Kalimantan Province, Indonesia (Source: [20])

2.3. Data collection and survey design

Data were gathered from three surveys. A preliminary survey was conducted from the 26th – 30th of September 2014. Survey dissemination occurred from the 27th – 31st of July 2015, and households survey and observation were conducted on 8th–30th of August 2016. Unstructured questionaires were used in unquiry for key informants, while structured questionaires were used for households interview. Key informants came from various institutions, namely: District Forestry Office, REDD+ working group, NGO's (such as The Nature Conservancy, GIZ-Forclime, and Yakobi), FMU, Village Heads, and other representative villagers. Household survey respondents were selected randomly from the three villages under study. A total of 145 households were selected, with 45 respondents from Merabu, 24 from Long Duhung, and 76 respondents from Merapun.

From these data sources, this research examines the following:

1. Information from national policies that highlight the bundle of rights contained within different forest institutions. These rights consist of access, withdrawal, management, alteration, exclusion, and alienation rights.
2. Information related to the effectiveness of local forest institutions within a REDD+ framework that approached the ability to control additionality, leakage, and permanence. Indicators of each ability were modified and adapted from [7] and [13].
   - Ability to control additionality, including capacity of carbon enhancement by enrichment planting, rehabilitation, reclamation, local knowledge/local wisdom on forest management and forest uses, local knowledge/local wisdom on forest protection.
   - Ability to control leakages, including the existence of buffer zones around the forest, and the buffer zones ownership and management.
   - Ability to control permanence, including: the ability to exclude, dispute resolution, rule enforcement (procedures, people compliance to the rules), and share liability (including: insurance, the cost required, and the ability to provide funds).

2.4. Data analysis

This research examines content from formal Forest Management Unit and Village Forest rules to understand the bundle of rights afforded by local forest institutions in each context. A content scoring system was used to assess the ability of local forest institutions to control additionality, leakage, and permanence (see table 1). The level of ability was divided into three categories: high, medium, and low for the data interpretation. The range of abilities was determined by: *range = (maximum score – minimum score) / number of category*. The effectiveness of existing forest property rights in local forest institutions within a REDD+ framework for the FMU and Village Forest was analysed qualitatively.

Table 1. Scoring system used in data analysis

Criteria	Indicator	Scoring system
Ability to control additionality	- Ability to conduct enrichment planting, rehabilitation, reclamation, or other planting activities. - Ability to involve local knowledge/local wisdom on forest management and forest use. - Ability to involve local knowledge/local wisdom on forest protection activities	3 : can make decisions to conduct additionality-related activities based on the available resources. 2 : part of the system that can make decisions 1 : cannot make decisions (Total score in this criteria: maximum score=9; minimum score=3)
Ability to control leakage	- Availability of livelihood change mechanism - Buffer zones availability (or other forest surrounding the FMU/Village Forest area functioned as a buffer) to	3 : there is a mechanism which directly supports avoiding unplanned forest conversion or logging in other forest areas

Criteria	Indicator	Scoring system
	localize community land-based activities - Buffer zone ownership and management rights - Buffer zone management - Cut the buffer zone to substitute the need for wood products	2 : there is a mechanism which indirectly avoids unplanned forest conversion or logging in other forest areas 1 : there is no mechanism (Total score in this criteria: maximum score=15; minimum score=5)
Ability to control permanence	- Ability to exclude unwanted outside users - Type of outsider that can be excluded - Compliance to forest rules - Rule enforcement and sanction - Insurance - Share liability	3 : significant progress and maximum power and authority to conduct permanence related-activities 2 : progressing well, but further development required 1 : no demonstrating progress (Total score in this criteria: maximum score=24; minimum score: 6)

3. Results and Discussions

3.1. Bundle of rights on the FMU and Village Forest

Based on the forest land status and it's bundle of rights, FMU of Berau Barat and Merabu Village Forest have the same property rights regime, namely State property (table 2). However, those two forest institutions include different management rights. Transfer of rights from the FMU can be classified as a decentralization model, while Village Forest is a devolution model.

Evidence from selected sites in this study showed that not all formal rules are accepted by people as a rule-in-use. The first case was production forest under the FMU of Berau Barat. There is a *Wungun* forest area claimed by Long Duhung Village as their customary protection forest. The second case was most of the villagers in Long Duhung and Merapun Village claimed that they have a rights to manage forest surrounding the village. It means that the villager has a rights to conduct day to day activities on the forest. Whereas, only Merabu Village received a licence from the government through Village Forest Management Rights. The last case was some of the villagers claimed that they have a rights to alter forest for other landuses.

In addition, this study finds that other formal rights are relatively similar to local rules in the two villages and logging company under the FMU of Berau Barat. In Merabu Village, there is no differences between national formal rights with rule-in-use in managing Village Forest. Therefore, when there is a contestation of formal and local rules, there is lack of rights enforcement and the local rule is more important to determine how people respond and manage forest areas. Comparing FMU and Village Forest institutions, this indicates that the Merabu Village Forest provides higher forest tenure security than the FMU of Berau Barat.

Table 2. National formal rule on forest rights of the FMU and Village Forest

Attribute	***FMU***	***Village Forest***
A. Forest ownership and forest function		
Forest ownership	State	State
Forest function	Conservation, protection, and/or production forest	Protection and/or production forest.
B. Bundle of right on forest		
Access rights	Community can access the forest. Community should get a compensation due to lost their access because of forest area determination.	Access rights is included within management/withdrawal rights.

Attribute	***FMU***	***Village Forest***
Withdrawal rights	- Community should get tangible and intangible benefits from the forest. Community should get compensation due to lost their access and benefits from forest because of the forest area determination. - Local people are allowed to collect non-timber forest products (from protection and production forest), and timber (from production forest for non-commercial use only). - FMU should utilize timber and non timber forest products, as well as environmental services. - Private company can utilize forest products by permit mechanism.	- Protection forest: non-timber forest products, and environmental services, - Production forest: timber, non timber forest products, and environmental services.
Management rights	- Central government transfers some forest management authorities to local government. - Forest area can be managed by FMU, and private (corporation), cooperation, individual, government and local government's firm through concession permit mechanism. - Scope of forest management: inventory (biophysic and socio economics), forest arrangement and forest planning, rehabilitation, community enpowerment, investment development, and program coordination and integration.	- Village should establish a Village Forest institution to conduct forest management activities in the Village Forest area. - Village Forest Management Rights consist of: forest arrangement, forest planning, forest utilization, rehabilitation, and forest protection.
Alteration rights	No rules	The rights holder is prohibited to: - develop palm oil plantation. - change the forest status and function, as well as to be used for other purposes.
Exclusion rights	FMU is responsible to protect the forest area. Concesion permit holder is responsible to protect their concession area.	The right holder is responsible to protect their village forest area and its function from destruction and environmental polution.
Alienation rights	FMU does not have alienation rights. Concession permit can be taken over by other party with the government's approval.	Village Forest Management Rights cannot be taken over by other party.

3.2. Capacity to control additionality, leakage, and permanence

3.2.1. Additionality

The capacity of Merabu Village Forest to control additionality is better than the FMU of Berau Barat. All atributes show a positive assessment. Meanwhile the FMU of Berau Barat has one positive result, namely the ability to conduct additionality related-activities (table 3). This implies that Merabu Village Forest, in practice, is more effective than the FMU of Berau Barat in developing capacity to control additionality for the REDD+ scheme. The FMU has a weakness, namely insufficient authority to involve local knowledge/local wisdom on forest management and forest protection activities.

Table 3. Capacity to control additionality of the FMU and Village Forest

Atribute	***FMU of Berau Barat***		***Merabu Village Forest***	
	Evidence	***Score***	***Evidence***	***Score***
Ability to conduct enrichment planting, rehabilitation, reclamation, or other planting activities.	FMU can make decisions to conduct additionality-related activities. FMU developed long term and annual plan. The FMU has certain human resources and fund to support the activities.	3	Kerima Puri and village authority can make decision to conduct additionality-related activities. Village authority developed business plan and annual plan.	3
Ability to involve local knowledge/local wisdom on forest management and forest use.	FMU has the authority to identify and invite local wisdom, and decide to involve them in the forest management and forest use activities. FMU then proposes the programme to central government (MoEF) to get an approval. However, final decision officially come from central government.	2	Kerima Puri and village authority possible to identify and invite local wisdom, and decide to involve them directly in the Village Forest management activities.	3
Ability to involve local knowledge/local wisdom on forest protection activities	FMU has authority to identify and invite local wisdoms, and decide to involve them in the forest protection activities. FMU proposes the programme to central government (MoEF). However, final decision officially come from central government.	2	Kerima Puri and village authority can identify and invite local wisdom, and decide to involve them directly in the Village Forest protection activities.	3
Total		***7***		***9***
Level of ability	***Medium***		***High***	

3.2.2. Leakage

The capacity of the FMU of Berau Barat to control leakage is low, while Merabu Village Forest is high. The FMU of Berau Barat does not have any leakage management to make sure that the entities within FMU area committed to protect the forest. There include trainings, capacity buildings, or other community development activities conducted by FMU authority. There is also no buffer zone surrounding FMU area used to localize community land-based activities.

Merabu Village Forest performs betters in regard to leakage. There are intensive community development activities conducted by TNC, focused on ecotourism development. Village Forest has a programme to ensure people change their livelihoods and do not disturb forest stands. There is also a cultivation area surrounding the Village Forest to localize villagers' land-based activities. The result implies that Merabu Village Forest is quite effective in controlling leakage compared to the FMU of Berau Barat (see table 4 for detailed description).

Table 4. Capacity to control leakage of the FMU and Village Forest

Attribute	***FMU of Berau Barat***		***Merabu Village Forest***	
	Evidence	***Score***	***Evidence***	***Score***
Availability of livelihood change mechanism	There are trainings, capacity buildings, and other community development activities. However, it was not followed by intensive assisstance to change their behaviors become environmental friendly livelihoods.	2	There are trainings, capacity buildings, and other community development activities, as well as intensive assisstance conducted by TNC, focused on ecotourism development. Income from forest services now become a new productive livelihoods.	3
Buffer zones availability (or other landuses surrounding the FMU/Village Forest area functioned as a buffer) to localize community land-based activities.	There is no buffer zone. There are forest and other landuses areas surrounding FMU of Berau Barat, (such as: forest area at Bulungan, Malinau, and Kutai Timur Districts, concession forest area of PT Inhutani and others, as well as plantation, and settlement), but those areas are not the buffer zone.	1	There is no buffer zone. However there is a agricultural or cultivation area surrounding Village Forest functioned as a buffer zone.	2
Buffer zone ownership and management rights	Forest areas and plantation surrounding FMU are belongs to the State, while settlement is belong to private. Forest areas and plantation are managed by private companies.	1	The protection and production forest areas are belong to the State. Protection forest is managed by local government, while production forest is managed by logging firm.	2
Buffer zone management	Most of those forest areas are managed as a production forest using selective cutting method.	1	Local government reserves the protection forest area, and logging firm cuts the forest by selective cutting method.	2
Cut the buffer zone to substitute the need on wood product	FMU does not have authority to control (reserve) those forest areas, as well as does not cut those forest area.	3	Villagers do not harvest those forest area.	3
Total		***8***		***12***
Level of ability	***Low***		***High***	

3.2.3. Permanence

Content assessment shows that the capacity to control permanence within Merabu Village Forest is better (medium level) than the FMU of Berau Barat (low level) (table 5). The weaknesses of the FMU in the context of capacity to control permanence is very low due to its exclusion ability, low levels of compliance with formal forest rules, a lack of rules enforcement and sanctions, and no insurance mechanism. Allocated budget and source of fund availability indicate a capacity of share liability. There are internal and external sources of fund available, but the budget ratio is irational to manage and protect the forest. Again, the result implies that Merabu Village Forest is more effective than FMU of Berau Barat in controlling permanence.

Table 5. Capacity to control permanence of the FMU and Village Forest

Attribute	*FMU of Berau Barat*		*Merabu Village Forest*	
	Evidence	*Score*	*Evidence*	*Score*
Ability to exclude unwanted outside users	There is only 1 forest ranger (*Polisi Kehutanan, Polhut*) available. It is not possible to control forest area of 288,935.26 ha (concession areas are excluded). There are preventive approaches, namely: 1) Developing SOP of forest patrol 2) Establishing Forest Patrol Unit 3) Involving community in the forest protection programme through establishing forest care unit in the villages 4) Integrated forest patrol. In case of double claims based on different source of legitimacy, then the FMU adopts a partnership approaches to resolve the conflicts.	1	There is no experience on exclusion of outside users. There has not been logging, encroachment, or conflicting rights over Merabu Village Forest area. However, Merabu people is now opposing Merapun people who claim another forest area. They are looking to local government to resolve the village boarder.	2
Type of outsider could be excluded	Ideally the FMU could exclude large scale players (such as: timber or oil palm company), as well as small scale players (including individual player). But in practice, both large and small scale players are difficult for the FMU to exclude.	1	Village authority and villagers can exclude small scale players (including individual player). Large scale players (such as: timber or oil palm company) are more difficult to exclude without any additional support from local government and NGO.	2
People compliance to forest rules	A lot of people and concession rights holders of the FMU area (50-75%) comply with forest rules. Deforestation occurred of 4,816.74 ha during period 2012-2015 (or 1,431.99 ha annualy). Accumulated deforested area of the FMU area on 2015 (since 2000) was now 16,291.27 ha.	1	Merabu people, in majority (>75%), comply with Village Forest rules. The annual deforestation is zero during period 2012-2015.	3
Rules enforcement and sanction	There was around 20,000 ha of concession forest area (PT Inhutani I Labanan) encroached by people. But rule enforcement and sanction is very rarely. Most of case used community development and social approach to resolve the case.	1	There is no experience on rule enforcement for the rule breakers within Merabu Village Forest area. However, some violations were found at another area/forest surrounding village. The sanction was in-kind fines (the fines was not in cash, such as renovating villager housings, village road, bridge, etc.).	3
Insurance	There is no insurancemechanism	1	There is no insurancemechanism	1
Share liability (budget allocation to	- 2015: District government budget= IDR 1,516,210,000 (budget ratio = IDR 1,928.97/ha)	2	- 2014: Village budget = IDR 29,300,000 (budget ratio=IDR 3,554 /ha).	2

Attribute	*FMU of Berau Barat*		*Merabu Village Forest*	
	Evidence	*Score*	*Evidence*	*Score*
maintain, protect, and sustain the forest, and source of funding)	- 2016: Total budget 2016 = IDR 8,656,564,916 (consisted of District government budget=IDR 7,373,943,916.; and Central government budget=IDR 1,282,621,000) (Budget ratio = IDR 11,013.15/ha). - The funding come from Central government, local government, TNC, Forclime. - There are also development partners (such as Froclime, and TNC) who allocate their budget to support the FMU programmes and activities.		- 2015: Village budget = IDR 10,000,000 (budget ratio=IDR 1,213/ha). - The funding coming from Village fund, local government, TNC. - There are other fund sources (from NGO's such as TNC and TFCA) to support village forest management activities.	
Total		***7***		***13***
Category	***Low***		***Medium***	

3.3. Forest dwellers capacity

Community in three villages indicates has little capacity to control additionality (table 6). Most of them can neither make formal tree planting decisions nor include local knowledge/local wisdom in forest management and forest protection activities.

However, community in three villages demonstrates a high level of their capacity to control leakage. The majority of respondents did not cut forest outside of their village. It is good to support leakage management. Meanwhile, capacity to control permanence was at a medium level. Most of them did not have any experiences on exclusion of unwanted users, as well as people compliance on forest rules is relatively good. The exception was found in Long Duhung community, they had many experiences in exclusion unwanted forest users, both for large scale and small scale/individual players. In addition, lack of fund participation on forest management and protection activities was found in all community in three villages.

Table 6. Capacity of village community to control additionality, leakage, and permanence

Atribute	**Criteria**	**Indicator**	**Village (in % of respondent)**		
			Merabu	**L Duhung**	**Merapun**
Capacity to control additionality	Ability to conduct planting activities	Can make decision to conduct planting activities	4,3	8,3	2,6
		Part of the system who can make decision	17,4	25	7,9
		Can't make decision	78,3	66,7	89,5
	Ability to involve local knowledge of forest management/utilization	Can make decision to conduct	6,5	4,2	2,6
		Part of the system who can make decision	15,2	33,3	5,3
		Can't make decision	34,8	16,7	30,3
		Don't have local knowledge	43,5	45,8	61,8

Atribute	Criteria	Indicator	Village (in % of respondent)		
			Merabu	**L Duhung**	**Merapun**
	Ability to involve local knowledge of forest protection	Can make decision to conduct	6,5	0	2,6
		Part of the system who can make decision	15,2	33,3	5,3
		Can't make decision	30,4	16,7	28,9
		Don't have local knowledge	47,8	50	63,2
Capacity to control leakage	Logging other forests	Yes	4,3	8,3	1,3
		No	95,7	91,7	98,7
Capacity to control permanence	Exclusion capacity	Always	10,9	16,7	3,9
		Often	15,2	50	3,9
		Never	73,9	33,3	92,1
	Who are able to be excluded	Large scale	10,9	12,5	5,3
		Small scale/individual	6,5	62,5	2,6
		Other	17,4	0	0
		Don't know	65,2	25	92,1
	Level of obedience on forest rules	All (100%)	52,2	58,3	28,9
		Majority (more than ¾)	30,4	8,3	39,5
		Some (½ - ¾)	10,9	20,8	15,8
		Minority (¼ - ½)	2,2	8,3	9,2
		Less (less than ¼)	0	4,2	1,3
		Noone	0	0	5,3
		Don't know	4,3	0	0
Rights enforcement cost capacity	Fund participation	Yes	6,5	12,5	0
		No	93,5	87,5	100

Table 7 indicates at least two situations. The first is that the capacity of villagers in controlling additionality and permanence does not sufficient to support the effectiveness of FMU and Village Forest on REDD+ framework, but supports that avoidance of leakage. The second, there is no significant difference among three villages (table 7, where significant values are more than 0.05 for all comparations). Forest management institutions do not have any particular impact on the level of villagers capacity in controling additionality, leakage, and permanence.

Table 7. Comparative analysis among three villages on their ability to control additionality, leakage, and permanence

Paired Samples Test

Pair		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Merabu - Long_Duhung	-.4310	19.3568	3.5945	-7.7940	6.9319	-.120	28	.905
Pair 2	Merabu – Merapun	-.2069	11.3542	2.1084	-4.5258	4.1120	-.098	28	.923
Pair 3	Long_Duhung – Merapun	.2241	26.3259	4.8886	-9.7897	10.2380	.046	28	.964

3.4. Discussions

This study creates a framework to identify criteria that are relevant to the capacity of forest property rights on REDD+ scheme, and it used this framework to assess the FMU of Berau Barat (as a decentralization model) and Merabu Village Forest (as a devolution model). The framework was built on the concepts of bundle of rights from [14] and the effectiveness of REDD+ effectiveness modified from [5]. This study shows that capacity of the FMU of Berau Barat is lower than Merabu Village Forest in all REDD+ contextual outcomes (additionality, leakage, and permanency). The constelation of forest rights on Merabu Village Forest is more effective for achieving REDD+ outcomes, indicated by its capacity to control additionality, leakage, and permanence.

The effectiveness of Village Forest is important for management considerations. First, the extent of control within the Village Forest is better. The Village Forest area (8,245 ha) is technically easier to control rather than FMU area (786,021 ha). Participation in forest management and forest protection in Village Forest is higher than the FMU. It helps to enhance villager capacity to enforce their management rights. Second, the transfer of management rights from government to village authority (devolution model) is effective in creating responsibility to conduct rule enforcement. This is consistent with [21], which states that community (at the village level) has higher capacity to enforce their rights, with greater homogeneity, less conflict, and fewer landless actors. Institutions at the community level have high decision-making power in day-to-day forest management activities, especially over the use of forest products for both subsistence and commercialization purposes [22]. Importantly, benefits from forest management are now, for the most part, reaching the community. A positive outcome from devolution model is that Village Forest is able to encourage user groups to organize themselves in way that is adapted to their circumstances and exists in conjunction with well-organized user groups with strong connections to national and international network who can advocate on their behalf [23].

This finding supports another argument that when other conditions are appropriate, communities can put effective and adaptive conservation practices in place [24] The finding also indicates that when formal (government) and informal local forest institutions (village authority, case of Village Forest) have common goals, they complement each other to achieve those goals [25]. Meanwhile, the FMU is less effective since the State has never fully transferred full bundle of rights on decentralization model for decision-making and harvesting benefits [26];[22].

The next challange is to improve the effectivenes of FMU of Berau Barat for REDD+. The options include:

- Capacity to involve local knowledge/local wisdom in forest management and forest protection activities should be improved. Transferring authority from central government to the FMU to manage local community involvement is crucial. The FMU should also explore another scheme or programme to involve local people in a simple bureaucratic process.
- Buffer zone systems should be provided inside the FMU area. Forests surrounding villages could be considered as a utilization zones for villagers. This can help reserve the nuclear zone of the FMU area from encroachment or other illegal activities.

- Forest ranger availability should be enhanced to improve exclusion and law enforcement capacity of the FMU. Employing a number of forest rangers in specific proportion to forest area is important.
- Enhancing community awareness is important to increase compliance. Exclusion and law enforcement capacity is not enough without community awareness.

Both local forest institutions have less ability to control leakage. Thus, the FMU and Village Forest facing the same problem to deal with leakage management. However, the difficulty in leakage management is actually not only at the site level, but also at the national level in Indonesia [27]. While the highest score for both forest management institutions is ability to control additionality. It means that additionality is the easiest REDD+ requirement developed by local forest institutions. This finding implies that a leakage management system is a priority to improve local forest management institution in accordance with the REDD+ framework. In addition, additionality can be positioned as a main strength of forest management programmes or activities for both local forest institutions.

Insight from three villages implies that there is no interrelationship between local forest institutions and individual ability in determining capacity to control additionality, leakage, and permanence. Iindividually, community in Merabu Village has low performance on controlling additionality and permanence, whereas as an institution, Merabu Village Forest authority (Kerima Puri) has high performance on both attributes. Also, local forest institutions (the FMU of Berau Barat and Merabu Village Forest) have not been developed to increase the forest dwellers' capacity in the context of REDD+ framework.

Therefore, there is a need to increase the integration of national and local tenure efforts [10], and support from government to increase local community's capacity [28]. As a precondition for reducing deforestation and degradation, the government's focus should be shifted to strengthening village institutions and enhancing internal compliance [29]. Such implications confirm to argument on the importance of the ability of community as a social capital on successfully climate change related-project participation [30]; [9]. It is also because of the government's relatively low commitment to addressing tenure issues at the local/community level and to integrate national and local tenure clarification efforts [10].

This study provides theoretical insights. The same forest property rights regime shows differing capacity in supporting the REDD+ framework, dependent on management type. The type of forest management institution plays an important role to determine their capacity to control additionality, leakage, and permanence. The evidence examined in this paper provides support for the argument that forest property rights play an important role in forest dependent communities and in forest management [31].

Finally, as with [5], this finding emphasizes that tenure security enacted in particular local forest institutions is necessarry condition for REDD+, but not sufficient. Effectiveness depends on both the ability and interest of community and REDD+ project on manage their forests, although this study approved to the ability aspect only. Thus, lessons learned from this study is similar with the experience from India [32] that the effort to strengthen land tenure and resources rights for forest communities can be applied to climate change mitigation in forestry sector.

4. Conclusions

This paper has demonstrates to what extent existing forest property rights are enacted at local forest institutions effective to support REDD+ contextual outcomes. The FMU of Berau Barat (representing decentralization model) and Merabu Village Forest (representing devolution model) support the initial premise, where secure forest property rights will improve REDD+ effectiveness if forest institutions have ability to reduce deforestation and forest degradation through specific contextual outcomes, namely additionality, leakage, and permanence. Examining two local forest institutions, this research argues that Merabu Village Forest provides higher forest tenure security than the FMU of Berau Barat. The constellation of forest rights from Merabu Village Forest is more effective in achieving REDD+ outcomes, indicated by its capacity to control additionality, leakage, and permanence.

Numerous challanges remain, including the need to develop a leakage management system to improve local forest institutions in accordance with the REDD+ framework. Also, the need to integrate national and local tenure efforts will remain important for strengthening village institutions and enhancing internal compliance. There are also challanges of the FMU for REDD+ framework on the following issues: improvement on local knowledge/local wisdom involvement in forest management and forest protection activities, buffer zone system, exclusion and law enforcement capacity, and community awareness rising.

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