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Reducing emissions from land use change in Indonesia: An overview☆

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ABSTRACT

The goals of the Paris Agreement on Climate Change cannot be achieved without a significant reduction in emissions from forests. Reductions of emissions from land use, particularly forests, account for a quarter of the reductions pledged in the Nationally Determined Contributions (NDCs) submitted by Parties to the UNFCCC. The papers included in this Special Issue of *Forest Policy and Economics* provide a contribution to the analysis of the design and implementation of the NDCs and REDD+ by considering aspects of reducing emissions from forests in Indonesia. Indonesia is the second largest emitter of greenhouses gases from forest after Brazil, but it becomes the largest emitter from forests in years when it experiences significant forest and peat fires.

1. Introduction

The goals of the Paris Agreement on Climate Change cannot be achieved without a significant contribution from forests (Griscom et al., 2017; Rockström et al., 2017). Reductions of emissions from land use, particularly forests, account for a quarter of the reductions pledged by Parties to the United Nations Framework Convention on Climate Change (UNFCC) in their Nationally Determined Contributions (NDCs) (Grassi et al., 2017). Reducing emissions from deforestation as a possible global contribution to limiting climate change was first discussed in 2005 at the Montreal Conference of the Parties (COP) of the UNFCCC. Reducing Emissions from Deforestation and Forest Degradation (REDD+) was then included in the negotiations for a climate agreement by the UNFCCC in Bali, Indonesia, in 2007, and its implementation was finally included in the Paris Agreement on Climate Change in 2015.

Emission reductions pledged in the NDCs could be delivered unconditionally or conditionally through REDD+ with external support provided by other countries, or by a combination of the two. REDD+ was initially conceived as a scheme through which forested developing countries would be provided payments by developed countries (possibly via carbon markets) to reduce deforestation and forest degradation. However, whether REDD+ will deliver significant emission reductions has been questioned (e.g. see Fletcher et al., 2016, and the comment by Angelsen et al., 2017). Concerns about the implementation of REDD+ and its outcomes have developed among government officials, consultants and academics from a combination of three factors.

First, it took eight years from the formal inclusion of REDD+ in the climate change negotiations to reach the point when REDD+ was formally adopted as part of the 2015 Paris Agreement. Whilst expectations for the rapid implementation of REDD+ held by those concerned about high emissions from forests are understandable, international negotiation processes are usually lengthy, as demonstrated by the time taken to reach consensus in Paris. A second factor might be that a market-based approach to the implementation of REDD+ appeared in effect to be excluded by the 'result based payments' approach stated in Article 5 of the Paris Agreement. This decision seems to have led to a situation where the hoped-for tens of billions of dollars that had been called for to reduce emissions from deforestation and forest degradation might not eventuate. Without a market in forestry carbon credits that directs funds from the private sector into efforts to reduce emissions from forests, there is an extremely low likelihood that developed countries will provide the required financial resources. A third factor could be the practical difficulties linked to reducing emissions from forestry: the complex national institutional and governance arrangements required to implement REDD+ may be hampered by many factors including corruption and the cost of reducing forestry emissions which might not be as cheap as initially believed. Despite those factors, REDD+ appears to still have political traction as demonstrated by the fact that 56 out of 162 NDCs include it (Hein et al., 2018). However, since it was first

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envisioned, REDD+ has evolved in several ways (Angelsen, 2017). First, while it initially had a focus on carbon, it has taken on additional objectives, in particular livelihoods/poverty reduction, biodiversity conservation, adaptation, indigenous rights and good governance. Second, international funding is provided from mainly bilateral and multilateral development aid budgets rather than carbon markets. And, third, domestic policy has evolved from a narrow focus on payments for environmental services (PES) to the implementation of broader policies.

Although REDD+ has been the subject of thousands of publications,[1] the design and implementation of NDCs has yet to be scrutinized to a similar extent. Due to the significance of emissions from forests their prominence in many NDCs, including the fact that unconditional reduction of emissions may become more significant than conditional reductions through REDD+, as in the case of Indonesia, there is a need to research NDC design, implementation and eventual outcomes.

The papers included in this Special Issue provide a contribution to the analysis of the design and implementation of the NDCs by considering aspects of reducing emissions from forests in Indonesia. They address both issues specific to REDD+ as well as Indonesia's broader NDC's emissions reduction pledge. With regard to REDD+, there are several Special Issues of journals dedicated to the topic (e.g Corbera and Schroeder, 2011; Murdiyarso et al., 2012) and many papers have considered REDD+ in Indonesia, some of which will be considered later. To the best of our knowledge, however, there have been no attempts to address REDD+ in a relatively comprehensive way for a specific country, nor has there been analyses of various issues concerning the reduction of emissions from forests through NDCs (which include REDD+) with a focus on a specific country. Analyses of the aspects of emissions reductions that affect different countries (such as land tenure, politics and policies, institutions) (e.g. Brockhaus et al., 2012a) are important. But when it comes to policy decisions, there is always a question mark about the extent to which recommendations may be applied to various countries (Flyvbjerg, 2001). This Special Issue is not immune from that tension. It does seek, however, to provide insights that contribute to the design of policies to reduce emissions in Indonesia. In addition, its insights into policy and practical issues may also be relevant when analyzing emission reduction policies for NDCs and REDD+ in other countries. Nevertheless, we do not claim that the findings are easily transferable to other settings. Potentially reduced generalizability – the extent to which that is possible is, in any case, debated (Flyvbjerg, 2001) – appears to be an acceptable price to pay in order to achieve a more in-depth understanding of a particularly significant forested country.

The focus of this Special issue is on Indonesia because of the national and global significance of its forests. Indonesia is thought to be the second largest emitter of greenhouses gases (GHG) from forest after Brazil (Zarin et al., 2016). However, due to the often extremely significant fires that Indonesia experiences (Tacconi, 2016; Zarin et al., 2016), the Indonesian National Development Planning Agency indicates that the country is fourth for total emissions after China, USA and India (BAPPENAS, 2019). Given that about 63% of GHG emissions are from land use change, forest and peatland fires, Indonesia will only achieve the emission reductions pledged in its NDC if it succeeds in reducing deforestation, forest degradation and fires, particularly those affecting peatland.

As the host to the 2007 Bali COP of the UNFCCC, Indonesia was one of the first countries to commit to the implementation of REDD+. This contributed to Norway pledging US$1 billion to support its global implementation (Angelsen, 2017). Over the past ten years, Indonesia's institutions have worked on the development of the regulatory and administrative framework for the implementation of REDD+, which is now part of its NDC. Because of Indonesia's interest in reducing emissions from forests, the Australian Government decided to support collaborative research between Australian and Indonesian researchers to provide input to the analysis of issues involved in reducing emissions from forests and to strengthen research capacity (Tacconi, 2017). That research focused on REDD+ but during the final year of the project it also considered issues concerning the NDC. The papers presented in this Special Issue have arisen from that collaboration. Their importance rests upon the fact that they present the views of some Indonesian researchers on an issue that has significant relevance to Indonesia (and many other developing countries) but which has, so far, seen research that is dominated by academics from developed countries.

2. Indonesia's greenhouse gas emissions and reduction targets

Total emissions of Indonesia's greenhouse gases increased from 1000.4 $MtCO_2e$ in 2000 to 1844.3 Mt. CO_2e in 2014, with emissions from forests and peat fires increasing from 505.3 $MtCO_2e$ in 2000 to 979.4 $MtCO_2e$ in 2014 (Republic of Indonesia, 2017). Indonesia has pledged an 'unconditional reduction target of 29% and conditional reduction target up to 41% of the business-as-usual scenario by 2030' (Government of Indonesia, 2016, p. 2). The forestry sector is expected to contribute 17.2% of the unconditional reduction of 29%. The NDC uses the year 2010 as its base for the projection of the business-as-usual scenario by 2030. The forestry sector (including peat fires) emitted 647 $MtCO_2e$ in 2010, which was about 48.5% of total emissions. Forestry emissions have been projected to increase to 714 $MtCO_2e$ by 2030 (Government of Indonesia, 2016) or 24.8% of total emissions.[2] The significantly lower share of forestry emissions by 2030 is due to an almost four-fold increase in projected emissions from energy production. The unconditional target for emission reductions by 2030 assigned to the forestry sector amounts to 497 $MtCO_2e$. A further reduction of 153 $MtCO_2e$ has also been assigned to forestry as a contribution to delivering conditional reductions of 9% against business-as-usual to achieve the 38% total emissions reductions target. These targets imply that the forestry sector is expected to reduce its emissions by about 69.6% unconditionally, and by a further 21.4% with external support that is conditionally through REDD+. Therefore, the total emissions reduction amounts to 91% against business-as-usual by 2030.

The effort to achieve the 2030 overall emissions reduction target may be even more substantial than that implied by the data reported above. This is because emissions appear to be increasing at a significantly faster rate than the projected average, which is 3.9% between 2010 and 2030. Actual total emissions in 2014 were about 18.6% higher than projected, while actual total *forestry* emissions in 2014 were about 48.3% higher than the projection.[3] This assumes an average growth rate of 0.5% a year for forestry emissions. Deforestation has been projected at 0.82 million ha per year between 2021 and 2030. The government aims to reduce this by 0.495 million ha, and to bring deforestation down to 0.325 million ha per year with unconditional measures (Government of Indonesia, 2016). The other measures outlined by the government to reduce emissions involve the implementation of sustainable forest management principles in production forests (i.e. reducing degradation) and plantation forests; rehabilitating 12 million ha of degraded land; and restoring 2 million ha of peatlands (Kementerian Lingkungan Hidup dan Kehutanan, 2017).

3. The papers in this special issue

According to the Indonesian NDC, projected emissions from land use change, forestry and peatland fires should be reduced by 91%, an

[1] A search for "REDD+" in Google scholar on June 6th 2019 counted 8230 publications.

[2] The assumptions adopted in the NDC to calculate the business as usual scenario to 2030 are not very clear, as noted by Wijaya et al. (2017).

[3] Calculations based on data from Ministry of Environment and Forestry (2018).

extremely high target. Achieving that target will be challenging and require a range of policies and activities, some of which have been noted earlier. Extensive action research will also be needed to assess whether the design of the planned policies and activities is appropriate and whether it is likely to deliver the reduction targets, and to monitor and evaluate policies and activities as they progress. It is therefore important to stress that it is beyond the scope of one Special Issue of a journal to consider all the issues involved in the design and monitoring of emission reduction policies and activities. While this Special Issue seeks to provide an extensive analysis of some key challenges faced by a country in reducing forestry emissions, it is bound to leave gaps. These will need to be addressed by further research.

In considering the enormity of the challenge that lays ahead in reducing projected emissions in the sector by up to 91%, it is obvious that a comprehensive plan will need to be developed, rigorously implemented, monitored and eventually revised. Such a plan is being developed (Kementerian Lingkungan Hidup dan Kehutanan, 2017). Its final design and implementation should learn from past experience similar to that generated by the National Action Plan for Greenhouse Gas Emissions Reductions. This plan was implemented between 2010 and 2014 following the commitment made by the Indonesian President at the G20 meeting in 2009 to reduce emissions by 2020 by 26% unconditionally and by a further 15% depending on international financial support (Government of Indonesia, 2011).[4]

Meehan et al. (2019) evaluated the Action Plan's design and implementation and find that of the seven emission reduction activities assessed, only two had a direct (evidence-based) link to emission sources while three had some evidence of a link—albeit dependent on multiple factors. For the remaining two activities–focused on emissions from agriculture in peatlands—there was no information available for assessment. They also found that the indicators used in the Action Plan were insufficient to demonstrate meaningful environmental change. Essentially, the research found that there is little evidence that any of the forestry related activities of the Action Plan had reduced emissions. It could be argued that it is the overall achievement of an emission reduction target that matters rather than the reductions delivered by individual activities which might behave synergistically. There may be some truth to this argument. However, unless a policy or activity has a well-defined way in which they are expected to reduce measurable emissions, it is unclear as to why they should be adopted. Overall, and on the basis of the existing data, the Action Plan appears to have been ineffective. Emissions increased by about 38% between 2010 when they stood at 1337.4 $MtCO_2e$ (Government of Indonesia, 2016), and 2014 when they reached 1844.3 $MtCO_2e$ (Republic of Indonesia, 2017).

A comprehensive plan to reduce emissions requires a careful review of policies within the forestry sector as well as those of other sectors to ensure that they all support the overall emissions reduction goal, or at least do not counter it. Brockhaus et al. (2012b) noted that land allocation policy in Indonesia has been dominated by conflicting policies, lack of institutional clarity and poor coordination. They also stressed that a moratorium on new logging concessions that had been introduced not long before they produced their research might have presented an opportunity for reducing emissions from deforestation. Similarly, Anderson et al. (2016) - who examined green growth ambitions at the provincial level in East Kalimantan province - found that local plans to expand oil palm plantations were at odds with provincial efforts to reduce emissions. They concluded that the main challenges to addressing these contradictions were related to the weak coordination between different levels of governance and a political economy which was not conducive to reforms in the land-based sector.

Within this context, Ekawati et al. (2019) conducted a detailed analysis of national and local government policies and regulations relating to REDD+, as well as considering the readiness to implement them. Given the fine-grained nature of their research, the findings are difficult to summarize. As an example, however, they suggest that several regulations for the forestry sector need to be revised, including: i) the formula for sharing reforestation funds should be changed from incentives for districts to produce or harvest more timber to disincentives; ii) charges for mining in state forests (should be increased so that funds can fully cover reclamation and rehabilitation costs of mined areas; and, iii) the technical requirements for underground mining in protection forests should be tightened to limit the issuance of mining permits by local governments. Their work demonstrates the extensive review of policies and regulations that is required to achieve highly ambitious emissions reduction targets.

The role of the private sector and its possible contributions to reducing emissions will need to be considered by the Government of Indonesia both to achieve unconditional and conditional emission reduction targets. Even though there has been limited financial flows, the private sector has been responsible for a great deal of development and innovation in the forest carbon sector in Indonesia (e.g. Dixon and Challies, 2015). However, to further stimulate those activities, changes to the fiscal policy framework need to be considered. Addressing this aspect is also important because the Paris Agreement (Article 6) includes a market mechanism for emission reductions that allows carbon offsets between developing and developed countries to meet their NDC targets.

Cadman et al. (2019) explored the performance of fiscal incentives and primary industry and business stakeholder insights as to whether the private sector could be encouraged to engage in REDD+ through those incentives. While their research was framed in terms of engagement in REDD+, their findings are also relevant to reducing emissions unconditionally. They provide a detailed analysis of the many fees and charges that need to be reviewed by the government to incentivise sustainable forest management. They also stress that the government should consider providing incentives for the non-exploitation of forests by businesses engaged in the provision of environmental services as well as carbon transactions. These could take the form of private investments, private-public partnerships or civil society engagement in forestry and land use change, and may include incentives such as payment for ecosystem services or forest ecosystem restoration. It is worth noting a recent positive development in the context of these findings. A regulation on *Environmental Economic Instruments* (No. 46/2017), followed by a Presidential Regulation on the *Management of the Environmental Fund* (No. 77/2018) were introduced by the government, allowing it to develop a range of environmental incentive schemes as well as measures to dis-incentivise environmental degradation.

It had been recommended that the government also consider using inter-governmental fiscal transfers to provide incentives to regional governments, such as districts, because initiatives that limit land use change to avoid deforestation can result in significant reductions in local government revenues (Irawan et al. 2013,2014). The design of incentive schemes at the local government level requires a clear framework for assessing emissions reductions and determining which level of local government should be involved. Irawan et al. (2019) analysed the design of REDD+ in the context of Central Kalimantan province. While the research considered the jurisdictional approach to REDD+, its relevance is broader because a national government could use a jurisdictional approach to deliver (part of) its target for unconditional emission reductions. They analysed the main land use based activities taking place at the provincial, district and village level, and proposed that the implementation of REDD+ involve these three levels of jurisdiction. However, the implementation at the village level should be coordinated at the district level due to the size of areas and potential for emissions reduction. The authors found that district governments could contribute to reducing emissions by stopping deforestation by oil palm concessions, which in the case study area has the potential for reducing emissions by as much as 15% from a business-as-usual scenario.

[4] A second phase that would have been implemented between 2015 and 2020 was superseded by the requirement to submit the NDC to the UNFCCC.

Provincial governments have the authority to reduce emissions from state forest areas. In Central Kalimantan, for example, if no more deforestation occurred in production forests, projected avoided emissions between 2013 and 2020 are about 21% from business-as-usual. It is clear from these findings that local governments have a very significant role to play in controlling land use change and avoiding emissions.

The focus of research on inter-governmental fiscal transfers for the environment has, so far, been on transfers from federal governments to states – in federal systems such as Germany and India (Kumar and Managi, 2009; Ring, 2002) – and to the level of provinces and districts in Indonesia, as discussed above. However, there may be scope to provide incentives for improved environmental management to villages, the closest administrative level to families and individuals.[5] The Village Fund is a mechanism used by the Government of Indonesia to provide an annual inter-governmental fiscal transfer to villages which can be spent for priority activities selected by a village's government. The Fund has the potential to support sustainable practices among smallholders. Watts et al. (2019a) explored how the Fund could be used to finance tree planting and confirm that it could be used to support environmental management activities. To gain an understanding of how the Fund has been implemented in practice, they interviewed village heads about its operational aspects and their perceptions and understanding of it.

Given that the Fund has not yet supported environmental activities, Watts et al. (2019a) analysed the experience of the predecessor of the Village Fund which did support environmental activities, even if to a limited extent. The national level Community Empowerment Development Program began in 2007 and included a small component known as PNPM Green, with PNPM being the Indonesian acronym for the name of the overall program. Watts et al. (2019a) surveyed respondents in villages in seven districts in Southeast Sulawesi who had participated in the PNPM Green program about their recollections and perceptions of the program. They argue that although the Village Fund could be used to promote community tree planting, several improvements to the Fund would be needed, including: better defined lists of potential projects or earmarking portions for funding; improved technical assistance and access to materials; and the allocation of resources for developing village land use plans. Although these changes would increase the likelihood of successful community forestry and agroforestry initiatives, they would probably not encourage the planting of native species on degraded or critical areas. Therefore, they propose that additional funds be provided through the same mechanism and tied to extension support for rehabilitating degraded areas with native species. Although Watts et al. (2019a) detailed findings are specific to Indonesia, the experience of supporting village-based environmental activities may be relevant to countries that might already have inter-governmental fiscal transfer mechanisms to the village level; or which could be considering them and are interested in improving environmental management at that level.

Village level incentives have been trialed by the private sector as part of a package aimed at reducing the occurrence of fires near plantations established to supply the APRIL pulp and paper mill in Sumatra. A reduction in the incidence of fires needs to be part of a broader strategy for reducing emissions from land uses and forestry. For this reason, Indonesia's NDC includes the rehabilitation of two million hectares of peatland as a way of limiting the occurrence of fire, which normally does not affect non-degraded peatland. Fires in peatland also result in significant haze pollution which causes a range of negative impacts, including on human health and the economy. The cost to Indonesia of the two largest fire events, which occurred in 1997 and 2015, has been estimated at US$2.8 billion (Tacconi Tacconi, 2003) and US$16.124 billion respectively, the latter being equivalent to 1.8% of Indonesia's GDP in 2014 (Tacconi, 2016).

Watts et al. (2019b) analysed the effectiveness of the Fire Free Village Program implemented by APRIL which involved a mix of incentives, community engagement and support for alternative livelihoods. The program started a few months before the major fires associated with the El Nino (ENSO) event of 2015. Soon after the fires, a Presidential Instruction led to the imposition of a total ban on fires, including those used for agricultural purposes. Watts et al. (2019b) found a declining pattern of burning in the years prior to and including 2015, followed by an almost total cessation of burning. The reasons cited by villagers for fire reduction centred on regulations. The benefits of the Fire Free Village Program were valued at the community level. The incentives, however, appeared to encourage compliance rather than desirable voluntary behaviour. It is also important to stress that a transition to non-burning livelihoods was enabled by ongoing changes to permanent agricultural crops in particular oil palm and rubber as well as in non-farming livelihoods such as fishing, labouring, business and the civil service. They conclude that stricter environmental regulation reduces the potential for using voluntary incentives and suggest that incentives should focus on assisting smallholders to comply with regulation.

In considering a range of incentive options, it should be noted that the national government currently gives preference to command and control instruments, particularly moratoria on specific land use activities. The first moratorium, the *Suspension of Granting of New Licenses and Improvement of Governance of Natural Primary Forest and Peatland,* was introduced by Presidential Decree in 2011 for two years as a result of a bilateral agreement with Norway for the preparation and implementation of REDD+. The moratorium had an initial validity of two years and has been regularly renewed with the most recent in 2017. It suspended the issuance of new logging licenses which covered an estimated 22.5 million hectares, consisting of 7.2 million hectares of primary forest, 11.2 million hectares of peatland and 4.1 million hectares that fell into neither of these two categories (Murdiyarso et al., 2011). The Government of Indonesia is in the process of making the suspension permanent, meaning that, if it eventuates, there would be no new licenses issued for logging in primary forests and peatlands. A moratorium on the expansion of oil palm plantations was introduced on 19 September 2018 by Presidential Decree. It suspends the issuance of new oil palm concessions for three years and mandates increased attention to raising the productivity of existing oil palm plantations.

The Decree appears to have wide ranging governance implications for the oil palm plantation sector as shown by the tasks assigned to relevant ministries. These include: i) the Coordinating Ministry for Economic Affairs which is tasked with the verification of existing forest/concession permits and a range of other permits issued in relation to oil palm concessions to ensure that they are consistent with the national land use map (known as One Map Policy); ii) the Ministry of Environment and Forestry which needs to identify oil palm plantations illegally located in forest areas of high conservation value and prepare legal cases and claims for compensation; iii) the Ministry of Agriculture which has to verify the map of Business Permits allocated to oil palm plantations, evaluate whether plantation companies comply with the mandatory requirement to provide no less than 20% of the total plantation area as community plantation, and ensure that all oil palm plantations are certified according to the Indonesian Sustainable Palm Oil standard and, iv) the Ministry of Agrarian Affairs and Spatial Planning which has to evaluate the suitability of oil palm plantation permits against land use designation, increase the issuance of land rights to the communities for the area that each company has allocated to them, and accelerate the issuance of land rights for smallholder oil palm plantations.

The government's preference for the use of command and control instruments does not imply that it does not want to use incentive based approaches. For example, starting in early 2019, the national government and local governments in East Kalimantan province will

[5] Payment for environmental services schemes (PES) normally focus at the family and individual level, and in some cases on community groups.

implement the *Emission Reduction Program in East Kalimantan* with funding from the Forest Carbon Partnership of the Carbon Fund. The program will pay US $5/ton of CO_2e for reduced emissions. All levels of government will receive a share of the payments, from the national to the village level.[6] The national government may be favouring command and control instruments for the implementation of unconditional emission reductions because they are seen as less costly than incentive programs, or more effective, or a combination of the two. Research on incentive-based approaches for the implementation of unconditional emissions reduction activities may be useful to assess the reasons for their relative lack of adoption as well as for their potential effectiveness, efficiency, cost effectiveness, and equity when compared to command and control instruments.

The potential and actual impacts on livelihoods have been at the centre of the debate concerning the positive and negative aspects of REDD+. An initial warning that REDD+ could lead to the recentralization of control over forests (Phelps et al., 2010) was followed by extensive research on REDD+ and land tenure. Empirical cross-country comparisons found that REDD+ has provided some new opportunities for securing local tenure rights, but that interventions at the local level were insufficient, and that national programs for land tenure reform were needed (Larson et al., 2013; Sunderlin et al., 2014). Findings that are overall positive for livelihoods do not necessarily mean that there might not be negative impacts on livelihoods in certain circumstances (e.g. Chomba et al., 2016). Since those studies, the implementation of REDD+ and further unconditional emission reductions have been formally agreed as part of the Paris Agreement. It will therefore be important to consider how emission reduction measures affect tenure and, in turn, how changes in tenure affect emission reductions. In Indonesia, the governments of President Joko Widodo (elected in October 2014 and re-elected in April 2019) have initiated an extensive land reform program aimed at redistributing control over 21.7 million hectares of land, equivalent to about 12% of the nation's land area. Of that, 16.8 million hectares is forested land. Resosudarmo et al. (2019) considered how that part of the land reform program focused on the redistribution of access to forests might contribute to improving livelihoods, and how the redistribution of forest land might affect the attainment of emission reduction commitments. The land reform program consists of two major components: i) distribution of land and formalization of land ownership to landless farmers or farmers with small landholdings which targets an area of nine million hectares (not necessarily forested land); and, ii) the social forestry program which grants local communities usufruct and management rights to state forest lands and targets 12.7 million hectares of forests. The research considered four districts in the province of Central Kalimantan. The authors found that the current land reform process is increasing the area distributed to local people compared to previous reform attempts, although it is considerably behind schedule. They also stress that the resources allocated to grant forest use rights have not been accompanied by the same attention to fostering land-based livelihood activities and forest protection. Whether the allocation of forest land for social forestry will improve livelihoods in the near future is therefore questionable since post-licencing support needs to be provided and the distance from villages and markets of many forest areas.

In relation to climate change mitigation the authors note that social forestry is one of the country's core mitigation strategies and is expected to deliver 20% of the emissions reduction target from avoided deforestation and degradation (Republic of Indonesia, 2017). It is therefore concerning that they find that peat soils comprise nearly half (45.2%) of the almost 700,000 ha of forest identified in the official map for allocation to social forestry indicating major potential for increased emissions depending on underlying forest-use designations and peat depths. Particular attention will need to be devoted to balancing the livelihood aspects of the reform with its emissions reduction goal. In relation to the overall academic debate concerning the implications of REDD+ for land tenure, the case of Indonesia so far suggests that in the medium term land tenure is more likely to be determined by broader domestic political developments than REDD+ per se, as a result of the election of a President focused on improving the economy while giving special attention to rural and urban livelihoods.

The implications for livelihoods has probably been one of the most written about aspects of REDD+. It has been argued that sustainable livelihoods together with biodiversity conservation and equity are critical to both the legitimacy and effectiveness of REDD+ and they therefore need to be considered as pre-requisites for its implementation (e.g. Visseren-Hamakers et al., 2012). For this reason, benefit-sharing mechanisms are considered a central design aspect of REDD+ in order to create the necessary incentives to reduce carbon emissions (Luttrell et al., 2013). In the context of these views about benefit sharing from the implementation of REDD+ and the renewed emphasis on community development and social forestry in Indonesia (which favors community participation in forest emissions reduction programs), Muttaqin et al. (2019) explore the interests of nine communities in relation to the utilization of forest products and services and their participation in emissions reduction programs.

The communities are located in the provinces of Riau (most developed, particularly with opportunities for oil palm development); Central Kalimantan (medium level of development opportunities); and Papua (the more remote sites). Communities were also selected for their access to different categories of community and state forests to represent the spectrum of institutional settings under which forests in Indonesia can be managed. Muttaqin et al. (2019) point out that while communities doubted that REDD+ could be successful, most were willing to be involved in REDD+ given that it aims to conserve forests. Communities want REDD+ activities to provide higher income when compared to that from their usual activities. This study highlights that communities have different views about forests, ranging from interest in conservation for spiritual and/or livelihood reasons to clearing forest to establish oil palm plantations. The design and eventual implementation of social forestry and community-based emissions reduction programs (for unconditional or conditional emissions reductions) will need to account for this range of community motivations and expectations.

A strategy to reduce emissions in Indonesia would not be complete if it did not deal with the question of illegal deforestation and illegal logging. This is because it has been estimated that 40% of deforestation in Indonesia has occurred in forest classification types that restrict or prohibit land clearing (Margono et al., 2014), meaning that the deforestation detected by these authors was illegal. In recent years, the literature dealing with illegal forest activities has devoted significant attention to the Voluntary Partnership Agreements between the European Union and timber exporting countries (e.g. Rutt et al., 2018). Even if these agreements were successful, however, they would only influence deforestation and/or forest degradation associated with the harvest of timber for export purposes. To be successful, national emissions reduction programs need to address illegal deforestation in a holistic way. That is, they have to address all deforestation and forest degradation taking place in the country. Law enforcement is one of the key factors needed to control illegality in the forest sector.

Tacconi et al. (2019) compared Brazil and Indonesia to derive lessons for forest law enforcement. The study shows that Brazil implemented a forest law enforcement strategy that is reasonably successful in reducing illegal deforestation. Indonesia, on the other hand, is still considered to be struggling to control illegal land clearing and illegal timber production. The authors find that Brazil's forest law

[6] Another incentive-based mechanism has also been initiated in Jambi Province with funding from the BioCarbon Fund of US$15 million. The *Initiative for Sustainable Forest Landscapes* seeks to improve landscape management and reduce emissions from the forest and land use sector, while promoting alternative livelihoods.

enforcement activities relied on a clear strategy that involved key elements including remote sensing imaging to identify illegal deforestation, confiscation of timber and machinery, fines, and the blacklisting of municipalities that were not reducing deforestation. At the time Tacconi et al. (2019) completed their study, Indonesia did not have a centralized, strategic approach to law enforcement that relied on timely remote sensing data. Therefore, the authors stress that law enforcement strategies initiated at the local level mean that: i) the national budget and human resources for forestry law enforcement are not necessarily being allocated to the areas that have the most significant illegal forestry activities, and ii) local forestry enforcement officers do not necessarily target the most significant illegal forestry activities in their areas as they are unlikely to be able to monitor large forest areas without frequent remote sensing information. The authors recommend that Indonesia should consider the development of a centralized national law enforcement strategy. Indonesia should therefore consider the development of a centralized national law enforcement strategy. The important message arising from their research is that more attention will need to be devoted to addressing illegal deforestation and illegal logging in order for countries to be able to deliver on the emissions reduction commitments they have made in their NDCs. As this paper was being finalized, the Ministry of Environment and Forestry established the intelligence centre for environmental and forestry law enforcement.[7] This event seems to indicate that the Ministry of Environment and Forestry might be moving to modify its approach to law enforcement in a way that parallels the recommendations provided by Tacconi et al. (2019).

Tacconi and Muttaqin (2019) conclude the Special Issue by outlining the regulatory architecture for the implementation of emissions reduction activities and provide an initial analysis of the activities proposed to reduce emissions in the forestry sector. Whilst Indonesia's regulatory architecture is ready for the implementation of emissions reduction activities, Tacconi and Muttaqin (2019) find that proposed activities fall short of the emissions reduction committed in the NDC. Policies and activities with the potential to further reduce or increase emissions are highlighted by drawing on the findings of the papers published in this Special Issue.

4. Conclusion

Reducing emissions from deforestation and forest degradation is essential in order for the Paris Agreement to achieve its aims. It is clear that countries that have committed to reducing emissions from the forest sector face a highly complex problem. This is exemplified by the many aspects of the design and implementation of an NDC and their incorporation of REDD+, that have not been addressed by the papers presented in this Special Issue.

Countries that intend to reduce emissions from forests will need to implement a range of policies and activities which may involve command and control instruments, incentive schemes, national level activities such as forest rehabilitation; and project based ones, such as site-specific carbon conservation projects. The design and implementation of the NDCs which are the overarching guide for these programs will require a significant research contribution. We hope that this Special Issue provides some useful directions for the further development of Indonesia's NDC as well as stimulating and informing research for other countries and their NDCs.

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[7] https://kabar24.bisnis.com/read/20190503/15/918266/klhk-miliki-intelligence-center-dukung-penegakan-hukum-lingkungan

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