TECHNICAL REPORT:

Improving Governance Of Indonesia's Peatlands And Other Lowland Ecosystems

February 2021

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We acknowledge the lack of official consensus on the appropriate extent and translation of "lowlands" in Indonesia. This study updates the extent of lowland boundaries based on the Water Management for Climate Change Mitigation and Adaptive Development in the Lowlands (WACLIMAD) project (2010–2012), which were developed in consultation with relevant government agencies. This results in new lowland maps that contain larger areas than the WACLIMAD maps. The objective of this mapping exercise is not to advocate new physical lowland boundaries that are absolute, undisputed, and legally binding. Rather, the aim is to develop analytical boundaries of the lowlands as landscape units with a set of unifying physical and hydrological characteristics that distinguish them from the upland systems, in order to foster a cross-sectoral policy dialogue on sustainable lowland developments. The details can be found in the later sections of the report.

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Acronyms and Abbreviations

ATR/BPN	Ministry of Agrarian and Spatial Planning, <i>Kementerian Agraria dan Tata Ruang/National Land Agency, Badan Pertanahan Nasional</i>
BAL	Basic Agrarian Law
BAPPENAS	Ministry of National Development Planning, <i>Badan Perencanaan Pembangunan Nasional</i>
BBSDLP	Indonesian Agency for Agricultural Land Resource Research Development, <i>Balai Besar Penelitian dan Pengembangan Sumberdaya Lahan Pertanian</i>
BIG	Geospatial Information Agency, <i>Badan Informasi Geospasial</i>
BRGM	Peatland and Mangrove Restoration Agency, <i>Badan Restorasi Gambut dan Mangrove</i>
cm	centimeter
CMEA	Coordinating Ministry for Economic Affairs, <i>Kementerian Koordinator Bidang Perekonomian</i>
CO₂	carbon dioxide
COP	Conference of Parties to the United Nations Framework Convention on Climate Change (UNFCCC)
EU	European Union
FLEG-T	Forest Law Enforcement, Governance, and Trade
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GoI	Government of Indonesia
GtC	Gigaton of Carbon
ISPO	Indonesia Sustainable Palm Oil Standard
LULUCF	land use, land-use change and forestry
MoA	Ministry of Agriculture
MoEF	Ministry of Environment and Forestry
MoPWH	Ministry of Public Works and Housing
PHU	Peat Hydrological Unit, <i>Kesatuan Hidrologis Gambut</i>
PPKL	Directorate General of Environmental Pollution and Damage Control (<i>Direktorat Jenderal Pengendalian Pencemaran dan Kerusakan Lingkungan</i>)
QANS	Quick Assessment and Nationwide Screening
RBO	River Basin Organizations
REDD	Reducing Emissions from Deforestation and Forest Degradation
SFP	Social Forestry Program
WACLIMAD	Water Management for Climate Change Mitigation and Adaptive Development in the Lowlands project (2010–2012)

OPENING

Executive Summary

Executive Summary

01 Overview of Indonesia's lowlands

Indonesia's lowlands are endowed with significant natural capital. Indonesia's lowlands cover approximately 33.9 million hectares of low-lying landscapes in the islands of Sumatra, Kalimantan, and Papua. Lowland areas comprise peatlands (41%), mineral soil lands (53%), and mangroves (6%). Rich natural assets, including forest, land, water, peat, marine life, and mineral resources, make the lowlands strategic landscapes for Indonesia to achieve its national policy priorities on poverty reduction, agriculture, forestry, and climate change. Indonesia's lowlands are also home to the world's largest tropical peatlands, which are important carbon sinks for global climate change mitigation. Mostly located within the lowlands, Indonesia's peatlands account for roughly 45% of the world's tropical peatlands and are estimated to store 37% to 65% of the global tropical peat carbon pool, or roughly 31 years of Indonesia's annual emissions in 2014. The value of ecosystem service of carbon sequestration provided by peat in Sumatra and Kalimantan alone is estimated to be around US\$ 130 million annually.

The lowlands have powered significant economic and livelihood improvements both nationally and regionally, but to minimize unsustainable trade-offs, lowland development models should be improved and made more sustainable. Almost all of Indonesia's lowland areas were historically forested, but in recent decades have been significantly converted for the expansion of agriculture, particularly food crops and, more recently, timber, fiber (pulp and paper), and oil palm plantations. These commodity-based exports generate foreign exchange and employment and support the livelihoods of a large number of smallholders. However, commodity-driven lowland developments in both peat and non-peat areas have been associated with high health and environmental costs due to the impacts from deforestation, forest degradation, and biodiversity loss. Drainage-based agriculture has also resulted in increasingly fire-prone lowlands. Investments in the lowland areas also face an increasing risk from drainage-related land subsidence and flooding.¹

Although lowland provincial and district governments have shown high gross domestic product (GDP) growth, poverty remains high among the lowland population, reflecting missed opportunities in promoting shared prosperity. Peat fires disproportionately account for globally significant damage from toxic haze and carbon dioxide (CO₂) emissions. The Government of Indonesia has spent more to deal with the aftermath of peat fires than to prevent them. Burned areas and fire frequency following peatland drainage have been increasing in the last two decades. Fires also lead to peat

¹ Subsidence is the gradual caving in or sinking of an area of land. In peatlands, subsidence refers to irreversible lowering of the surface as a consequence of peat shrinkage and biological oxidation (Hooijer et al., 2012).

deprivation. Fires on drained peatlands begin as surface fires and can transition rapidly to subsurface peat fires. Compared to fires on mineral soils, burning peat soils produce greater smoke intensity and CO₂ emissions, the latter of which can continue for decades. Unless actively managed, the sustainability challenges from fires and other externalities associated with the lowland development model will impose rising costs on Indonesia and compromise future development.

02

Report objective

This report aims to advance a policy dialogue on how to address sustainability challenges from lowland developments. The specific approach discussed in this report is the “landscape approach” which, in turn, calls for improved “landscape governance.” As a technical background study, the report serves four functions. First, it summarizes the principles of a landscape approach, elaborated in the context of Indonesia's lowlands through two previous technical studies. Second, it takes stock of current governance challenges in Indonesia's lowlands, focusing on those related to the government sector, and discusses how these challenges currently prevent a landscape approach from being implemented in Indonesia's lowlands. Third, it reviews Indonesia's recent efforts to address the governance challenges in the management of peatlands and other lowland ecosystems. Fourth, it offers recommendations on options to improve lowland governance in order to shift toward integrated management of Indonesia's lowlands based on a landscape approach.

The report focuses on the lowland areas in eight fire-prone provinces, and on key landscape governance issues related to peatlands. Indonesia suffered many years of repeated fires and haze crises, with landmark events in 1982/83, 1997/98, 2002, 2006, 2009, and 2015. The 2015 El Niño-driven fires were particularly extensive and costly. Almost 80% of the 2015–16 fires occurred within the lowland areas in eight fire-prone provinces—Central Kalimantan, East Kalimantan, Jambi, Papua, Riau, South Kalimantan, South Sumatra, and West Kalimantan—which together account for 87% of lowland areas nationally. The report highlights the importance of sustainable landscape management of lowland areas, particularly of the peatlands within lowland boundaries, for achieving the Government of Indonesia's objective in preventing land and forest fires.

03

Current landscape governance challenges and their consequences on the lowlands

Integrated land and water management supported by landscape governance is central to ensuring the sustainable development of lowland areas. In this study, landscape governance is defined as the coordinated actions and processes of the Indonesian government across sectors, which together comprise an overall framework to manage lowland areas as landscape units. Landscape governance requires, first and foremost, the delineation of lowlands based on all relevant sectors' mutual and science-based understanding of natural biophysical and hydrological conditions, a shared overall vision for lowland development, and land-use zoning and resource management based on hydrological boundaries, particularly for the peat ecosystems. This is currently not the case in Indonesia.

While several government ministries and agencies are involved in managing natural resources in the lowlands, there is neither a common understanding of the term “lowlands”, nor a government champion with a clear mandate and responsibilities for overall lowland sustainability. There is also no official consensus on the appropriate extent and definition of “lowlands” in Indonesia that could support an effective landscape approach. Currently, the term “lowlands” has a different meaning to different government agencies in Indonesia. For example, the Government of Indonesia recognizes both the terms “swamp” (*rawa*²) and “lowlands” (*dataran rendah*³). The 2015 national swamp map used by the Ministry of Public Works and Housing (MoPWH) suggests that swamp covers 80% of the 33.9 million hectares of lowlands delineated in this study. The Ministry of Agriculture's (MOA's) definition of lowlands (*dataran rendah*), however, expands over 154 million hectares of area, covering almost all of the country.

The lack of a common lowland definition is one of the underlying issues leading to Indonesia's lack of a coherent framework for a landscape-based lowland management.

This report uses the definition and boundaries of lowlands used by the maps generated by the Water Management for Climate Change Mitigation and Adaptive Development in the Lowlands (WACLIMAD) project (2010–2012) as a starting point for analysis and updated them with the latest data. Based on this approach, the term “lowlands” in this study refers to the landscapes in the coastal and near-coastal zones that share the common characteristics of low elevation, boundary separation from the upland land systems, drainage dependent on the tidal fluctuations and sea level, permanent water saturation, unconsolidated soils under natural conditions, and the formation of extensive areas of peat. With updated data, the lowlands are delineated in this study to cover 33.9 million hectares of low-lying areas across Sumatra (36%), Kalimantan (35%), and Papua (29%). Covering roughly a fifth of Indonesia's land area, the lowlands encompass peatlands, mineral-soil lands, and mangroves. Most of the lowlands are coastal lowlands (93%), which are found in the low-lying coastal and near-coastal areas of the three islands, but also include some non-coastal lowlands located further inland.

Weak landscape governance is a driver for unsustainable lowland development in Indonesia in four ways. First, uncoordinated policy targets, together with the dual land administration practice, constrain effective land-use planning. Sectoral agencies' pursuit of uncoordinated and conflicting policy targets calls for more land than the country has available and has thus driven land competition in the resource-rich lowlands. This situation is also complicated by the dualism in land administration practice, whereby lands classified as Forest Area (*Kawasan Hutan*) are managed separately from lands classified as Non-Forest Area (*Areal Penggunaan Lain* - APL). Due to the use of multiple maps and unclear forest boundaries, overlapping sectoral operational boundaries among ministries also lead to coordination problems that complicate land-use planning. For example, licensing for the use of natural resources (extractives, timber and forest products, and estate crops, including oil palm) is spread across key lowland ministries, causing issues with transparency and overlap, which are further complicated by the absence of a common base map and data platform. This lack of clarity makes it

2 In Ministerial Regulation of the Ministry of Public Works and Housing No. 11, 16, 29 Year 2015 defined “rawa” generally as “water vessel and the water resources contained therein, permanently or seasonally inundated, formed naturally on relatively flat or concave land with mineral or peat deposits, and overgrown with vegetation, which is an ecosystem.”

3 A 2015 publication of the Ministry of Agriculture's Centre for Agricultural Land Resource Research Development (BBSDLR) defined “lowlands” (*dataran rendah*) as land below 400 meters above sea level. The publication also defined “midland” (*dataran sedang*) (as land 400 to 700 meters above sea level) and “highland” (*dataran tinggi*) (as land more than 700 meters above sea level).

extremely difficult to enforce laws and regulations managing land use and to prevent land conversion. The situation encourages agricultural expansion into forest areas and hinders the Government of Indonesia's ability to optimize land-use planning and protect forest resources. With insufficient compensation for local land users and lack of clear boundaries of issued concessions, large-scale forest and agricultural concessions have also created land conflicts between private concessionaires and local communities. Unclear legal recognition of land rights and insecure tenure arrangements that result from a dual land administration practice are also key drivers of recurrent man-made fires in the lowlands.

Second, overlapping sectoral operational boundaries preclude integrated water management in lowland areas based on natural hydrological boundaries. Current lowland water management is largely based on sectoral operational boundaries, whereby institutional mandates over Forest versus Non-Forest Areas largely determine the responsibility for managing water. Institutionally, the Ministry of Public Works and Housing (MoPWH) is the official water resources manager in the lowlands based on a national swamp regulation. However, this study's analysis suggests that, given the overlapping sectoral operational boundaries among the Ministry of Public Works and Housing (MoPWH), the Ministry of Environment and Forestry (MoEF), and the Peatland and Mangrove Restoration Agency (BRGM), MoPWH actively manages water resources in only 12% of the delineated lowland swamps in the eight fire-prone lowland provinces. This is due to the concentration of MoPWH assets in the Non-Forest Areas (APL), which are not under private concessions. MoPWH is not involved in plantation licensing and in practice is not engaged in water management in swamps located in the plantation areas, which are managed by the private sector. For Forest Area, management institutions are being developed in the form of Forest Management Units (*Kesatuan Pengelolaan Hutan*), which are typically, but not always, defined based on watersheds (*Daerah Aliran Sungai*). Nevertheless, the Forest Management Units still generally lack integration with water resource management by MoPWH.

Third, unsynchronized forestry and spatial planning regulations, as well as overlapping operational boundaries for water management, particularly impede peatland protection. Many environmental regulations to protect peatlands have come into force more recently than many key spatial plans. As such, significant areas of peatland remain designated as plantation in existing spatial plans, with licensing in place for commercial use (*Hak Guna Usaha*) that is at odds with peatland protection regulations. It would be difficult to reverse such land use, not only in spatial planning documents, but also with regard to the land-use rights already issued. In addition, while effective protection of peatlands requires integrated water management based on Peat Hydrological Units (PHUs) as stipulated in Government Regulation No. 57/2016, so far, no follow-up technical regulations on PHU-based water management have been issued. In practice, water management on peatlands is currently influenced by a number of entities—BRGM, MoEF, MoPWH, provincial- and district-level governments, as well as private companies, whose water management approaches do not always complement one another. Due to limited coordination in some areas, there have been cases where the local Public Works Agency (*Dinas Pekerjaan Umum*) has conducted draining activities on peatlands where BRGM is rewetting.

Fourth, governance challenges also contribute to the difficulty in effectively monitoring private sector practices in Indonesia's lowlands. A large proportion of the country's lowland is under private sector control through concession licenses issued by multiple ministries, which in several cases can be conflicting, without a clear framework for water management under existing concessions. Meanwhile, the government is facing a major task in ensuring compliance. Although some local and national community sustainability initiatives are underway, they currently do not affect the eligibility of private companies to apply for concession extensions.

04

Government responses to the governance challenges in the lowlands

Indonesia has taken some bold steps to address the governance challenges in the lowland areas, the overarching goal of which is the protection of peatlands. Key measures taken include establishment of BRGM, strengthening peatland protection through moratoriums and environmental regulations, strengthening the protection of peat swamps in water regulations, and an effort to forge a common definition of peatlands across key lowland ministries through a Peatland Hydrological Unit map and Maps of National Peatland Functions. These peat-centric actions have been complemented by broader reforms to improve cross-sectoral coordination for fire prevention, strengthening Forest Management Units, enhancing access to forest land use rights, and developing community sustainability certification schemes.

Despite these positive initiatives, more needs to be done for the sustainable management of Indonesia's lowlands. In particular, Indonesia needs to have a cross-sectoral champion to move the lowland sustainability agenda forward. In terms of short-term priority actions, there is an urgent need to enforce the protection of deep peat areas as a key lowland policy priority, which needs to be reviewed in the context of what appears to be a setback in peatland protection. For example, while previous regulations require the protection of peat domes, a 2019 environmental regulation allows the development of peat domes under certain conditions.

Beyond the protection of peat domes, there is also an urgent need for clear guidance on how to manage peatlands based from a whole PHU perspective, which covers both the peat domes and surrounding areas with shallower peat depth, including some mineral soil areas. At the strategic level, new actions are also needed in the medium to long term to forge a common lowland sustainability vision, promote data sharing and use in lowland management, mainstream peatland protection and management in key regulations outside the forestry and environment sector, and enhance the monitoring of private sector practices. Improved governance of other lowland ecosystems such as mangroves also needs to be addressed. Unless there is a serious policy reform to institutionalize coordination among these institutions, actions will most likely fall short of being effective.

05

Recommendations

This report offers nine key governance-related recommendations to support Indonesia in improving its management of peatlands and other lowland ecosystems. Strengthening peatland protection is a necessary priority but is not sufficient for sustainable development of Indonesia's lowlands. Peatland management must especially focus on deep peat and be complemented by actions from the national to local levels to transition from uncoordinated sectoral management of lowland resources to integrated governance of lowlands based on a landscape approach.

While each ministry or agency has a specific mandate with regard to the lowlands, improved coordination is also needed to ensure that the execution of each institutional mandate is complementary and leading to overall positive lowland outcomes. Table ES.1 summarizes the report's recommendations, which are divided into two groups: (1) strategic-level recommendations to promote a paradigm shift within the government toward integrated landscape governance of Indonesia's lowlands, focusing on four overall actions related to a common lowland vision, transition to a landscape governance approach, lowland coordination mechanisms, and the role of subnational and local governments; and (2) five recommendations geared toward addressing specific lowland sustainability issues, i.e. peat, land, fire, water, and private sector practices discussed in this report. In terms of prioritization, the Government of Indonesia could prioritize in the short term the incremental actions, such as enforcing existing laws and regulations and improving technical guidelines (such as on PHU-based water management) and strengthening existing monitoring systems (such as for water level in peatlands and fire incidents), as these are relatively easy to achieve and could be immediately implemented. In the medium and long term, the government needs to focus on the transformative actions, such as establishment of a cross-sectoral lowland mandate and coordination mechanism, which requires fundamental changes in the lowland governance framework.

Table ES.1. Summary of Recommendations to Improve Landscape Governance to Address Key Sustainability Issues in Indonesia's Lowlands

Strategic-Level Recommendations		
RECOMMENDATION		KEY ACTIONS
1.	Establish a common lowland vision that balances economic development, vulnerability reduction, and environmental sustainability	<ul style="list-style-type: none"> • Develop a national common vision and goal statement for Indonesia's lowland management. • Establish commonly agreed sustainability indicators for the lowlands, linked to the Sustainable Development Goals. • Assess the cumulative impact of sectoral policy targets on the lowlands against the sustainability criteria. • Consider alternative options to achieve sustainable lowland outcomes.

2.	Promote a paradigm shift toward a landscape approach across government agencies	<ul style="list-style-type: none"> Establish lowland boundaries within each region based on scientific evidence and stakeholder consultations. Develop a master plan for land-use macro-zoning of lowland hydrological units, and associated water management standards; and incorporate the zoning in the provincial spatial planning process, provincial-level landscape management strategy, and/or provincial green growth initiatives. Define lowland landscapes as strategic areas in spatial plans, but also ensure that land-use planning in the lowlands is integrated with the broader landscape of the province. Develop specific guidelines on land-use and water management in tidal and non-tidal lowlands based on the macro-zoning.
3.	Enhance coordination, enforcement, and monitoring mechanisms in the lowlands	<ul style="list-style-type: none"> Establish a formal coordination mechanism across relevant ministries and agencies for lowland management. Develop processes for integrated and coordinated lowland management (e.g., through forward spatial planning). Identify and pilot bottom-up institutional mechanisms for participatory lowland governance at the local level, including through existing mechanisms such as village or district development planning roundtables (<i>Musdes</i> and <i>Musrenbangkab</i>). Enhance the participation of community and nongovernmental organizations in lowland planning and management. Strengthen the overall lowland monitoring system, by building new capacities in addition to existing parameter-specific ones (e.g., water, land cover, fire).
4.	Establish a clearer lowland management mandate for subnational and local governments	<ul style="list-style-type: none"> Strengthen the role of subnational and local governments in lowland management through mandates and through fiscal and other incentives.

Recommendations to Address Specific Sustainability Issues

RECOMMENDATION		KEY ACTIONS
5.	Broaden the focus on peatland restoration to peatland management, based on the landscape approach	<ul style="list-style-type: none"> Enforce the legal protection of deep peat areas. Consider regulatory changes to shift the focus from peatland restoration focusing on peat domes to integrated peatland management and ensure overall consistency. Incorporate a shared peat mandate, a paradigm shift, and peat-related targets and budgets in MoPWH's water management activities in provinces beyond the priority seven provinces. Improve coordination among the BRGM, MoEF, MoA, and MoPWH, using PHUs as a joint planning unit.

6.	Improve land management in the lowlands through spatial planning, synchronized maps, and rationalized land classification	<ul style="list-style-type: none"> • Scale-up implementation efforts under the One Map Policy Initiative: Finalize PHU maps at 1:50,000 and legalize the detailed functions map at 1:50,000. • Rationalize land classifications to optimize land use in the conservation, adaptive management, and development zones of the lowlands. • Consider extending the moratorium on new licenses on peatlands and primary forests until the rationalized land classification is in place.
7.	Strengthen integrated water management in the lowlands, based on hydrological boundaries and harmonized water standards	<ul style="list-style-type: none"> • Improve institutional coordination and harmonize operating procedures of agencies affecting water use in the lowlands. • Set water management standards for all three macro-zones of the lowlands, differentiating between the requirements of tidal and non-tidal lowlands. • Implement and monitor the lowland water management standards across public and private lands regardless of forest or non-forest status. • Incorporate lowland water management standards into agricultural regulations and concession licenses. • Clarify the water management role of the MoPWH in areas where it is inactive (e.g., areas under private sector concessions). • Improve regular monitoring for both sea level rise and subsidence as part of a lowland water monitoring system.
8.	Improve fire management, through improved monitoring system and building local capacities	<ul style="list-style-type: none"> • Strengthen a lowland-wide fire monitoring system, particularly early warning and detection capacities. • Strengthen and adequately finance local systems for preventing and responding to fires. • Promote alternative methods of land clearing without using fire via provincial and local government regulations and communication campaigns.
9.	Improve oversight of private sector practices, using performance-based licensing	<ul style="list-style-type: none"> • Use performance indicators as one of the criteria for renewing the licenses of private concessionaires operating on lowlands. • Use incentive mechanisms to comply with recommendations in the study, such as carbon trade schemes that ensure environmental sustainability and benefits for local people.

CHAPTER 1

Indonesia's lowlands: an overview

1

Indonesia's lowlands: an overview

1.1. National and global significance of Indonesia's lowlands

Lowlands are deemed as strategic landscapes for Indonesia to achieve its national policy priorities on poverty reduction, agriculture, forestry, and climate change.

Indonesia's lowlands are endowed with nationally significant natural capital. The lowland areas cover approximately 33.9 million hectares of low-lying landscapes on the islands of Sumatra, Kalimantan, and Papua, comprising peatland, mineral-soil land, and mangroves (map 1.1). Lowland areas contain rich forest, land, water, marine life, and mineral resources, and are among the most biodiverse landscapes in Indonesia (Hergoualc'h et al. 2018).⁴ Many globally significant national parks are found within the lowlands.⁵

These rich natural assets make the lowlands strategic landscapes for Indonesia to achieve its national policy priorities on poverty reduction, agriculture, forestry, and climate change.

Indonesia's lowlands are home to the world's largest tropical peatlands, which are important carbon sinks for global climate change mitigation. Around 41% of Indonesia's lowlands are peatlands, including 9% of deep peat (see box B1.1 and figure B1.1.1). The total peatlands in Indonesia's lowlands are equivalent

to 92% of all peatlands in the country, and the deep peat found with lowland peatlands account for almost all (99%) of the country's deep peat areas (3 meters and above). Indonesia's peatlands account for roughly 45% of the world's tropical peatlands (Dohong, 2018), which is the largest share worldwide, and are estimated to store between 37% to 65% of the global tropical peat carbon pool,⁶ or roughly 31 years of Indonesia's annual emissions in 2014.⁷ In terms of economic value, a World Bank study estimated that the value of ecosystem services of carbon sequestration provided by peat in Sumatra and Kalimantan alone are equivalent to around US\$ 130 million annually (World Bank, 2019c).

⁴ Indonesia's lowlands are home to iconic species including orangutan, Sumatran tiger, and elephant.

⁵ Giam Siak Kecil (Riau), Berbak (Jambi), Sembilang (South Sumatra), Sebangau (Central Kalimantan), and Tanjung Puting (Central Kalimantan).

⁶ Warren et al. (2017) estimated Indonesia's total peat carbon store range at 13.6 to 40.5 gigatons of carbon (GtC), with a best midpoint estimate at 28.1 GtC, equivalent to 37% of the current estimate of the global tropical peat carbon pool (75 GtC). Page, Rieley, and Banks (2011) estimate that Indonesia's share of global tropical peat carbon is as high as 65% (57.4 GtC).

⁷ According to Indonesia's Third National Communication to the United Nations Framework Convention on Climate Change (Republic of Indonesia 2017), Indonesia's total emissions in 2014 were 1.84 GtC. Assuming the high bound number of 57.4 GtC stored in Indonesia's tropical peat as per Page, Rieley, and Banks (2011), Indonesia's peatlands store carbon equivalent to roughly 31 years of the country's annual emissions.

Box 1.1. Indonesia's Lowlands and Peatlands

Despite the national and global significance of Indonesia's lowlands, there is no officially agreed definition of the term "lowlands" or the boundaries of lowland areas. The term "lowlands" has different meanings to different agencies. However, in the context of agricultural development and water management, they are largely associated with swamp (*rawa*) reclamation efforts during the 1970s and 1980s, which were supported by the Government of Indonesia, largely through the Ministry of Public Works and Housing (MoPWH). The 2015 national swamp map suggests that swamp covers 80% of the 33.9 million hectares of lowlands delineated in this study. The Ministry of Agriculture (MoA) has its own definition of "lowlands"^a (*dataran rendah*). The MoA's definition of lowlands expands over 154 million hectares of area, covering almost all of the country.

This report uses the definition and boundaries of lowlands used by the maps generated by the Water Management for Climate Change Mitigation and Adaptive Development in the Lowlands (WACLIMAD) project as a starting point for analysis and updated them with the latest data.^b Additional data (such as satellite images and results from ground checking a new lowland mapping project 2013–2015), which were not used during the WACLIMAD mapping process were also included. This process resulted in the new lowland boundaries that are larger than those delineated by the WACLIMAD project (see Annex 1 for more detail).

With updated data, Indonesia's lowlands are delineated in this study to cover 33.9 million hectares of low-lying areas across Sumatra (36%), Kalimantan (35%), and Papua (29%). Covering roughly a fifth of Indonesia's land area, the lowlands encompass peatlands, mineral-soil lands, and mangroves. Most of the lowlands are coastal lowlands (93%), which are found in the low-lying coastal and near-coastal areas of the three islands, but also include some non-coastal lowlands located further inland. Both coastal and non-coastal lowlands share the characteristics of low elevation, common parental materials (for example, alluvium and organic matter), permanent water saturation, and unconsolidated soils under natural conditions. Coastal lowlands are tidally influenced along primary river segments for the larger part of the year, contributing to their waterlogged conditions. The high degree of water saturation precludes the decomposition of organic matter such as plant material, resulting in the formation of extensive areas of peat.

Not all peat-containing lowland areas are defined as peatlands, and this report employs the official definition of peatland used by Indonesia's Ministry of Agriculture (MoA), which is an area with an accumulation of partly decomposed organic matter, water saturated with carbon content of at least 12% (usually 40% to 60% carbon content) and the thickness of the

carbon rich layer of at least 50 centimeter (cm) (Agus, Hairiah, & Mulyani, 2011; Kartawisastra, 2015). In peatlands, there is a gradient of peat depths from the deepest around the main peat domes to the diminishing layers away from the domes, with a mineral substratum under all, and therefore peatlands can be classified as shallow and deep peat areas. Areas that do not meet the definition of peatland are classified as land with mineral soils, even though they may have some peat content.

Estimates of Indonesia's total peatland area vary widely. According to the 2017 MoA peat map, the country has approximately 15 million hectares of peatland, of which 92%, or 13.8 million hectares (which includes 99% of deep peat areas more than 3 meters thick, equivalent to 2.97 million hectares), are found within the lowland boundaries delineated in this study.^c These 13.8 million hectares of peatlands constitute 41% of all lowland areas. Outside these peatlands, the lowlands are composed of mineral soil lands (18 million hectares), and mangroves (2.15 million hectares) underlain primarily by mineral soils (map 1.1).

Figure B1.1.1. Peatland Share of Indonesia's Lowlands

Note:

- BBSDLP (Balai Besar Litbang Sumberdaya Lahan Pertanian), 2015 defined "lowlands" (dataran rendah) as land less than 400 meters above sea level. The publication also defined "midland" (dataran sedang) as land 400 to 700 meters above sea level, and "highland" (dataran tinggi) as land more than 700 meters above sea level.*
- The WACLIMAD study defines "lowlands" as landscapes in the coastal and near-coastal zones that share the common characteristics of low-elevation, boundary separation from the upland land systems, drainage dependent on the tidal fluctuations and sea level, permanent water saturation, unconsolidated soils under natural conditions, and the formation of extensive areas of peat.*

- c. The calculation is based on the 2017 peat map produced by the Indonesian Center for Agricultural Land Resources Research and Development (Balai Besar Litbang Sumberdaya Lahan Pertanian - BBSDLP), which was obtained for this study through the Peatland and Mangrove Restoration Agency (BRGM). There is a difference between the estimated area of peatlands within the WACLIMAD study's lowland boundaries and this report's updated lowland boundaries (see Annex 1 for more details).

Map B1.1.1. Indonesia's Lowlands

Note:

- The lowland maps produced during the WACLIMAD project have been updated by this study with new scientific data. The new lowland maps contain larger areas than the WACLIMAD maps (see Annex 1).
- The objective of this mapping exercise is not to advocate new physical lowland boundaries that are absolute, undisputed, and legally binding. Rather, it aims to develop "analytical boundaries" of the lowlands as a landscape unit with a set of unifying physical and hydrological characteristics that distinguish it from the upland systems.
- Boundaries are approximate and not official map projections.
- Area is calculated based on a base map of a scale of 1:250,000.

1.2. Land-use change in Indonesia's lowland areas

Since the 1970s, Indonesia's lowlands have been significantly converted for the expansion of agriculture, particularly food crops and, more recently, timber, fiber (pulp and paper), and oil palm plantations.

Since the 1970s, Indonesia's lowlands have been significantly converted for the expansion of agriculture, particularly food crops and, more recently, timber, fiber (pulp and paper), and oil palm plantations. The lowland areas, including the peat forests and mangroves, have historically been forested. In the 1970s, the Government of Indonesia started developing the lowlands for food crops and promoted farmers' resettlement from the overpopulated islands of Java and Bali under a transmigration program (Whitten, 1987). These government-sponsored swamp reclamation schemes were located mainly on mineral and shallow peat soils along the tidal rivers (BAPPENAS et al. 2013). In the 1990s, the government began issuing more plantation licenses in lowland areas as private companies became interested in using peatlands for the production of pulpwood, mostly from acacia and oil palm plantations (McKinsey & Company 2015).

The pattern of land-use and land-cover change since the 1990s differs among the three lowland islands. Sumatra's lowlands have seen the rapid expansion of monoculture estate crops with rapid deforestation, particularly of peat forest, and a recent shift toward plantation expansion in Non-Forest Areas (figure 1.1). Land use in Kalimantan's lowland areas has changed from large-scale land conversion to irrigated rice schemes to land conversion for plantation crops. While facing increasing pressure from land-use changes, Papua's lowlands are home to the largest relatively intact primary natural ecosystems in Indonesia, presenting opportunities for the pursuit of sustainable lowland development pathways.

Figure 1.1. Overall Land-Use and Land-Cover Change in the Lowland Areas across Sumatra, Kalimantan, and Papua, 1990–2014

Panel A. Sumatra

Panel B. Kalimantan

Panel C. Papua

Source: MoEF data on land use and cover (1990–2014) overlaid with the lowland boundaries produced for this study.

Note:

The same 10 land-use and land-cover classifications used as Uda, Hein, and Sumarga (2017):

1. Primary forests: upland forest, swamp forest, and mangrove forest;
2. Secondary forests: upland forest, swamp forest, and mangrove forest;
3. Industrial timber forest plantations;
4. Agricultural plantations: public and estate plantations of crops such as oil palm and rubber;
5. Degraded land: dry shrub, wet shrub, savanna, grasses, open areas, and open swamp areas;
6. Paddy rice field;
7. Dryland agriculture;
8. Urban areas: settlements, transmigration settlements;
9. Open water: water bodies; and
10. Other uses: fish ponds/aquaculture, mining, ports and harbors, areas where satellite images are covered by cloud or there are no data.

1.3. Sustainability challenges from lowland developments

1.3.1. Limited sharing of economic prosperity

While Indonesia's economic and livelihood gains have been substantial, the overall prosperity from lowland development has not been shared equitably.

Commodity-driven development has powered significant economic and livelihood improvements both nationally and in Indonesian lowland areas. In the last decade, Indonesia has become the world's leading producer and exporter of timber products and palm oil. Primary timber products accounted for an export value of US\$ 2.5 billion in 2015, with key exports including plywood, pulp and paper, moldings and joinery, furniture, sawn timber, and veneers.⁸ Indonesia is also the world's largest producer and exporter of palm oil, with production in 2016 reaching 32 million tons and exports of 27 million tons, equivalent to US\$ 18.6 billion in total value.⁹ These commodity-based exports are an important foreign exchange earner and provide employment opportunities for millions of Indonesians. Smallholders' land accounted for approximately 44% of total oil palm area in Indonesia in 2014¹⁰, and these farmers have the potential to manage 60% of total palm oil production by 2030 (Suhada, Bagja, and Saleh 2018). Income from oil palms is an important livelihood source for smallholders, a large proportion of whom live in the lowlands (Rist et al., 2010).

While Indonesia's economic and livelihood gains have been substantial, the overall prosperity from lowland development has not been shared equitably. Lowland provincial and district governments have seen high GDP growth from the rapid development of industrial oil palm and wood fiber plantations, however, pockets of high poverty remain.

For example, while Riau has the highest economic performance in its lowlands, paradoxically the area has many of the worst indicators of poverty, inequality, education, and rural infrastructure compared to the other seven fire-prone provinces, suggesting that the high growth has generated relatively low prosperity (WACLIMAD, 2012a). In South Sumatra and Jambi, which have experienced rapid commodity-driven development, the lowland districts also have higher poverty than non-lowland districts; in South Sumatra, the poverty rate in lowland districts stands at 14.3% when compared to 13.3% in non-lowland districts; in Jambi, the poverty rate in lowland districts stands at 10.0% versus 8.8% in non-lowland districts.¹¹

In addition, large-scale lowland conversion has accelerated a range of social conflicts in the lowlands, which in many cases has resulted in loss of access to the land of traditional land users such as poor forest communities.

Many of these conflicts arise from unclear recognition of land rights and competition for land among businesses, migrants, and local communities (Muur, 2018; Thorburn & Kull, 2015). To ensure shared prosperity in the lowland areas, lowland provincial and district governments could benefit from both the fiscal and governance incentives to address the environmental impacts and social conflicts from lowland developments.

8 Indonesia Country Profile in Timbertrade Portal (<https://www.timbertradeportal.com/countries/indonesia/>)

9 Indonesia-investments.com, 2019.

10 Data from Directorate General of Estate Crops (2014) quoted in INOBU (2016)

11 World Bank calculation based on the National Socioeconomic Survey (SUSENAS) Hidden Dimensions of Poverty Dataset.

1.3.2. Deforestation and biodiversity loss

The expansion of agricultural plantation crops and industrial timber forest plantations has significantly contributed to a decline in primary and secondary natural forest cover in lowland areas.

The expansion of agricultural plantation crops and industrial timber forest plantations has significantly contributed to a decline in primary and secondary natural forest cover in lowland areas.

In 1990, primary and secondary natural forests were the largest land-cover classifications in the lowlands, together accounting for roughly 60% of the total area. During the 1990s, combined agricultural and forestry land uses, comprising industrial forest plantations (Hutan Tanaman Industri), agricultural plantation crops (for example, oil palm, rubber), and paddy and dryland

agriculture, together accounted for 15% of total lowland area. By 2014, the combined areas under primary and secondary forests in the lowlands declined to 37%, resulting from a 21% decline in primary natural forests and a 47% decline in secondary natural forests. At the same time, the combined lowland areas under agricultural and forestry land uses rose to 28%, almost double the 1990 baseline. Between 1990 and 2014, lowland areas under agricultural plantations increased by 2.1 million hectares (a 220% increase compared to 1990) to reach approximately 3.1 million hectares, while areas under

Figure 1.2. Trend in Land Use and Land Cover in Indonesia Lowland Areas, 1990–2014

Source: MoEF data on land use and cover (1990–2014) overlaid with the lowland boundaries produced for this study.

The conversion of lowland ecosystems also diminishes the habitats of many endangered species, leading to biodiversity loss.

industrial timber forest plantations increased by over 1 million hectares to reach 1.07 million hectares (a 32-fold increase compared to 1990). During the same period, the use of lowlands by paddy and dryland agriculture experienced a relatively moderate expansion of 27.5% and 23%, respectively, compared to their 1990 baselines (figure 1.2).

The conversion of lowland ecosystems also diminishes the habitats of many endangered species, leading to biodiversity loss. Oil palm plantations have had reduced species richness compared with primary and secondary forests (Savilaakso et al., 2014). For example, Uryu et al. (2008) studied the impact of lowland conversion on two endangered species, Sumatran tiger and elephant. Focusing on Riau, where substantial lowland areas are under palm oil concessions, they found that while forest cover in Riau had declined by 65%

over the past 25 years, these wildlife species had been disappearing even faster than the forests. The population of the Sumatran elephant in Riau is estimated to have declined by up to 84%, from an estimated 1,067 to 1,617 in 1984 to possibly as few as 210 in 2007. Riau's Sumatran tiger population declined by 70%, from 640 in 1982 to 192 in 2007. The high rate of biodiversity loss is estimated to have occurred due to habitat fragmentation and an increase in human-wildlife conflict as animals had been driven from the disappearing forest. A World Bank study estimated that the biodiversity loss in the peatlands of Sumatra and Kalimantan alone is worth around US\$ 1.7 billion per year (World Bank, 2019c.).

1.3.3. Pressure on peatlands from conversion

While the fiber, timber, and oil palm industries are major users of peatlands, an analysis suggests that oil palm plantations are most likely to be responsible for the fastest increase in peatland conversion up until 2014.

While the fiber, timber, and oil palm industries are major users of peatlands, an analysis suggests that oil palm plantations are most likely to be responsible for the fastest increase in peatland conversion up until 2014. In terms of the extent of peatland areas allocated to each type of license, Abood et al. (2015) estimated that fiber (pulp and paper) plantations are the biggest users of peatlands followed by oil palm plantations, and then timber plantations for logging (table 1.1). However, Uda, Hein, and Sumarga (2017) analyzed the actual land cover change and found that "the fastest increase in land cover was related to expansion of oil palm plantations in Indonesian peatlands, which increased from about 700 thousand hectares in 2000 to almost 2 million hectares in 2014." (p. 687)

The same period, 2000–14, also witnessed a particularly rapid decline in peat swamp forests. Uda, Hein, and Sumarga (2017) estimated that the area of peatland classified as primary and secondary forest decreased by almost a third between 2000 and 2014, from about 9 million hectares in 2000 to about 6.4 million hectares in 2014. Focusing on peatland areas covering 16 of 33 provinces in Indonesia, including Sumatra, Kalimantan, and Papua, they also found that there are about 2.6 million hectares of protected peat swamp forests in these 16 provinces, but 28% of these protected areas are covered by plantation forests and crop areas, which the authors suggested could be interpreted as the result of illegal encroachment. The most extensive conversion of natural peat

Table 1.1. Estimate of Relative Use of Peatlands in Sumatra, Kalimantan, and Papua by Industry in Terms of Areas under Different License Types (in ha and as % of concession in peatlands)

Industrial Sectors												
	Oil Palm		Logging		Fiber		Mining		Mixed Concessions		Total All Industries	
Island	Peat	Deep peat	Peat	Deep peat	Peat	Deep peat	Peat	Deep peat	Peat	Deep peat	Peat	Deep peat
Sumatra	1,058,096	457,916	302,313	222,289	1,733,855	866,927	35,566	8,892	57,795	26,675	3,187	1,582,698
	34.9%	15.1%	21.9%	16.1%	39.1%	19.6%	2.1%	0.5%	7.1%	3.3%	28.2%	13.9%
Kalimantan	1,138,120	386,783	155,602	71,133	466,807	146,711	31,120	-	120,036	66,687	1,911,686	671,313
	14.9%	5.1%	1.7%	0.8%	11.4%	3.6%	-	-	2.5%	1.4%	6.8%	2.4%
Papua	84,470	-	1,431,542	-	422,349	-	-	-	106,699	-	2,045,060	-
	21.8%	-	13.6%	-	28.7%	-	-	-	36.9%	-	16.2%	-
Total	2,280,686	844,699	1,889,457	293,422	2,623,011	1,013,638	66,687	8,892	284,530	93,361	7,144,371	2,254,011
	20.7%	7.7%	8.9%	1.4%	26.2%	10.1%	1.6%	0.2%	4.9%	1.6%	13.7%	4.3%

Source: Table 4A in the Supplementary information file to the Abood et.al (2015) paper.

Note:

Area of concessions found over peatlands and over deep peat (over 3 meters) (hectares). Values in parentheses represent the percentage of concession area found over peatlands. Figures were calculated by overlaying the concession maps, which were based on 2010 data from the Ministry of Environment and Forestry updated by Greenpeace International as of January 2013, and the map of peatlands from Wetlands International (http://www.wetlands.or.id/publications_maps.php).

Forests in Papua are also facing high deforestation, with 2015 seeing the highest forest cover loss since 2001.

swamp forest occurred in Sumatra, followed by Kalimantan, which is currently undergoing rapid land-use change. Most of the remaining undisturbed peat swamp forest today is in Papua (Uda et al., 2017). However, forests in Papua are also facing high deforestation, with 2015 seeing the highest forest cover loss since 2001 (Wijaya et al., 2017).

Land-clearing for economic development has been a key driver of recurrent fires since the 1980s.

1.3.4. Fire-prone lowlands

Drainage-based agriculture has resulted in increasingly fire-prone lowlands, with significant cost to the Indonesian economy and the poor. Fire is not a natural part of Indonesia's tropical forest ecosystems, and all such fires are anthropogenic.¹²

Land-clearing for economic development has been a key driver of recurrent fires since the 1980s (Murdiyarso & Adiningsih, 2003). Economic actors large and small are engaged in clearing land by burning

for commercial logging, forest conversion, and new plantations (including for food crops), the petroleum extraction industry, transmigration schemes, massive scale of encroachment, and smallholder agriculture (Bowen et al. 2001; Cattau et al., 2016; World Bank, 2016). Indonesia has suffered many years of repeated fire and haze crises, with landmark events in 1982/83, 1997/98, 2002, 2006, 2009, and 2015. The 2015 El Niño-driven fires were particularly extensive and costly.

Box 1.2. Defining Fire-Prone Lowlands in the Context of this Study

Drainage-based agriculture has made Indonesia's lowlands increasingly fire-prone. To understand the extent of fire-prone lowlands and the importance of lowland management for achieving the government's fire prevention objectives, the updated lowland maps produced for this study were overlaid with the boundaries of the eight priority fire-prone provinces under the Government's Grand Design for Forest, Plantation and Land Fire Prevention (or Grand Design): Central Kalimantan, East Kalimantan, Jambi, Papua, Riau, South Kalimantan, South Sumatra, and West Kalimantan.^a

The overlay shows that around 29.6 million hectares, or 87% of all national lowlands, fall within the boundaries of the eight fire-prone provinces, which comprise 54% mineral soils (15.6 million hectares), 42% peat soils (11.8 million hectares), and 4% mangroves (1.27 million hectares). The term "fire-prone lowlands" in the context of this study refers to these eight fire-prone lowland provinces.

Sources: World Bank 2015, 2016.

Note:

- a. Formulated in 2017, this plan outlines a strategic and programmatic response to improve fire prevention, including efforts to address both the direct and indirect causes of fire. The Grand Design was developed by the Ministry of National Development Planning (BAPPENAS) with the participation of the 17 national ministries and agencies responsible for fire management and suppression.

12 That is, they are the result of human activity.

Almost 80% of the 2015–16 fires occurred within the eight fire-prone provinces, the total area of which accounts for 87% of Indonesia's total lowland area.

Almost 80% of the 2015–16 fires occurred within the eight fire-prone provinces (box 1.2), the total area of which accounts for 87% of Indonesia's total lowland area.

Most (79%) of the areas in these fire-prone lowland provinces were affected by different episodes of fires occurring during 2015–16 (figure 1.3), and include more than 26,000 hectares repeatedly burned during both 2015 and 2016 (figure 1.4).

The 2015 fires in Indonesia led to huge cost driven by serious short-term impacts to the health, well-being, livelihoods, and environment of Indonesians living in and around fire zones who could not escape the haze. The estimated cost does not include unreported health impacts and long-term and transnational costs, meaning that the true cost is likely to have been much greater.

Peat fires disproportionately account for the damage from toxic haze and carbon dioxide (CO₂) emissions, the magnitude of which is globally significant. In their undisturbed state, peat soils are typically saturated with water, making them almost impossible to burn. However, the conversion of peatlands to agricultural and plantation activities requires drainage, which makes the carbon-rich peat vulnerable to fire. Uda et al. (2017) estimated that as of 2014, about 4 million hectares of peatland had been drained in Indonesia for various uses including forest plantations, agricultural estate crops, drainage-based agriculture, and paddy fields. Fires lead to peat deprivation. Fires on drained peatlands begin as surface fires and can transition rapidly to subsurface peat fires.

Compared to fires on mineral soil, burning peat soil produces greater smoke intensity and CO₂ emissions, the latter of which can continue for decades (Hooijer et al., 2010).

Figure 1.3. Fire Occurrences in the Eight Fire-Prone Provinces:
A Comparison between Lowland and Non-Lowland Parts of the Provinces, 2015–16

Note: The figure covers area burned in 2015 only, area burned in 2016 only, and area burned repeatedly in both 2015 and 2016.

Figure 1.4. Repeatedly Burned Areas in the Eight Fire-Prone Provinces:
A Comparison between Lowland and Non-Lowland Areas of the Provinces, 2015–16

Source: Calculations based on data obtained from BRGM in 2018 during the research phase for this study.

Note: The figure covers area burned repeatedly in both 2015 and 2016.

Compared to fires on mineral soil, burning peat soil produces greater smoke intensity and CO₂ emissions, the latter of which can continue for decades.

Burned areas and fire frequency following peatland drainage have been increasing over the last two decades. For example, Hoschilo et al. (2011) found that in southern Central Kalimantan between 1973 and 1996, when peat swamp forest was the most extensive land-cover class, fires were of relatively limited extent, while between 1997 and 2005, there was a 72% fire-related loss in peat swamp forest area, which had been largely converted to non-woody vegetation, a land-cover subclassification indicating that the land has been cleared. Analysis since

then reports that peat fires accounted for roughly 35% of total area burned in 2015, and for the majority of emissions and haze from fires (MoEF, 2016).

One estimate suggests that peat fires accounted for as much as 81% of total emissions from the 2015 fires (Pribadi and Kurata, 2017). Reflecting the global magnitude of Indonesia's peat fire emissions, the earth's tropical forests released more emissions than China in 2015, roughly one-third of which was from Indonesia's 2015 peat fires (Liu et al., 2017).

1.3.5. Subsidence

Drainage-based agriculture aggravates the subsidence¹³ of drained soils, particularly in peatlands. Subsidence increases the risk of floods and threatens lowland investments. A study of acacia tree plantations in Riau and oil palm plantations in Jambi found subsidence of almost 1.5 meters after the first five years of drainage, 50% (75 centimeters)

of which occurred in the first year, continuing at the rate of 5 centimeters per year for the five following years (Hooijer et al., 2012). While lowlands are already exposed to flooding and sea level rise in general, subsidence exacerbates these risks, which are projected to increase with climate change. By 2014, 31% of the existing plantation area (including 5% of

¹³ Subsidence is the gradual caving in or sinking of an area of land. In peatlands, subsidence refers to irreversible lowering of the surface as a consequence of peat shrinkage and biological oxidation (Hooijer et al., 2012).

existing pulp plantations) on the Kampar Peninsula in Riau were already suffering regular flooding and drainage problems, and it is projected that this will increase to 71%, 83%, and 98% within 25, 50, and 100 years, respectively, putting at risk nearly all pulp and oil palm plantations on the peninsula's peatlands in the medium to long term (Hooijer et al., 2015).

Unless actively managed, these sustainability challenges associated with Indonesia's current lowland development model will impose rising costs and compromise future development. Table 1.2 summarizes the challenges discussed in this chapter. Addressing these changes calls for balancing the risks and opportunities from lowland developments, taking into consideration the economic, social, and environmental trade-offs from multiple uses.

Table 1.2. Summary of Key Sustainability Challenges in Indonesia's Lowlands and their Impacts

Key Sustainability Challenges in Indonesia's Lowlands	Key Impacts
Limited sharing of economic prosperity	<ul style="list-style-type: none"> Pockets of poverty in lowland provinces Social conflicts, including land conflicts
Deforestation and biodiversity loss	<ul style="list-style-type: none"> Decline in primary and secondary natural forest cover Loss of peat swamp forests Loss of iconic species
Pressure on peatlands from conversion	<ul style="list-style-type: none"> Peatlands, including deep peat areas, previously licensed for use by industries
Fire-prone lowlands	<ul style="list-style-type: none"> Peat deprivation Damage from toxic haze and CO₂ emissions Short-term impacts on health, well-being, livelihoods, and the environment Unreported health impacts Uncalculated long-term economic, social, health, and transnational costs
Subsidence	<ul style="list-style-type: none"> Increased risk from floods, threatening lowland investments

1.4. Policy relevance and report objectives

In a Learning Exchange Visit to Everglades in April 2018, Indonesian delegates across various government agencies agreed that “getting the water right” should be a common principle guiding government action in the lowlands going forward.

There is renewed momentum among Indonesian government ministries and agencies to pursue an integrated approach to address sustainability challenges in the lowlands based on multisectoral dialogue and science-based policymaking. The Water Management for Climate Change Mitigation and Adaptive Development in the Lowlands (WACLIMAD) project (2010–2012) was a recent effort to foster cross-sectoral dialogue about developing lowland maps for Indonesia, based on a common

conceptualization and delineation of lowland boundaries in consultation with multisector government agencies. This dialogue was renewed during the Learning Exchange Visit to the Everglades in April 2018, where Indonesian delegates across various government agencies agreed that “getting the water right” should be a common principle guiding government action in the lowlands going forward.

In addition, the green growth planning initiative of some subnational governments also provides another key entry point to mainstream lowland protection into planning processes in the lowland provinces. This report contributes to advancing such renewed policy dialogue on how to address sustainability challenges from lowland developments. The specific approach discussed in the report is the “landscape approach,” which in turn calls for improved “landscape governance.” As government agencies do not share the same understanding of key terms such as “lowlands,” “landscape approach,” and “landscape governance,” the report aims to contribute to science-based policymaking on lowlands by establishing clarity on these terms, as well as identifying key issues for policy discussion. The report also makes policy recommendations to the Government of Indonesia, which could be discussed further in a dialogue between the World Bank and key lowland stakeholders.

As a technical background study, the report has four objectives. First, it summarizes the principles of a

landscape approach, which have been elaborated in the context of Indonesia's lowlands through two previous technical studies: the Water Management for Climate Change Mitigation and Adaptive Development in the Lowlands (WACLIMAD) project (2010–2012) and the Quick Assessment and Nationwide Screening (QANS) project (Chapter 2). Second, it takes stock of current governance challenges in Indonesia's lowlands, focusing on those related to the government sector, and discusses how these challenges currently prevent a landscape approach from being implemented in Indonesia's lowlands (Chapter 3). Third, it reviews Indonesia's recent efforts to address the governance challenges in the management of peatlands and other lowland ecosystems (Chapter 4). Fourth, it offers recommendations on options to improve lowland governance in order to shift toward integrated management of Indonesia's lowlands based on a landscape approach (Chapter 5).

1.5. Scope of analysis and sources of data

The report focuses mostly on the policy and institutional aspects of lowland governance, while touching on some laws and regulations, mainly environmental regulations related to the protection and restoration of peatlands.

The analytical scope of this report has three aspects. First, it analyzes challenges for integrated landscape management in Indonesia's lowlands from a governance perspective. Governance is understood as the actions and processes of the Indonesian government across sectors that together comprise an overarching management framework affecting the economic, environmental, and social outcomes of the lowlands as landscape units. The framework involves three components:

(1) formulation of policy direction and targets,

(2) establishment of a legal framework through enactment of laws and regulations, and
(3) design of institutional arrangements for implementation.

The report focuses mostly on the policy and institutional aspects of lowland governance, while touching on some laws and regulations, mainly environmental regulations related to the protection and restoration of peatlands. Second, to underscore the government's clear commitment to restoring Indonesia's peatlands, the report focuses on discussing sustainability issues and

government actions related to peatland management. Third, the report zooms in, where possible, on the fire-prone lowlands, for example, the eight fire-prone, priority provinces under the government's Grand Design for Forest, Plantation, and Land Fire Prevention (see box 1.2), as they hold strategic importance for the Government of Indonesia's peat, fire, and climate agenda.

This report draws on four main sources of data for its analyses. First, it reviews the recent literature on Indonesia's lowlands to identify key sustainability challenges from lowland developments. On the landscape approach for sustainable lowland management, this report draws substantially from the findings of the

WACLIMAD project (2010–2012) and the QANS project (2013). Second, it made use of spatial data used during the WACLIMAD project, but also analyzed a wide range of other data (for example, peat distribution, elevation, tidal influence and salinity intrusion, land use and land cover, forest areas, and non-forest areas), which have become available since 2012. Third, it reviews some key sectoral policy documents and legislation from key sectors (for example, forestry, agriculture, water) affecting land-use change in the lowlands. Fourth, the study team also interviewed government officials from key ministries and agencies with mandates involving the lowlands in order to gain a deeper understanding of key lowland governance issues.

1.6. Limitations and areas for future research

Key issues to be examined more closely in future research include how regulatory changes so far have contributed to peatland restoration.

Some limitations of this report should be noted and could be addressed in future research. First, as the report takes a closer look at the management of peatlands within the lowlands, the report did not examine in detail possible interventions in other lowland ecosystems, that is, mangroves and mineral-soil lands. Future research should analyze key issues in these lowland ecosystems, such as the rehabilitation of mangroves and degraded mineral soils and sustainable land-use planning, in order to build a comprehensive lowland picture.

Second, the report was designed to provide clarity on lowland governance and related challenges from the central government's perspective. As such, an in-depth analysis of the role of subnational governments at the provincial and local levels (including village administrative units) or the private sector contribution to lowland governance are not within the scope of this report. The report does, however, discuss issues related to the

oversight of private sector concessions in the lowlands and the importance of engaging commitment and action from subnational governments. Recognizing the paramount importance of both subnational governments and the private sector for the governance of Indonesia's lowlands, this study recommends that they merit a separate in-depth analysis.

Finally, while this report touches on the legal framework for peatland protection, its findings could be complemented by a comprehensive legal analysis of overall lowland governance. Key issues to be examined more closely in future research include how regulatory changes so far have contributed to peatland restoration; how to move beyond peatland protection through environmental laws to a comprehensive cross-sectoral legal framework for peatland management; and what the remaining drivers are of weak governance in the peatlands, and the lowlands more broadly, from a regulatory perspective, and how to address them.

CHAPTER 2

A landscape approach to integrated management of Indonesia's lowlands

2

A landscape approach to integrated management of Indonesia's lowlands

2.1. Definitions of the terms “landscape” and “landscape approach”

A “landscape approach” provides a spatially explicit framework to conceptualize complex problems within a space, with a key objective of helping entities reconcile trade-offs among multiple objectives.

A “landscape” refers to an area delineated for a specific set of objectives. Landscape is not simply a physical space. Rather, it is an arena that is shaped by the interactions between human activities and the biophysical environment. As the priorities of the entities involved in such arena are often not aligned, a landscape becomes the setting in which complex problems unfold (Sayer et al. 2013). In turn, these problems call for a holistic way of understanding their causes and relationships in order to identify the solutions.

A “landscape approach” provides a spatially explicit framework to conceptualize complex problems within a space, with a key objective of helping entities reconcile trade-offs among

multiple objectives. There is no one definitive interpretation of a landscape approach in the literature. However, the term “landscape approach,” which is sometimes used interchangeably with “ecosystem approach,” has gained prominence largely in the context of a search for solutions to reconcile between conservation and development trade-offs (Sayer et al. 2013). In this context, a landscape is generally conceptualized as a multifunctional space, that is, having “multiple uses and purposes, each of which is valued in different ways by different stakeholders,” and the term landscape approach is used to describe “any spatially explicit attempt to simultaneously address conservation and development objectives” within the space (Sayer et al. 2013) (p.8350).

2.2. Understanding the landscape approach in the context of Indonesia's lowlands

Indonesia's lowlands are physically and hydrologically unique landscapes that cross administrative boundaries. They comprise hydrological units (*Kesatuan Hidrologi*), or areas with an independent hydrology that are separated from other areas by permanent hydrological boundaries formed by sea, rivers, and upland formations. Because of their flat topography, permanently high groundwater tables, and permeable soils,

hydrological processes in the lowlands are much more interconnected than those in upland areas.¹⁴ Within the lowlands, various landforms can be defined, including the different wetland complexes, such as peatlands and coastal mangroves, each with its own specific management requirements.

Integrated land and water management is central to ensuring the sustainable

Macro-zoning is key to implementing a lowland landscape approach.

development of lowland areas, for which a landscape approach is needed.

In the context of Indonesia's lowlands, a landscape approach means one that follows the geomorphological, biological, and hydrological characteristics of the landscapes for land-use zoning and resource management. For land management, the landscape approach helps align conservation and development priorities in the lowlands through macro-zoning (for example, a conservation zone, adaptive management zone, development zone, and coastal zone, that is, mangroves). For water management, the landscape approach helps policymakers manage water resources effectively by capturing the relationship between wetland ecosystems and between wetlands and drylands, allowing the management of wetland ecosystems based on natural hydrological units and a water balance analysis.

Macro-zoning is key to implementing a lowland landscape approach. The process for such zoning should start with the definition of independent hydrological units, followed by the delineation of four macro-level land-use zones for conservation; adaptive management; full development (such as agriculture); and coastal zone, that is, mangrove (figure 2.1). As elaborated in a report by the Water Management for Climate Change Mitigation and Adaptive Development in the Lowlands (WACLIMAD) project (2010–2012), “Units with no or only very minor areas in need of protection are earmarked for development and belong to the so-called Development Zone. Units with important areas in need of protection are earmarked for conservation. Within the latter, a distinction is made between the conservation areas proper, the Conservation Zone, and other areas within that same unit, called the Adaptive Management Zone. The Adaptive

Figure 2.1. A Landscape Approach to Lowland Macro-Zoning

Source: Adapted from WACLIMAD 2012a

Management Zone serves as a buffer for the Conservation Zone and some development is allowed here provided it is managed in such a way that it has no negative impacts on the Conservation Zone.”

Macro-zoning is the recommended first step in the lowland area spatial planning process. This ensures that resource-

based management principles are used in planning and management. Macro-zones should form the basis of sectoral regulations that set the standards for sustainable land and water resource management in each zone.¹⁵ They should also guide further meso-zoning (for example, forestry, plantations, agriculture, settlements) and micro-zoning (for example, village-level land uses).

2.3. A landscape approach to peatland management

A landscape approach to land and water management is particularly important in the management of peatlands.

Peatlands are the most sensitive ecosystem in the lowlands and damage to peatlands is irreversible. Loss of deep peat areas to land conversion and fire, with the associated subsidence and carbon loss, not only brings significant costs to Indonesia, but also compromises global progress on climate change mitigation.

A landscape approach to land and water management, therefore, is particularly important in the management of peatlands. Independent hydrological units in the peatlands are called Peat Hydrological Units (PHUs). Peatland is a highly sensitive ecosystem given its sensitivity to disturbance and the irreversibility of the subsidence caused by drainage (BAPPENAS et al. 2013). Effective peat management, particularly the protection of peat domes with an average peat depth of more than 3

meters, can only be achieved through water management based on natural PHUs, because protecting the domes requires restricting drainage further away from the dome areas due to hydrological connectivity within PHUs.

Peatlands in tidal and non-tidal lowlands are distinct systems that require different management approaches. They are different in terms of their biophysical characteristics and particularly their hydrological connectivity. Non-tidal peatlands form a part of watersheds, and therefore a watershed-based approach (*Daerah Aliran Sungai*) is considered suitable for non-tidal swamp management, while tidal peatlands require a management approach based on “river-to-river” PHUs (WACLIMAD 2012c.). Figure 2.2 illustrates a river-to-river PHU.

15 Macro-zones are broad planning units at the landscape or delta level distinguishing between areas with different overall biophysical characteristics and functions. The main aim is to distinguish areas in need of conservation (legally protected areas as well as other areas considered of high conservation value) from areas developed for agriculture, based on hydrological and other criteria, and target management and resources in line with the specific biophysical and legal contexts. Once the macro-zoning has been accepted in principle, the zoning will serve as a basis for more detailed planning and formulation of management strategies at so-called meso-level, which are based on biophysical as well as socio-economic considerations, and ultimately at micro-level, whereby specific local land use contexts are considered. See WACLIMAD (2012e) for more detail.

Figure 2.2. A River-to-River Peat Hydrological Unit in Tidal Lowlands

Source: World Resources Institute Indonesia.

Note: *kubah gambut* = peat dome; *puncak kubah gambut* = peat dome peaks.

Figure 2.3 illustrates the application of a landscape approach, particularly the principles of macro-zoning, to manage a river-to-river PHU in tidal peatlands. Under Government Regulation No. 57/2016, the Ministry of Environment and Forestry is required to protect at least 30% of the PHU around peat domes, and potentially larger areas falling within additional criteria such as with a thickness more than 3 meters, specific or endemic germplasm, or ecosystems located in protected areas in spatial plans, protected forest areas, and conservation forest areas. As shown in figure 2.3, management of this PHU focuses on the peat dome conservation

zone where the peat is more than 3 meters deep. While the peatlands surrounding the peat domes are currently not legally protected because they are less than 3 meters deep, they should be treated as part of the conservation zone, and an adaptive management supporting the conservation of the peat domes should be applied, such as limited or no drainage. Outside the conservation zone, the area in figure 2.3 between the dashed line and the rivers indicates the adaptive management zone, which serves as a buffer conservation zone. Some development is allowed here, provided it is managed in a way that has no negative impacts on the conservation zone.

Figure 2.3. A River-to-River Approach to Managing Tidal Peatlands

Source: WACLIMAD 2012c.

2.4. A Landscape approach to watershed management

A landscape approach could also support integrated water management in the context of watersheds in non-peat areas.

A landscape approach could also support integrated water management in the context of watersheds in non-peat areas.

By explicitly considering trade-offs from water use in a watershed, a landscape approach allows the government to balance the competing demands specifically to support enough water

for productive industries, farmers, and communities while recovering the healthy environment for the water basin. Box 2.1 provides an international example of this approach that could be relevant for integrated water management in the watersheds in Indonesia's lowlands.

Box 2.1. International Experience in Integrated Water Management: The Case of Watershed Management in Murray-Darling Basin

Australia, South Africa, and the United States are pioneering countries that have, despite challenges, successfully improved the management regime of their water flows through modern water management (IUCN 2003). In South Australia, the Living Murray Program was created in 2002 in response to the declining health of River Murray. With more than 11 years of support through the Living Murray program, 1,204 gigalitres of total environmental water was delivered, achieving systemwide ecosystem benefits. The recovery program included a combination of infrastructure projects to improve efficiency of water use and market-based techniques. Major floodplain water management structures enable large-scale watering of 37,000 hectares of forests and wetlands across Gunbower Forest, Koondrook-Perricoota Forest, Hattah Lakes, and the Chowilla Floodplain (see map B2.1.1).

The Living Murray Program implemented environmental flows through active and restrictive flow management through watering and constructing water structures. A number of high-priority watering actions were implemented to direct water so it could flow into parts of the forest and wetlands before being returned to the River Murray via the Wakool River. For full operation, the works enable up to 16,000 hectares of forest to be watered (Murray-Darling Basin Authority, 2014). Such an elaborate intervention could only be achieved under a landscape approach.

In 2012, the Murray-Darling Basin Plan was developed under the Water Act 2007 to provide a framework for a coordinated approach to water use across Murray-Darling Basin. The Living Murray Program has used various scenarios to optimize water use and minimize any risks using computer-

simulated software models to assess options for management planning of the environmental flows. They allow the simulation of flow events through the targeted areas, providing information on the likelihood of improved conditions after scenarios are implemented. Testing of various management scenarios such as applying various inflows, setting holding times, and determining outflow patterns will help provide information on potential risks including flooding, poor water quality (low dissolved oxygen), or salinity, to identify the appropriate strategies.

Identification of trade-offs is at the center of environmental flow applications. Environmental flows must be included as an integral part of modern management of river basins and therefore should be supported by comprehensive basin-wide management practices and regulations, such as those relevant to land-use, water rights, and water use.

South Australia's annual environmental watering priorities are developed every year by its Department of Environment, Water and Natural Resources. With support from The Living Murray's Indigenous Partnerships Program, consultation and negotiations occur with the Ngarrindjeri Regional Authority on watering priorities for the Lower Lakes, Coorong, and Murray Mouth icon sites and the lower River Murray Channel (Murray–Darling Basin Authority, 2014).

Map B2.1.1. Floodplain Water Management across Gunbower Forest, Koondrook-Perricoota Forest, Hattah Lakes, and Chowilla Floodplain

Source of picture: Murray-Darling Basin Authority (2014)

CHAPTER 3

Current governance challenges in Indonesia's lowlands

3

Current governance challenges in Indonesia's lowlands

A landscape approach to resource management in Indonesia's peatlands and other lowland ecosystems urgently calls for landscape governance.

Landscape governance is defined in this study as coordinated actions and processes of the Indonesian government across sectors that together comprise an overarching framework of management for lowland areas as landscape units. Such a framework involves three components: (1) formulation of policy direction and targets, (2) establishment of a legal framework through enactment of laws and regulations, and (3) design of institutional arrangements for implementation. Ideally, the Government of Indonesia should coordinate these three components of governance to develop a coherent lowland governance

framework that promotes macro-level land-use zoning and integrated water management based on hydrological boundaries (such as PHUs, and watersheds). The macro-zoning should then inform a coherent lowland policy to balance economic, environmental, and social outcomes from multiple land uses.

A coherent framework for the governance of Indonesia's lowlands as landscapes is not currently in place.

This chapter discusses the current governance challenges in Indonesia's lowlands, and how they inhibit the adoption of a landscape approach for the integrated management of lowlands, with negative consequences on land, water, and peatland, and on the oversight of private sector activities.

3.1. Current governance challenges in Indonesia's lowland

3.1.1. Lack of a common definition of lowlands and planning/management units

Parts of Indonesia's lowlands are currently managed by different sectoral entities, and there is no overarching landscape governance framework for the lowlands overall.

Parts of Indonesia's lowlands are currently managed by different sectoral entities, and there is no overarching landscape governance framework for the lowlands overall. As a result, there is also no government champion with a clear mandate and responsibilities for overall lowland sustainability. Landscape governance requires, first and foremost, the delineation of lowlands based on all relevant sectors' mutual and science-based understanding of natural

biophysical and hydrological conditions, and a shared overall vision for lowland developments. However, such common definition and vision are not currently in place. In practice, Indonesia's lowlands are under the purview of many government agencies that do not recognize or operate based on the same definition of lowlands and planning/management units.

At least five government agencies play a key role in setting policy goals with major implications for the lowlands, but each uses a different planning or management unit (figure 3.1). These agencies have their own sectoral regulations and define their own specific management areas of interest. For example, the Ministry of Agrarian and Spatial Planning/National Land Agency (ATR/BPN) executes spatial planning primarily based on administrative units, but also implements area-based planning in some areas. In the forestry sector, the MoEF defines Forest Management Units typically but not necessarily based on watersheds. A Peat Hydrological Unit (PHU) is a management

unit for peat restoration undertaken by the Peatland and Mangrove Restoration Agency (BRGM), which later became a common unit for all agencies working on peatland. Water resource management is based on river basin areas (*wilayah sungai*) and watersheds (*daerah aliran sungai*), while river-to-river hydrological units (*kesatuan hidrologi sungai*) have recently been integrated with swamp regulations. Agricultural development focuses on agricultural schemes without considering local agricultural areas or the broader biophysical landscape in which such schemes are located (WACLIMAD, 2012d).

Figure 3.1. Key Ministries Involved in the Management of Indonesia's Lowlands and their Planning/Management Units

Note: See Annex 2 for more details on the mandates of these institutions in the context of Indonesia's lowlands. The size of each circle does not represent scope, importance, or strength of the institutions.

3.1.2. Uncoordinated sectoral policy targets

Sectoral agencies pursue uncoordinated policy targets that simultaneously put pressure on resource-rich lowlands.

Sectoral agencies pursue uncoordinated policy targets that simultaneously put pressure on resource-rich lowlands.

The targets are ambitious and their directions not always consistent. For example, Indonesia is committed to achieving substantial greenhouse gas emissions reductions by 2030 by reducing its emissions from Land-Use, Land-Use Change and Forestry (LULUCF), while sectoral policies call for a substantial increase in rice production, the doubling of oil palm production, and expansion in the production of biofuels, all likely to drive land-use change and land-based emissions. At the same time, qualitative policy targets are not based on realistic assessments of resource availability in the lowlands, which will play a strategic role in achieving these policy targets.

The national policy target to expand oil palm production by 2045 has particularly important implications on the forest

conservation policy targets in the

lowlands. By 2045, Indonesia aspires to produce an estimated 60 million tons of crude palm oil annually, and make 70% of palm oil sustainable by 2020. While there is evidence that new plantations are increasingly developed on non-forestland (Austin et al. 2017), the ambitious oil palm expansion target will still likely put more pressure on forest areas and marginal lands (such as shrub) in the lowlands, particularly in Kalimantan. World Resources Institute estimates that from 1995 to 2015, Indonesia lost 2.3 million hectares of forest for oil palm plantations. If Indonesia is to keep up with its national target, it will need to increase its palm oil production. Under current practices, this would require approximately 8.2 million additional hectares for cultivation—an area the size of Papua Island (Saleh et al, 2018). This, in turn, will put pressure on land that is also required for allocation toward conservation goals.

3.1.3. Multiple sectoral maps and overlapping operational boundaries

Multiple sectoral maps also create overlapping sectoral operational boundaries, which further contribute to the uncoordinated management of lowland ecosystems.

Multiple sectoral maps also create overlapping sectoral operational boundaries, which further contribute to the uncoordinated management of lowland ecosystems. In this study, sectoral “operational boundaries” refer to the spatially delineated areas to which each government agency’s policy and legal and institutional mandates are operationalized. These sectoral operational boundaries can be inferred from the official maps accompanying key ministerial regulations and on-the-ground operations in targeted areas (table 3.1).

Multiple overlapping sectoral operational boundaries characterize the current management of the fire-prone lowlands in eight provinces (figure 3.2). Around 90%

of the total area of fire-prone lowlands are covered by the Ministry of Public Works and Housing’s swamp map (2015), which accompanies swamp-related regulations that constitute a basis for water resource management in the lowlands. The Ministry of Environment and Forestry’s (MoEF’s) forest management is based on an official map (2017) of designated forest areas (kawasan hutan), which, after being overlaid with the lowland boundaries delineated in this study, indicates that around 72% of total lowland area in the eight provinces are legally classified as forest areas. BRGM’s 2017 Indicative Peatland Restoration map covers around 55% of the total fire-prone lowland area, apart from the general broad definition of lowlands, which cover most of the

Table 3.1. List of Maps that Define Operational Boundaries of 5 Key Ministries in Indonesia's Lowlands

Ministry	Map
Ministry of Public Works and Housing	National swamp map 2015
Ministry of Environment and Forestry	An official map (2017) of designated Forest Areas (<i>Kawasan Hutan</i>)
Ministry of Agriculture	Lowland (rawa characteristic) map (2012)
Peatland and Mangrove Restoration Agency (<i>Badan Restorasi Gambut dan Mangrove</i>)	Indicative Peatland Restoration based on Peat Hydrological Unit Map and Peatland Function Map (2017) issued by Ministry of Environment and Forestry under Decree of the Minister of Environment and Forestry Numbers 129 and 130 year 2017 (Decrees 129/ 2017 and 130/ 2017)
Ministry of Agrarian and Spatial Planning/ National Land Agency	No official map specific to lowlands, but the ATR/BPN focuses on the administration of Non-Forest Area (area for other use, known as <i>Areal Penggunaan Lain</i> (APL), in practice)

Figure 3.2. Percentage of Fire-Prone Lowlands Covered by Sectoral Operational Boundaries of Five Key Ministries

Note:

ATR/BPN = Ministry of Agrarian and Spatial Planning/National Land Agency; BRGM = Peatland and Mangrove Restoration Agency; MoA = Ministry of Agriculture; MoEF = Ministry of Environment and Forestry; MoPWH = Ministry of Public Works and Housing.

country. MoA has also developed its own map of the lowlands (2012) from an agricultural suitability perspective (see Annex 2 for MoA's classification of

lowland), which covers 70% of the total fire-prone lowland area. While the ATR/BPN has a mandate to administer all land cover including forest cover, in practice

Each agency needs to improve coordination to ensure that the execution of each institutional mandate is complementary and leading to overall positive lowland outcomes.

ATR/BPN only exercises this mandate in non-Forest Area (APL). Given this dual land administration practice, it is assumed that the 72% (21.3 million hectares) of the fire-prone lowlands classified as Forest area are administered by the MoEF, while the remaining 28% (8.3 million hectares), which are classified as non-Forest Area, are administered by ATR/BPN.

Overlaying the five sectoral operational boundaries of the fire-prone lowlands

shows that the responsibility for 54% of lowlands in Sumatra, 34% of lowlands in Kalimantan, and 21% of lowlands in Papua are shared by all five agencies.

This suggests that, while each agency has a specific mandate with regard to the lowlands, they also need to improve coordination to ensure that the execution of each institutional mandate is complementary and leading to overall positive lowland outcomes.

3.2. Consequences of weak landscape governance

The pursuit of uncoordinated and conflicting policy targets by sectoral agencies calls for more land than the country has available, and has thus driven land competition in Indonesia, including in the lowlands.

3.2.1. Ineffective land-use planning and land conflicts

The pursuit of uncoordinated and conflicting policy targets by sectoral agencies calls for more land than the country has available, and has thus driven land competition in Indonesia, including in the lowlands. For example, Harahap, Silveira, and Khatiwada (2017) compared four sectoral policy goals that increase the amount of land used: (1) biofuel, involving oil palm expansion; (2) food crop expansion; (3) climate change mitigation (lowland areas to be protected to reduce greenhouse gas emissions); and (4) forestry (areas for the creation of Forest Management Units). They estimated that meeting these four goals alone will require 164 million hectares of land, roughly equivalent to the total size of Indonesia. Given the overlaps in land-cover type and legal land status claimed by each policy goal, the actual land area available to these four policy goals combined was estimated at 83.35 million hectares. Assuming that agricultural policy goals are a top priority, followed by climate policy, forestry, and biofuel policy goals,¹⁶ Harahap, Silveira, and Khatiwada (2017)

estimated that the available 83.35 million hectares would be allocated as follows: 72% to agriculture (10.19 million hectares), 80% to mitigation (43.07 million hectares), 71% to biofuel (20.86 million hectares), and 14% to forestry (9.23 million hectares) (figure 3.3). This allocation scenario also assumes that degraded lands (shrub/bush, shrub swamps, and grassland) would play a key role in meeting the biofuel target, which in the case of Indonesia relies overwhelmingly on oil palm production (Harahap et al., 2017).

Overlapping sectoral operational boundaries leads to coordination problems that complicate land-use planning. Currently, licensing for the use of natural resources (extractives; timber and forest products; and estate crops, including oil palm) is spread across key lowland ministries, causing issues with transparency and overlaps, which are further complicated by the absence of a common base map and data platform. This lack of clarity makes it extremely difficult to enforce laws and regulations managing

Figure 3.3. Available Land Compared to Land Required to Fulfill the Four Main Policy Targets

Source: Harahap et al., 2017.

Current land classification is inconsistent and does not necessarily allow for agricultural intensification in appropriate areas, or for the enforcement of forest conservation regulations.

land use and to prevent land conversion. The situation encourages agricultural expansion into forest areas and hinders the Government of Indonesia's ability to optimize land-use planning and protect forest resources.

Current land classification is inconsistent and does not necessarily allow for agricultural intensification in appropriate areas, or for the enforcement of forest conservation regulations. A comparison between land cover and legal land classification based on data presented in Harahap et al., (2017) suggests that 7.6 million hectares with forest cover (4% of the total national land area) falls outside the officially designated forest areas, while 32.6 million hectares without forest cover (17% of total land) is classified as forest. Another study found 5.3 million hectares of land suitable for agricultural activities forming part of the forest

estate, and therefore legally unavailable for agricultural development (Rosenbarger et al., 2014). It is not surprising that not all of the official forest areas are forested, as many of such areas are intended to be zoned for forestry use (such as forest plantations) or mining, with some areas in different stages of development following, among others, provincial spatial plans. As the issuer, the subnational governments play a critical role in determining the lands designated as cultivation areas. Overall, the wide mismatch between actual forest cover, administrative forest status, and agricultural suitability criteria suggests that more analysis is warranted to understand the extent by which this mismatch represents land misallocation and should therefore be corrected.

16 For example, Harahap et al. (2017) reviewed both biofuel policy and agricultural policy and found that the national energy policy gives priority to food production in case of conflicts. They also found that the Government Regulation on forestry planning, management, and utilization (PP 3/2008) addressed the interaction between biofuel policy and forestry policy and confirms that palm biodiesel feedstock can be produced in degraded forest areas.

The dual land administration practice (box 3.1) leads to unclear legal recognition of land rights and contributes to land conflicts between the state and communities, with particularly negative impacts on lowland forest communities.

ATR/BPN has largely issued land titles in Non-Forest Areas (also referred to as Areas for Other Purposes (*Areal Penggunaan Lain*)). Given that all forest areas have been treated as state lands, community rights in these areas were not recognized in the past and were

overruled by state control. This has led to long-term conflicts between communities (particularly indigenous (*adat*) communities) and the state. The unclear legal recognition of landownership and tenure arrangements also prevents a large number of forest communities from benefiting from programs and initiatives such as reducing emissions from deforestation and forest degradation (REDD) and payments for ecosystem services (Fauzi and Anna 2013; Sunderlin et al. 2018).

Box 3.1. The Dual Land Administration Practice in Indonesia

Indonesia's land governance is characterized by a dual land administration practice that leads to unclear legal recognitions of land rights and tenure arrangements. Legally, both the Basic Agrarian Law (BAL) (Law No. 5/1960) and the Forestry Law (Law No. 41/1999) recognize tenures in all types of land use including land use in Forest Areas (*kawasan hutan*)^a, defined by the state as areas to be kept functionally as permanent forest. However, land inside forest areas, which is approximately 120.6 million hectares, or 63% of the nation's entire land area, has been treated in practice as state lands administered by MoEF. While the Ministry for ATR/BPN has a mandate to register all lands in the country, in practice it only fulfils this mandate on lands outside of forest areas. This division leads to duplication in policy, and in legal and institutional frameworks, resulting in unclear legal recognitions and tenure arrangements, particularly for local communities living or farming inside forest areas. The local communities are often considered illegal squatters, sometimes subject to criminal prosecution. While global experience and best practices encourage a unified registry and cadastre system for all properties and tenure types, the dual practice maintains two parallel systems to register, designate, and manage lands in Indonesia.

In a legal case brought by the Alliance of Indigenous Peoples of the Archipelago (Aliansi Masyarakat Adat Nusantara) pertaining to Forestry Law No. 41/1999, the Constitutional Court Ruling No. 35/2012 decided in 2013 that Adat Forests (*Hutan Adat*) are not state forests, thus legally recognizing that adat forests are collectively owned by Adat Law communities within forest areas. According to Constitutional Court Ruling No. 35/2013, adat forests are not state forests (*hutan negara*), owned by the state, as long as they are legally recognized by the government. Once an adat forest is recognized, the area becomes community owned (*hutan hak*)^b. This implies

that the state recognizes the community's land tenure while the forest remains designated as forest area.

Note:

- a. 120.6 million hectares, or 63% of the nation's entire land area, is designated as forest areas. Most of Indonesia's remaining land area is made up of non-forest public lands, known as Areas for Other Purposes (Areal Penggunaan Lain). The forest areas are managed in accordance with three functions. Production Forests (Hutan Produksi) cover 68.8 million hectares, or 57% of the Forest Area. Conservation Forests (Hutan Konservasi) cover 22.1 million hectares, or 18% (with an additional 5.3 million hectares of marine conservation areas). Protection Forests (Hutan Lindung) have watershed functions and cover the remaining 29.7 million hectares, or 25%. Source: MoEF 2018.
- b. However, the most recent ministerial regulation, Ministerial Regulation No. 21/2019, changed this and stipulates that adat forest is not community owned but another category of forest on its own, in addition to state forest (hutan negara) and titled forest (hutan hak). This categorization differs from Constitutional Court Ruling No. 35/2012. The legal implications of this 2019 regulation need to be assessed.

Unclear legal recognition of land rights and insecure tenure arrangements are also key drivers of recurrent man-made fires in the lowlands.

Large-scale forest and agricultural concessions in and outside forest areas have also created land conflicts between private concessionaires and local communities. Communities have been much less successful than private concessionaires in securing formal tenure or use rights to forestlands. In turn, inadequate land-use and access rights leave local populations at a disadvantage in negotiations with large businesses seeking access to land that the concessionaires hold or are controlled by these local people. Land conflicts often result in compromised access to forest resources and land insecurity for local communities, limiting their welfare and livelihood opportunities and further disenfranchising indigenous peoples. With unclear recognition of land rights, insufficient compensation for local land users, and lack of clear boundaries of issued concessions, land conflicts between private concessionaires and local communities also exist in non-forest areas. The lack of an effective conflict resolution system results in persistent land conflicts, which make up about 60% of legal cases in Indonesia (Utama and Irsan 2014).

Unclear legal recognition of land rights and insecure tenure arrangements are also key drivers of recurrent man-made fires in the lowlands. Fire has commonly been used in agriculture in Indonesia to fertilize the soil, control pests, and clear biomass residue (Ketterings et al., 1999). There is a strong economic incentive to use fire for land clearing, as it is cheap, fast, and effective (Simorangkir, 2007, Purnomo et al., 2017). This economic incentive is compounded by unclear boundaries, land tenure insecurity, and overlapping land claims (Purnomo et al., 2017; Suyanto, 2006). Fires are involved in many cases of competing land claims between local communities and companies (Purnomo et al., 2017). On the one hand, fires are employed in some cases by businesses to force local communities off the land, and, on the other, by some communities to exercise land claims (Suyanto, 2006). Such conflict is common in the lowlands, particularly in areas with rapidly expanding plantations, overlapping licenses, and a large number of local forest communities (Purnomo et al., 2017, Suyanto, 2006).

3.2.2. Limited integrated water management based on hydrological boundaries

This study suggests that, due to overlapping sectoral operational boundaries between ministries, the MoPWH actively manages water resources in only 12% of the delineated lowland swamps in the eight fire-prone provinces (table 3.2).

Overlapping sectoral operational boundaries in Indonesia preclude integrated water management in lowland areas based on natural hydrological boundaries. Like the land management discussed above, Indonesia's current lowland water management is largely based on sectoral operational boundaries, whereby institutional mandates over forest vs. non-forest areas in practice largely determine the responsibility for managing water in these respective areas. For example, the Ministry of Public Works and Housing (MoPWH) has the mandate and authority to manage the river bodies in public non-forestland, but not in the surrounding land areas that are part of the watersheds. In the forest areas, management institutions are being developed in the form of Forest Management Units, which are typically but not always defined based on watersheds. The Forest Management Units still generally lack integration with MoPWH's water resource management. Meanwhile, for swamps under private concessions, the mandate

for water management falls under the concessionaries, with certain parameters monitored by the Government of Indonesia. In general, a land custodian (for example, a subnational government or a community) is in charge of monitoring and preventing the development of new canals, sedimentary pyrite exposures, and land cover reduction. That said, there are some uncertainties around MoPWH's water management mandate since the annulment of the Water Resource Management Law by the Constitutional Court in 2015.

This study suggests that, due to overlapping sectoral operational boundaries of the MoEF and BRGM (BRG, under the period of the study), the MoPWH actively manages water resources in only 12% of the delineated lowland swamps in the eight fire-prone provinces (table 3.2). Institutionally, the MoPWH has the official mandate for lowland water resource management based on a National Swamp Map (2015), that covers 90% of Indonesia's lowlands.

Table 3.2. Division of Responsibility for Water Management in Lowland Swamps, in Practice, Given the Overlapping Sectoral Operational Boundaries and Private Concessions

Swamp Locations within Lowlands			
Non-Forest Areas (<i>Areal Penggunaan Lain</i>)		Forest Areas (<i>Kawasan Hutan</i>)	
Category 1 Non-Peatland (19%)	Category 2 Peatland (9%)	Category 3 Non-Peatland (39%)	Category 4 Peatland (33%)
<ul style="list-style-type: none"> MoPWH for area outside private concession (12%) Private sector for area under private concession (7%) 	<ul style="list-style-type: none"> MoPWH with MoEF for peatland under 3 meters (8%) MoEF for peatland above 3 meters (1%) 	<ul style="list-style-type: none"> MoEF 	<ul style="list-style-type: none"> MoEF

Note: These four classifications of swamp (*rawa*) mandates are determined as per Government Regulation 73/2013, and later Minister Regulation No. 29/PRT/M/2015. The determination of water management responsibility for each swamp location category is based on the study team's consultation with staff of the Department of Irrigation and Swamps (*Direktorat Irigasi dan Rawa*) of MoPWH.

In practice, overlaying the MoPWH National Swamp Map (2015) with the MoEF's official map (2017) of designated forest areas and the MoA's peat map (2017) creates four categories of lowland swamp under different management authorities (see table 3.2). They are Category 1: swamps in non-forest areas; Category 2: swamps in non-forest areas but on peatlands; Category 3: swamps on peatlands in forest areas; and Category 4: swamps in forest areas. The MoPWH mainly exercises its lowland water management mandate and authority in the parts of Category 1 swamps that are not under private concessions (12%) (see Category 1, table 3.2), due largely to the concentration of MoPWH assets (such as dams and irrigation canals) in these areas (represented in green in map 3.1). MoPWH is not engaged in water management in Category 1 swamps that are under private concessions (7%). This is because MoPWH is not involved in

plantation licensing, and therefore water in the plantation areas is managed by the private sector.

Category 2, 3, and 4 swamps in the lowlands are, in practice, largely managed by MoEF (see table 3.2). While staff at MoPWH's Department of Irrigation and Swamps (*Direktorat Irigasi dan Rawa*) advised that it is possible for the institution to work in Category 2 swamps (Non-Forest Area peatland) if the peat layer is less than 3 meters deep, this is not where most MoPWH water management assets are located. Within the forest areas (see Categories 3 and 4 in table 3.2), there are a few swamp irrigation assets in Central Kalimantan due to the legacy of the Mega Rice Project, which aimed to convert peatland to paddy fields to achieve national food security (see Annex 3). MoPWH needs to obtain permission from MoEF to work on assets in Category 3 and 4 areas.

Map 3.5. MoPWH's Lowland Boundaries Overlaid with Forest Areas, Peatlands, and Private Sector Concessions

Note: This report uses MoEF and ATR-BPN 2012 plantation concession data. The MoPWH's lowland boundaries are based on the 2015 National Swamp Map. Peatland data are from MoA (2017), provided by the Peatland and Mangrove Restoration Agency (BRGM).

Effective protection of peatland requires integrated water management, but in practice, water management on peatland is influenced by at least four entities.

3.2.3. Reduced effectiveness in the protection of peatlands

Unsynchronized forestry and spatial planning regulations impede peatland protection. MoEF regulations to protect peatlands (see Chapter 4) have come into force more recently than many key spatial plans. As such, significant areas of peatland are designated as plantation in existing spatial plans, with licensing in place for commercial use (*Hak Guna Usaha*) that is at odds with peatland protection regulations. According to the ATR/BPN, it would be difficult to reverse such land use, not only in spatial planning documents but also with regard to the land-use rights already issued. This is the case in several lowland areas. For example, comparing the Provincial Spatial Plan (*Rencana Tata Ruang Wilayah Provinsi*) of West Kalimantan and Central Kalimantan and the MoEF's Peatland Ecosystem Map, the ATR/BPN found that 25,971 hectare of peatland classified as having a protective function are currently under license for commercial use by 16 corporations in a handful of Kalimantan districts including Kapuas in West Kalimantan, and Katingan, Kotawaringi Barat, Kotawaringin Timur, and Seruyan in Central Kalimantan (ATR/BPN 2018).

Effective protection of peatland requires integrated water management, but in practice, water management on peatland is influenced by at least four entities—the Peatland and Mangrove Restoration Agency (BRGM), MoEF, MoPWH, and private companies—which do not always implement complementary water management approaches due to the lack

of regulation guiding Peat Hydrological Unit-based water management. The BRGM coordinates canal-blocking activities for peatland restoration in the seven priority provinces. MoEF is the *de facto* water manager for peatland in forest areas (Category 3, table 3.2). In the Category 2 area in table 3.2, there is some coordination between MoPWH and BRGM over developing the technical design for canal blocking in the BRGM's seven priority provinces. There is a memorandum of understanding between the MoPWH's Department of Irrigation and Swamps (*Direktorat Irigasi dan Rawa*) and the BRGM on this coordination. However, the actual construction and maintenance of these water structures on peatland in the Category 2 area are carried out separately, with the MoPWH and BRGM spending their own money on their respective assets. In reality, the word "restoration" could mean different things to the MoPWH and the BRGM, and the implementation approaches of the two agencies still need to be harmonized. This is due partly to the fact that the broader paradigm that guides MoPWH work is still heavily oriented toward draining. There is some evidence that this paradigm is slowly changing, as indicated by MoPWH expenditures flowing toward rewetting in some areas such as Central Kalimantan. However, due to limited coordination in some areas, there are still cases where MoPWH at the local level (*Dinas*) conducts draining activities on peatland where BRGM is rewetting.

3.2.4. Gaps in monitoring private sector practices

At the same time, water management in peatland under private concession is conducted by private companies, which if not effectively monitored could reduce

the effectiveness of peatland protection. For peatland already under concession, private concessionaries are currently required to conserve the undeveloped

A large proportion of the lowland areas is under private sector control through concession licenses issued by multiple ministries.

part of peatland classified as having protection functions and maintain the water level at 40 centimeters in the part classified as having production function. In deep peat areas where concessionaires have completed the current production cycle, the peatlands must be returned to the Government of Indonesia. Peatlands that are considered degraded are under the mandate of the Department of Peat Damage Control of MoEF to do peat restoration. In the meantime, the concessionaires are required to report this water level information to the MoEF's Directorate for Peatland Damage Control under the Directorate General of Environmental Pollution and Damage Control (*Direktorat Jenderal Pengendalian Pencemaran dan Kerusakan Lingkungan*). Monitoring such private sector's water management of peatlands will require improved capacity and coordination among government agencies. While the current reporting system relies mostly on paper-based self-reports, an online reporting system is being put in place in selected locations.

A large proportion of the lowland areas is under private sector control through concession licenses issued by multiple ministries. The regulations issued by different ministries need to be synchronized, and the government needs to issue a technical guidance for the private sector to conduct water management. As of 2012, around 31% of the lowlands in the eight fire-prone provinces were under private concessions (areas in pink in map 3.2). This makes the private concessionaires a key lowland stakeholder, whose role is important for overall lowland governance. Currently,

these companies are responsible for managing their land sustainably such as by self-financing restoration, conducting sustainability training, assisting their surrounding communities, and joining initiatives like certification schemes. The Government of Indonesia is facing a major task in ensuring compliance.

Governance challenges contribute to the difficulty in effectively monitoring private sector practices in Indonesia's lowlands.

For example, while MoA regulations direct oil palm developments at the landscape level, in practice, the power to issue oil palm licenses and enforce regulations remains scattered among central government agencies (ATR/BPN), and provincial and district governments. Their capacity and resources to execute these tasks are generally limited, and this could, in practice, lead to weak oversight of oil palm development (Paoli et al. 2015). In addition, overlapping land claims limit the use of satellites to monitor no-deforestation commitments and no-burning compliance (Gaveau et al. 2017).

Several local and national community sustainability initiatives are underway, but they currently do not affect the eligibility of private companies to apply for concession extensions. Examples are the legal timber certification known as the Timber Legality Verification System (*Sistem Verifikasi Legalitas Kayu*) for timber, and the Roundtable for Sustainable Palm Oil (RSPO) and the Indonesia Sustainable Palm Oil Standard (ISPO) for palm oil. These schemes aim to ensure that private companies comply with certain standards in producing commodities. However, the ISPO is completely voluntary.

Map 3.6. Private Concessions (in pink) and Sectoral Operational Boundaries across Sumatra, Kalimantan, and Papua

Panel A: Papua

Panel B: Kalimantan

Panel C: Sumatra

Source: Harahap et al.,2017.

CHAPTER 4

Indonesia's responses to the governance challenges of managing peatland and other lowland ecosystems

4

Indonesia's responses to the governance challenges of managing peatland and other lowland ecosystems

Under the leadership of President Joko Widodo, Indonesia raised its voluntary commitment to a 29% reduction in greenhouse gas emissions by 2030.

Recent policies toward the lowlands have been significantly shaped by the climate change and fire agenda and are justifiably focused on peatlands. The 2007 United Nations Framework Convention on Climate Change's Conference of the Parties (COP) 13 in Bali marked a turning point in the country's policy on lowland management, and particularly its conservation of peatlands. At the G-20 Summit in Pittsburgh, Pennsylvania, in the United States in September 2009, then-President Susilo Bambang Yudhoyono announced the government's voluntary decision to lower Indonesia's carbon emission level by 26% by 2020, and by 41% if external assistance was offered. Eighty-seven percent of those targets were to be met from reducing emissions from deforestation and with peatland conservation.

Under the leadership of President Joko Widodo, Indonesia raised its voluntary

commitment to a 29% reduction in greenhouse gas emissions by 2030. The recurrent fires of 2015 ushered in a new sense of urgency about addressing the underlying causes in the context of scaling up actions on climate change mitigation. As peat fires contribute to the intensity of haze from fire and account for the majority of Indonesia's land-based greenhouse gas emissions, achieving the climate policy target requires preventing their recurrence.

This chapter discusses key government actions to respond to the governance challenges in Indonesia's lowlands.

Subsections 4.1 and 4.2 focus on, respectively, the recent key actions targeting the peatlands, and those relevant to the lowlands more broadly. Figure A3.1 in Annex 3 presents a chronological overview of government actions related to Indonesia's lowlands over the past four decades.

4.1. Responses targeting peatlands

4.1.1. Strengthened peatland protection through moratoriums and environmental regulations

In October 2015, President Widodo issued an instruction to stop all conversion of peatland regardless of existing license status.

A series of peatland moratoriums since 2011 have helped slow the conversion of peatlands. The first moratorium on peatland licenses was issued in 2011 and was renewed in 2013 and 2015. In October 2015, President Widodo issued an instruction to stop all conversion of

peatland regardless of existing license status. This was followed by the 2016 moratorium on issuing new permits for oil palm plantation expansion.

New environmental regulations issued since 2014 have also significantly

A more recently issued MoEF Ministerial Regulation (No. P.10/2019) contains new provisions that set the conditions under which the development of peat domes is allowed.

strengthened the legal protection of Indonesia's peatlands (table 4.1).

Constituting the official government peatland policy, Government Regulation No. 71/2014 requires the government to produce a peatland hydrological area map, which divides the country's peatland areas into protection and cultivation functions. For protected peatlands, the regulation specifies the criteria of peatlands to be classified as having a protection function, including the requirement to protect at least 30% of PHUs around peat domes. Potentially larger areas are to be protected if other defined criteria are present, including peat with a thickness of more than 3 meters, specific or endemic germplasm, peat ecosystems located in protected areas as defined in spatial plans, protected forest areas, and conservation forest areas.

Peat ecosystems that do not match the protection criteria are assigned a cultivation function status, and can be used for all activities in accordance with the peat ecosystem protection and management plan. Government Regulation No. 57/2016 has since amended Government Regulation No. 71/2014, adding provisions related to planning, cross-institutional coordination, and enforcement of the peatland clearing ban. For peatlands that have already been developed, MoEF Ministerial Regulation No. 15/2017 requires that companies maintain the water level of 40 centimeters below the surface at all times. To address the consequences of peatlands licensed for industrial timber plantations being reclassified for protection functions, the government, based on MoEF Ministerial Regulation No. 40/2017, offered a land swap for timber plantation firms whose concession area comprised at least 40% of protected peatland according to the

government's peat map (Jong, 2017). However, this regulation was challenged by the timber industry and was struck down by the Supreme Court in October 2017 on the grounds that it illegally created a new category of protected areas by requiring a conversion of peatlands with cultivation permits back into protected areas (Jong and Arumingtyas, 2017).

A MoEF Ministerial Regulation (No. P.10/2019)¹⁷ contains provisions that set the conditions under which the development of peat domes is allowed, and thus constitutes a step backward in the legal protection of peatlands. Key provisions of the new regulation on peat conservation are (1) peatlands already used can continue until the license expires, while meeting the requirement of maintaining the water level at 40 centimeters below the surface; (2) if there are more than one peat domes in a PHU, and one of them is already developed, the development can be continued; and (3) peat areas around the peat domes can also be developed if they are already under development. These provisions directly contradict the 2014 regulation mandating protection of deep peats and at least 30% protection areas in one PHU. There are many deep peatlands already being developed in Indonesia, and this regulation will likely allow such development to continue on a wide scale. Given the hydrological connectivity within a PHU, allowing developments in areas around the peat domes to continue will also create a negative impact on the peat domes. The recent regulation also allows companies to provide their own maps without further independent verification, which may add to confusion around existing official maps.

17 MoEF Regulation No. P.10 / MENLHK / SETJEN / KUM. 1/3/2019 Concerning Identification, Determination and Management of Peat-Based Hydrological Units of Peat Dome.

Table 4.1. Environmental Regulations and Presidential Instructions Related to Peatland Protection

Year	Regulations and Instructions
2011	<p>Minister of Forestry Decree 323/Menhut-II/2011 on Development of an Indicative Map for Suspension of Granting New Licenses and Improvement of Natural Primary Forest and Peatland Governance ("Moratorium")</p> <p>The first of a series of two-year peatland moratoriums on new licenses in primary forests and peatlands. It created the space to review licenses and move toward resolution of mounting tenurial conflicts. The moratorium was part of Indonesia's program to reduce emissions from Deforestation and Forest Degradation (REDD) through improved governance, and a key element of the landmark agreements for bilateral cooperation with Norway in 2010, which committed as much as US\$ 1 billion for Indonesia under the emerging REDD scheme.</p>
2013	<p>Presidential Instruction No. 6/2013 on Suspension of New Licenses and Improving Forest Governance of Primary Forests and Peatlands</p> <p>This regulation extended the 2011 moratorium on new licenses on primary forests and peatland to May 2015.</p>
2014	<p>Government Regulation No. 71/2014 on the Protection and Management of Peat Ecosystems</p> <p>This regulation defines protection and management of peatland ecosystems to comprise planning, utilization, control, maintenance, monitoring, and administrative sanctions. The regulation defined a three-step process for protecting and managing peatlands: (1) Inventory, which includes remote and ground-based surveys, to map peatland hydrological units; (2) Assignment of peatland functions, i.e., zoning areas for production and protection; and, (3) Management planning and implementation.</p> <p>Key provisions on peatland ecosystem protection and management:</p> <ul style="list-style-type: none"> • Peatland ecosystem functions shall be classified as protected and for cultivation. • A minimum of 30% of PHUs must be protected, particularly areas located on the peat dome and surroundings. • Other criteria for being assigned a protection function are: <ul style="list-style-type: none"> » Peat with a thickness greater than or equal to 3 meters » Specific or endemic germplasm » Protected species in accordance with the laws and regulations, and/or » Peat ecosystems located in protected areas as defined in spatial plans, protected forest areas, and conservation forest areas. • Peatland ecosystems that do not match the above criteria shall be assigned a cultivation function. Peatland with a cultivation function can be used for all activities in accordance with the peat ecosystem protection and management plan. • Cultivation peatland could be designated as protected peatland based on ecological urgency (e.g., prevention of environmental degradation, peatland ecosystem recovery and storage), proposed by the regent/mayor or governor to the minister. • Protection and management of peatland ecosystems should be arranged in a multilevel hierarchy planning (national, province, regency/city).
2015	<p>Presidential Instruction No. 8/2015 on Moratorium on New Licenses in Primary Forests and Peatlands</p> <p>In the wake of the forest and peat fire disaster (2015), President Joko Widodo declared a moratorium on new peatland conversion, even within existing concessions. The first moratorium, which was extended in 2013, was extended by the president for the second time in May 2015, for a further two years, but the extension failed to mandate a thorough review of existing licenses and a resolution of overlapping claims. In October 2015, there was a President's Instruction after a Cabinet meeting to stop all conversion of peatland regardless of license status.</p>
2016	<p>Presidential Regulation No. 1/2016 on Peatland Restoration Agency</p> <p>This set up the Peatland Restoration Agency (BRG) to restore 2 million hectares of drained peatland.</p>

	<p>Moratorium on Oil Palm Plantation Expansion (Presidential Instruction) The president announced a freeze on new oil palm plantation permits.</p> <p>Government Regulation No. 57/2016 amends Government Regulation No. 71/2014 on Peatland Ecosystem Protection and Restoration Codification of peatland moratorium, protection, and restoration. The regulation places a permanent moratorium on peatland exploitation, stating that everyone is prohibited from clearing new land until a zoning system for the protection and cultivation of the peatland ecosystem is in place.</p>
2017	<p>Four ministerial regulations on the Peatland Restoration Framework issued by the MoEF to assist the operating regulations The ministerial regulations also contain technical details on the moratorium enshrined in the Government Regulation No. 57/ 2016, which says companies cannot plant on peat zoned for conservation.</p> <ol style="list-style-type: none"> MoEF Regulation No. 14/2017 provides guidelines for determining whether a peatland should be zoned for conservation or production. MoEF Regulation No. 15/2017 provides guidelines for how to measure the water table in a peat landscape. The law forbids companies from letting the water table in their concessions drop below 40 centimeters. MoEF Regulation No. 16/2017 is a technical guide for peat ecosystem recovery for all stakeholders, such as the government, rural communities, and the private sector. MoEF Regulation No. 17/2017 concerns the development of industrial plantation, which includes various obligations and compensations for timber and non-timber companies. For instance, companies whose concessions fall within conservation areas would be able to request substitution land (Peatland Swap). <p>MoEF Regulation No. 40/2017 Government Land Swap for Peat Provides a mechanism for land swaps, which outlines the requirement of timber planters to manage substitution land in their concessions. Under the regulation, the government will substitute the land of timber plantation firms whose concession comprises at least 40% protected peatland according to the government's map.</p>
2018	<p>MoEF Regulation No. P.61/2017 on the delegation of some of the mandates on peatland restoration in FY 2018 This regulation delegates peatland restoration mandates to the Governors of Central Kalimantan, Jambi, Papua, Riau, South Kalimantan, South Sumatra, and West Kalimantan.</p> <p>Legalization of Indonesian National Standard on Peatland Mapping based on satellite images 1:50,000, further regulated under Geospatial and Information Agency (Badan Informasi Geospasial - BIG) Regulation No. 12/2018.</p>
2019	<p>MoEF Regulation No. P.10/2019 Concerning Identification, Determination, and Management of Peat Dome Peak Based on Peat Hydrological Unit If there are more than one peat dome peaks in a PHU, and one of them is already being developed, the development can be continued.</p> <p>MoEF Regulation No. P.6/2019 on the delegation of some of the mandates on peatland restoration in FY 2019 This regulation delegates peatland restoration mandates to the Governors of Central Kalimantan, Jambi, Papua, Riau, South Kalimantan, South Sumatra, and West Kalimantan.</p> <p>Moratorium on New Permits and Improvement of Primary Forest and Peatland Management (Presidential Instruction) The president announced a freeze on new permits at any primary forest and peatland.</p>

4.1.2. Establishment of peatland restoration as a national priority

The restoration of Indonesia's peatlands was made a national priority in 2016.

The restoration of Indonesia's peatlands was made a national priority in 2016, as reflected by the establishment of the Peatland Restoration Agency (now, BRGM). In 2016, President Widodo established the Peatland Restoration Agency (*Badan Restorasi Gambut - BRG*)¹⁸ through Presidential Regulation No. 1/2016 to coordinate and facilitate the restoration of more or less 2 million hectares of peatlands across seven priority provinces: Central Kalimantan, Jambi, Papua, Riau, South Kalimantan, South Sumatra, and West Kalimantan.¹⁹ In collaboration with the MoEF's Directorate General of Ecosystem and Natural Resources Conservation (*Direktorat Jenderal Konservasi Sumber Daya Alam dan Ekosistem*), BRG is concentrating its restoration work on Non-Forest Areas (*Areal Penggunaan Lain*), Protected Areas, and Conservation Areas outside of concession areas.

The MoEF also has a shared responsibility in peat restoration.

The MoEF's Directorate for Peatland Damage Control under the Directorate General of Environmental Pollution and Damage Control (*Direktorat Jenderal Pengendalian Pencemaran dan Kerusakan Lingkungan-PPKL*), which is responsible for the roughly 24.7 million hectares of Indonesia's 865 PHUs, is supervising and monitoring peat restoration in forest areas under private concessions, including the types of licensing, for example, for Industrial Timber Forest (*Hutan Tanaman Industri*) and Agricultural Plantations (*Hak Guna Usaha*). The PHU was recently established through MoEF Regulation No. 10/2019 Concerning the Identification, Determination and Management of Peat-Based Hydrological Units of Peat Dome. Private companies are legally responsible

for financing the restoration of peatland in their concession areas and reporting to the Directorate General of Environmental Pollution and Damage Control.

a. Progress achieved through BRG

The Indonesian government has reported important achievements in peat restoration during 2016–18 through the work of the BRG. First, the BRG completed the key task of producing the indicative mapping of 2.5 million hectares of targeted areas for restoration in the seven priority provinces and uses this map as the basis for its operations. From these targeted areas, it is estimated that 29% (684,637 hectares) are in protected areas, 58% (1.4 million hectares) are in concession areas, and 17% (396,943 hectares) are in other cultivation areas (Safitri, 2016). Second, the BRG has incorporated the macro-zoning approach in mapping the PHUs in the priority provinces, particularly for identifying peat dome areas that should be conserved, and is developing strategies for adaptive management zones around the domes. Third, based on the indicative map of restoration areas, the BRG has carried out peat restoration involving the rewetting and revegetation of peatland areas, and the revitalization of the livelihoods of people living in those areas. During 2016–18, it reported that it had impacted 680,947 hectares, or 27% of its target, by constructing peat rewetting infrastructure in community areas, protected areas, and conservation areas. The infrastructure includes the digging of 12,223 deep wells, blocking of 6,117 canal lines, and back-filling of 242 canals and 42 ponds. In addition, the BRG and its partners have also assisted 259 villages and 958,595 hectares, 38% of the BRG's target areas,

18 The mandate of the *Badan Restorasi Gambut (BRG)* was extended in December 2020 for the next four years, with the agency expanding to the *Badan Restorasi Gambut dan Mangrove (BRGM)*.

19 This list of provinces is the same as those for the *Grand Design for Forest, Plantation and Land Fire Prevention*, excluding East Kalimantan.

Achieving Indonesia's ambitious peat restoration targets requires substantial institutional and technical capacity for implementation.

with the Peat Villages Program (*Desa Peduli Gambut*), which supports peat restoration and livelihood development.

BRGM also established the Peatland Water Monitoring System (*Sistem Pemantauan Air Lahan Gambut, SIPALAGA*) as a critical step in monitoring progress toward implementing the peat restoration target. Government Regulation No. 57/2016 requires that water be 40 centimeters below the surface, which would support the prevention of forest and land fires. This can be verified by real-time groundwater-level monitoring. As a result, the BRGM established the SIPALAGA system for priority target areas to simultaneously meet the objectives of (1) determining the water level (*Tinggi Muka Air*) in the peat ecosystem, (2) assessing the effectiveness of canal block installation, (3) assessing the water level as an early warning of fires, and (4) guiding the design of improved water management and governance of peatlands. To date, 142 such stations have been installed across the seven priority provinces, with real-time online monitoring of groundwater level accessible online on the BRGM's website.²⁰

b. Progress achieved through MoEF

The government has also reported major progress in peat restoration in private concessions and community areas in 2018 under the supervision of MoEF's Directorate General of Environmental Pollution and Damage Control (PPKL). PPKL reported that as of 2018 it had supervised the restoration of peatlands in 3.1 million hectares of private concession areas and 7,305 hectares of community areas. The restoration in concession areas was financed by the companies themselves

and was achieved through a combination of the restoration of the hydrological function of peatland, defined as returning the water level in peatlands to 40 centimeters, and the revegetation of the peatland with local forest timber or other natural species. In the community areas, the restoration was achieved through hydrological restoration and revegetation with plants of economic value such as wet agriculture and forestry on peatlands, known as paludiculture crops.

c. Remaining challenges in peat restoration

Despite the progress on peat restoration reported by the Indonesian government, at least three significant long-term challenges remain.

First, achieving Indonesia's ambitious peat restoration targets requires substantial institutional and technical capacity for implementation. The BRGM peat restoration targets require restoration work at an unprecedented rate and scale. By the BRGM's own account, it requires the blocking and construction of probably more than 10,000 kilometers of canal and 10,000 dams. This raises the question of what method or methods can produce a large number of affordable and permanent dams. And as many of the built structures are made of wood, they could be exposed to rapid degradation.

Second, there is currently a significant shortage of funding, which is key to fulfilling the long-term peat restoration agenda. One study estimates that the total cost of the BRGM initiative to restore 2.5 million hectares of peatland will be at least US\$ 4.6 billion (Hansson and Dargusch, 2017).

²⁰ <http://sipalaga.brg.go.id/>.

Third, restoring the water table in peatlands to 40 centimeters below the surface is likely inadequate as a sole indicator of their “restored” hydrological function. With a water table maintained at 40 centimeters below the surface, Indonesian peatlands still emit 40 tons of carbon dioxide (CO₂) per hectare and subside 3 to 4 centimeters per year (Couwenberg, Dommain, and Joosten,

2010). To achieve a significant reduction of Indonesia's greenhouse gas emissions the peatlands must be returned to their former hydrological functions, that is, fully flooded during the rainy season. This in turn will require the constant monitoring of other indicators (such as rainfall, biomass, and vegetation density), which is currently not happening.

4.1.3. A new national peat map

A new national peat map developed by MoA has started to forge an emerging common definition of peatlands across key lowland ministries. Reflecting a new data custodian policy, the MoA peat map is now used by MoA, MoEF, ATR/BPN, BRGM, and MoPWH in drafting new sectoral regulations. The newest version of the map was planned to be released in 2018 but at the time of writing this

report, the map had not been released. The map is supposed to contain a much-needed improved delineation of deep peat areas designated for legal protection, but at the moment, it only covers Sumatra and Kalimantan. A peat map with high accuracy for Papua is still needed. Governmental Regulation No. 57/2016 already mandated a detailed PHU map for Indonesia, but it has yet to be produced.

The absence of an overarching water resources law as of 2019 continues to create uncertainties in water resource management in Indonesia

Recent water sector regulations have strengthened the management and protection of peat swamps; however, the 2019 revocation of the Water Resources Law has created uncertainties. The 2015 Swamp Regulation (the 2015 Minister of Public Works and Housing Regulation No. 29/PRT/M/2015²¹), together with two regulations that substantiate exploitation and reclamation approaches for tidal and non-tidal swamps, constitutes the current legal framework for water management in the lowlands as of 2018. The 2015 Swamp Regulation contains provisions on macro-zoning, the management of tidal

and non-tidal swamps, and the protection of peat swamps.

Despite this 2015 regulation, the absence of an overarching water resources law as of 2019 continues to create uncertainties in water resource management in Indonesia (Kumpanan.com, 2019). It remains to be seen whether the New Water Resources law, when it is finally enacted, will give rise to new swamp regulations, with significantly different provisions on the protection and management of peat swamps.

4.1.5. Protection of peatlands in national spatial planning

National spatial planning regulations have begun to address the protection of

the peat ecosystems. The new national Spatial Planning Regulation No. 13

21 This regulation is referred to PP No.27/1973 in the absence of a water law.

Year 2017 includes guidelines for the protection of peat ecosystems in the National Spatial Plan (*Rencana Tata Ruang Wilayah Nasional*). In accordance with MoEF Regulation No. 71 Year 2014, ATR/BPN has designated 98% of all MoEF-designated protected peatland protected areas in the National Spatial Plan. It has also added another 45% of all MoEF-designated peatland, essentially going beyond the requirements of Regulation No. 71 Year 2014. Provincial and local spatial plans, which are subject to revision

in the coming years, will now have to ensure the complementarity of their peat protection plan with the National Spatial Plan. In terms of land titling, ATR/BPN also continues to postpone the issuance of land rights, including use rights, on peatlands in accordance with the moratoriums discussed in Subsection 4.1.1. Despite the protection of the peat ecosystems, the national spatial planning regulations do not yet contain broader guidance on comprehensive land-use zoning in the peatlands based on the PHUs.

4.2. Responses with broad relevance to the lowlands

The Coordinating Ministry for Economic Affairs has the critical role of coordinating all government efforts for the prevention and mitigation of forest and land fires in Indonesia and has issued Standard Operating Procedures for Fire Prevention (*Standar Pencegahan Kebakaran*).

4.2.1. Coordinating ministry leadership for fire prevention

Responding to the 2015 fires, the Government of Indonesia appointed the Coordinating Ministry for Economic Affairs (*Kementerian Koordinator Bidang Perekonomian*, CMEA) to assume leadership of the fire prevention agenda. The CMEA has a mandate to coordinate government agencies to implement integrated fire management in districts in fire-prone provinces.

Specifically, it has the critical role of coordinating all government efforts for the prevention and mitigation of forest and land fires in Indonesia and has issued Standard Operating Procedures for Fire Prevention (*Standar Pencegahan Kebakaran*) to harmonize the existing bureaucratic structure into a coherent system for forest and land fire prevention and management. The CMEA has also developed a specific framework for the prevention of peat fires for the 14 most fire-prone peat districts. The framework shifts peat-fire management efforts from suppression to proactive prevention, specifically targeting 80% of its effort at proactive reduction and 20% at fire

response and suppression. The framework also calls for the immediate establishment of seven cluster prototypes for integrated fire management involving government agencies, private concession-holders, and local communities.

The CMEA's cluster approach represents an effort to create a landscape-based governance model for fire management (see box 4.1). Chaired by the CMEA, an inter-ministerial forest, plantation, and land fire prevention task force is currently developing a cluster-based approach to fire prevention with pilot clusters in Central Kalimantan, Riau, and South Sumatera. The clusters bring together governmental and nongovernmental actors to discuss landscape-level issues related to fire prevention. These issues include peatland restoration, agricultural practices, and water governance. Community participation in fire prevention has been encouraged in the pilot areas, and collective fire-risk mapping and action plans are being developed.

A high-level focus group discussion with the cluster stakeholders, held in February 2018, highlighted the need to review policy gaps that currently prevent landscape-based solutions. For instance, communities living in the fire-prone landscapes will have to be provided with

the right skills and tools to prepare land without burning, while local governments must be incentivized to dedicate resources to fire prevention. The need to improve overall water governance in lowlands was also recognized as being key to the success of the fire prevention agenda.

In 2017 the MoEF also issued a new One Map Mangrove, covering more than 2 million hectares of the mangrove ecosystems in the lowlands.

4.2.2. The One Map Policy Initiative

The production of new official maps follows the national One Map Policy Initiative led by the Geospatial and Information Agency (Badan Informasi Geospasial), which aims to provide commonly accepted maps used by all government institutions in Indonesia. Apart from the updated national peat map discussed above, in 2017 the MoEF also issued a new One Map Mangrove, covering more than 2 million hectares of the mangrove ecosystems in the lowlands. At the time of writing this report, the national One Map platform had also been established, but many implementation challenges remain. For example, maps of provincial boundaries generated by subnational governments still have inconsistencies. The government has

published several maps of the state of the forest in Indonesia and updates them from time to time, but maps with more detailed information are not publicly shared. The MoEF hosts a system called Simontana on its geoportal and has established internal information commissions where the public can ask for information (Greeners. co, 2018); however, the maps that are demanded by the public, such as those showing concession boundaries, are in shapefiles²² and are no longer shared. Nongovernmental organizations and local communities face an obstacle in exercising their rights (such as by applying for social forestry permits) when information on the formal boundaries of concessions are not easily obtained and analyzed.

Box 4.1. A Landscape-Based Approach for Fire Prevention in Central Kalimantan

The Coordinating Ministry of Economic Affairs (CMEA) has designated Central Kalimantan as the province to which to apply its landscape-based fire management. The province will be designated as a cluster with districts as subclusters. There are five fire-prone districts in the province of Central Kalimantan: Kapuas, Katingan, Kota Waringin Timur, Palangkaraya, and Pulang Pisau. One of the districts approached to be a subcluster pilot site is the district of Pulang Pisau, Central Kalimantan. Approximately 60% of Pulang Pisau is peatland. The Ministry of Environment and Forestry (MOEF) is responsible for most land in Pulang Pisau (map B4.1.1). There are 95 villages

22 "The shapefile format is a geospatial vector data format for geographic information system (GIS) software" (<https://en.wikipedia.org/wiki/Shapefile>).

in the district, and 89 community-based firefighting groups (*Masyarakat Peduli Api*, MPA). The district plans to create guidelines to encourage village administration to allocate village funds for MPA operations. The district also organizes joint patrols including *Manggala Agni* (the Indonesian Forest Fire Brigade), the police, and the Regional Disaster Management Agency (BPBD).

Since 2017, the district has had an Integrated Fire Management Team, which brings together governmental and nongovernmental stakeholders to coordinate on matters related to forest and land fires. Membership is ad hoc and meetings are irregular, chaired by the Local Disaster Risk Management Agency. The team has drafted a District Action Plan on Forest and Land Fire Management, issued through a *Bupati* (Head of District) Decree.

Map B4.1.1. Land-Use Map of Pulang Pisau District, Central Kalimantan

Several commodity certification schemes have been developed to engage private sector actors in sustainable lowland use management, but are seen as a weak tool, and their immediate impact is limited.

4.2.3. Development of commodity certification schemes to protect forests

Several commodity certification schemes have been developed to engage private sector actors in sustainable lowland use management, but are seen as a weak tool, and their immediate impact is limited. Carlson et al. (2018) find that certification reduces deforestation in the long run and show that concessions with certification results in a lower deforestation rate but does not protect them from fire or clearance. Since the early 2000s, Indonesia has developed a timber certification scheme known as the Timber Legality Verification System (*Sistem Verifikasi Legal Kayu*). The scheme has engaged many small-to-midsize businesses to use legally sourced timber. The scheme gives credibility to their products so that they comply with the European Union (EU)'s Forest Law Enforcement, Governance and Trade (FLEG-T) standard and enter the EU market. There are hopes that Indonesia can replicate the success of the Timber Legality Verification System with its palm oil so that it meets EU standards (Hidayat, Offermans and Glasbergen, 2018).

A similar certification scheme is being developed by the Government of Indonesia to engage the private sector in palm oil. In addition to the Roundtable on Sustainable Palm Oil, which aims to

set a global standard on how palm oil should be produced sustainably, Indonesia has recently developed its own version, known as the Indonesia Sustainable Palm Oil Standard (ISPO), which is supposedly mandatory for thousands of companies and millions of smallholder farmers operating in Indonesia. Like the Timber Legality Verification System and the EU's FLEG-T, there are plans to link it with the Comprehensive Economic Partnership Agreement between the EU and Indonesia. Currently, the ISPO system is still voluntary and the target of much criticism. Hidayat, Offermans, and Glasbergen (2018) argue that the scheme will not meet its intended objective due to the governance challenge such as the weak authority of the implementing organizations and lack of reliability to convince the global market. These challenge the ISPO system's credibility. At the same time, the coalition of nongovernmental organizations in Indonesia that works on sustainable palm oil argues that the ISPO system does not protect all high conservation value forests and community rights (Kusumaningtyas, 2018). In general, it is seen as the weakest of all certification schemes and as potentially failing to incentivize concessionaires to protect Indonesia's lowlands.

4.2.4. Forest Management Units and social forestry

Forest Management Units have been established to support forest management, and together with communities, to prevent forest fires. The MoEF expects that Forest Management Units, in collaboration with communities, the police, and the military, can provide

a monitoring function to prevent fires in fire-prone lowland provinces. The units have been strengthened, including through capacity building delivered through development programs, although they work on an ad-hoc and voluntary basis and the budget to secure them is not

Supporting communities in sustainably using and managing forest resources after receiving permits, and building capacities of government institutions to implement the Social Forestry Program, are also key to the success of social forestry in Indonesia.

continuously available (Santika et al., 2019). Fisher et al. (2017) show that many of these Forest Management Units are still in early development. Despite their expected role in responding to forest governance issues at the local level, many Forest Management Units are unprepared to cope with the wide responsibilities and the rapidly changing policy and institutional framework affecting their operations.

The Government of Indonesia's Social Forestry Program (SFP) is expected to help address the issues surrounding forest land-use rights in parts of the lowlands, simultaneously contributing to reducing land conflicts and enhancing the livelihoods of forest-dependent communities.

Social forestry is an approach to forest management and protection that prioritizes social and environmental development through the restoration of degraded forestlands. The Government of Indonesia aims to use the SFP to address systemic poverty by selecting, demarcating, and registering lands in forest areas as community-managed, while simultaneously enhancing forest management and restoration in the buffer zones of critical protected areas. The latter is expected to help reduce the pressure to convert old-growth forest for agriculture and generate global environmental benefits (for example, conservation of biodiversity of global significance and mitigating greenhouse gas emissions).

Despite strong political support, implementation of the SFP has been slower than expected. As of 2018, the SFP has issued permits covering about 1.72 million hectares (4,581 licenses, covering approximately 384,816 households) (MoEF, 2018). The original target of 12.7 million hectares, which was expected to be achieved by 2019, has been reduced to 4.38 million hectares to reflect what might realistically be achieved within that time frame. A new target delivery date of 2024 has been set for accomplishing the 12.7 million-hectare target. This adjustment has been made due to various challenges the SFP has faced, including difficulties identifying and transferring appropriate degraded forestlands; weak capacity at the community level to access information, markets, and technical assistance; and limited institutional capacity and incentives at the national and local government level in implementing the social forestry schemes. While accelerating the issuance of social forestry licenses and strengthening the supportive policy and regulatory frameworks remain important, supporting communities in sustainably using and managing forest resources after receiving permits, and building capacities of government institutions to implement the SFP, are also key to the success of social forestry in Indonesia.

CHAPTER 5

Toward a landscape approach for Indonesia's peatlands and other lowland ecosystems: conclusions and recommendations

5

Toward a landscape approach for Indonesia's peatlands and other lowland ecosystems: conclusions and recommendations

5.1. Conclusions

The lowlands cover approximately 33.9 million hectares of low-lying landscapes in the islands of Sumatra, Kalimantan, and Papua, and comprise peatlands (41%), mineral soil lands (53%), and mangroves (6%).

Indonesia's lowlands are an important national asset, and their sustainable management requires national attention.

In this study, the term “lowlands” refers to the landscapes in the coastal and near-coastal zones that share the common characteristics of low elevation, boundary separation from the upland land systems, drainage dependent on the tidal fluctuations and sea level, permanent water saturation, unconsolidated soils under natural conditions, and the formation of extensive areas of peat.

Based on this definition, which builds on the Water Management for Climate Change Mitigation and Adaptive Development in the Lowlands (WACLIMAD) project (2010–2012) study, the lowlands cover approximately 33.9 million hectares of low-lying landscapes in the islands of Sumatra, Kalimantan, and Papua, and comprise peatlands (41%), mineral soil lands (53%), and mangroves (6%). While fueling substantial economic and livelihood gains, the commodity-driven lowland development model has also generated negative environmental and social externalities that are too costly to be ignored. These high costs to both the Indonesian economy and the poor were clearly demonstrated in the case of the eight fire-prone lowland provinces, whereby drainage-based agriculture has

been associated with the use of fire for land clearing, including on peatlands. Peat fires disproportionately account for the damage from toxic haze and CO₂ emissions, the magnitude of which is globally significant, and have cost the Government of Indonesia greatly to deal with their aftermath (World Bank, 2019a).

Indonesia has taken some bold steps to address the governance challenges in the lowland areas, the overarching goal of which is the protection of peatlands.

Key measures taken include establishing the Peatland Restoration Agency (BRG, subsequently expanded to BRGM), strengthening peatland protection through moratoriums and environmental regulations, strengthening the protection of peat swamps in water regulations, an effort to forge a common definition of peatlands across key lowland ministries through national Peat Hydrological Unit and National Peatland Functions Maps, and the integration of peatland protection into national spatial planning. These peat-centric actions have been complemented by, among others, broader reforms to improve cross-sectoral coordination for fire prevention, strengthen Forest Management Units, enhance access to forest land use rights, and develop community sustainability certification schemes.

Despite these positive initiatives, more needs to be done for the sustainable management of Indonesia's lowlands.

In particular, Indonesia needs to have a cross-sectoral champion to move the lowland sustainability agenda forward. In the short run, there is an urgent need to enforce the protection of deep peat areas as a key lowland policy priority, and such enforcement must be reviewed in the context of what could be seen as a recent setback in peatland protection (that is, a new 2019 environmental regulation allowing the development of peat domes). In the medium to long term, new actions are also needed to forge a common lowland sustainability vision, enhance data sharing and use in lowland management, mainstream peatland protection and management in key regulations outside the forestry and environmental sector,

and enhance the monitoring of private sector practices. Improved governance of other lowland ecosystems such as mangroves also needs to be addressed (Sidik et al., 2018).

It is also important to recognize that technically sound improvements in peat and lowland management require strong political support to address the institutional complexities that inhibit their implementation. This division of responsibilities among several agencies and between the central and decentralized levels currently creates multiple gaps and inefficiencies. Unless there are serious policy reforms to institutionalize coordination among these institutions, actions will always fall short of being effective.

5.2. Recommendations

Strengthening peatland protection is a necessary lowland priority but is not sufficient for sustainable development of Indonesia's lowlands. Rather, a holistic landscape approach is needed. Specifically, peatland management must be complemented by actions from the national to local levels to transition from uncoordinated sectoral management of lowland resources to integrated governance of lowlands based on a landscape approach. This will require setting up a lowland governance mechanism to coordinate reform actions of government agencies across sectors. Such a mechanism still needs to be designed.

This report offers nine key governance-related recommendations to support Indonesia in improving its management of peatlands and other lowland ecosystems. Table 5.1 summarizes these

recommendations into two groups: (1) four strategic-level recommendations to promote a paradigm shift within the government toward integrated landscape governance of Indonesia's lowlands, focusing on four overall actions related to a common lowland vision, a transition to a landscape governance approach, lowland coordination mechanisms, and the role of subnational and local governments; and (2) five recommendations geared toward addressing specific lowland sustainability issues, i.e. peat, land, fire, water, and private sector practices discussed in this report. In terms of prioritization, the government could prioritize in the short term the incremental actions, such as enforcing existing laws and regulations and improving technical guidelines (for example, on Peat Hydrological Unit-based water management) and strengthening existing monitoring systems (for example, for water level in peatlands and fire

incidents), as these are relatively easy to achieve and could be immediately implemented. In the medium and long term, the government needs to focus on the transformative actions, such as

establishment of a cross-sectoral lowland mandate and coordination mechanism, which require fundamental changes in the lowland governance framework.

Table 5.1. Summary of Recommendations to Improve Landscape Governance to Address Key Sustainability Issues in Indonesia's Lowlands

Strategic-Level Recommendations		
RECOMMENDATION		KEY ACTIONS
1	Establish a common lowland vision that balances economic development, vulnerability reduction, and environmental sustainability	<ul style="list-style-type: none"> • Develop a national common vision and goal statement for Indonesia's lowland management. • Establish commonly agreed sustainability indicators for the lowlands, linked to the Sustainable Development Goals. • Assess the cumulative impact of sectoral policy targets on the lowlands against the sustainability criteria. • Consider alternative options to achieve sustainable lowland outcomes.
2	Promote a paradigm shift toward a landscape approach across government agencies	<ul style="list-style-type: none"> • Establish lowland boundaries within each region based on scientific evidence and stakeholder consultations. • Develop a master plan for land-use macro-zoning of lowland hydrological units, and associated water management standards; and incorporate the zoning in the provincial spatial planning process, provincial-level landscape management strategy, and/or provincial green growth initiatives. • Define lowland landscapes as strategic areas in spatial plans, but also ensure that land-use planning in the lowlands is integrated with the broader landscape of the province. • Develop specific guidelines on land-use and water management in tidal and non-tidal lowlands based on the macro-zoning.
3	Enhance coordination, enforcement, and monitoring mechanisms in the lowlands	<ul style="list-style-type: none"> • Establish a formal coordination mechanism across relevant ministries and agencies for lowland management. • Develop processes for integrated and coordinated lowland management (e.g., through forward spatial planning). • Identify and pilot bottom-up institutional mechanisms for participatory lowland governance at the local level, including through existing mechanisms such as village or district development planning roundtables (<i>Musdes</i> and <i>Musrenbangkab</i>). • Enhance the participation of community and nongovernmental organizations in lowland planning and management. • Strengthen the overall lowland monitoring system, by building new capacities in addition to existing parameter-specific ones (e.g., water, land cover, fire).
4	Establish a clearer lowland management mandate for subnational and local governments	<ul style="list-style-type: none"> • Strengthen the role of subnational and local governments in lowland management through mandates and through fiscal and other incentives.

Recommendations to Address Specific Sustainability Issues

RECOMMENDATION		KEY ACTIONS
5	Broaden the focus on peatland restoration to peatland management, based on the landscape approach	<ul style="list-style-type: none"> Enforce the legal protection of deep peat areas. Consider regulatory changes to shift the focus from peatland restoration focusing on peat domes to integrated peatland management and ensure overall consistency. Incorporate a shared peat mandate, a paradigm shift, and peat-related targets and budgets in MoPWH's water management activities in provinces beyond the priority seven provinces. Improve coordination among BRGM, MoEF, MoA and MoPWH, using PHUs as a joint planning unit.
6	Improve land management in the lowlands through spatial planning, synchronized maps, and rationalized land classification	<ul style="list-style-type: none"> Scale-up implementation efforts under the One Map Policy Initiative: finalize PHU maps at 1:50,000 and legalize the detailed functions map at 1:50,000. Rationalize land classifications to optimize land use in the conservation, adaptive management, and development zones of the lowlands. Consider extending the moratorium on new licenses on peatlands and primary forests until the rationalized land classification is in place.
7	Strengthen integrated water management in the lowlands, based on hydrological boundaries and harmonized water standards	<ul style="list-style-type: none"> Improve institutional coordination and harmonize operating procedures of agencies affecting water use in the lowlands. Set water management standards for all three macro-zones of the lowlands, differentiating between the requirements of tidal and non-tidal lowlands. Implement and monitor the lowland water management standards across public and private lands regardless of forest or non-forest status. Incorporate lowland water management standards into agricultural regulations and concession licenses. Clarify the water management role of the MoPWH in areas where it is currently inactive (e.g., areas under private sector concessions). Improve regular monitoring for both sea level rise and subsidence as part of a lowland water monitoring system.
8	Improve fire management, through improved monitoring system and building local capacities	<ul style="list-style-type: none"> Strengthen a lowland-wide fire monitoring system, particularly early warning and detection capacities. Strengthen and adequately finance local systems for preventing and responding to fires. Promote alternative methods of land clearing without using fire via provincial and local government regulations and communication campaigns.
9	Improve oversight of private sector practices, using performance-based licensing	<ul style="list-style-type: none"> Use performance indicators as one of the criteria for renewing the licenses of private concessionaires operating on lowlands. Use incentive mechanisms to comply with recommendations in the study, such as carbon trading schemes and tax reduction.

Sustainable development of Indonesia's lowlands should be guided by a common vision that balances economic development, vulnerability reduction, and environmental sustainability.

5.2.1. A common government vision for the lowlands

Sustainable development of Indonesia's lowlands should be guided by a common vision that balances economic development, vulnerability reduction, and environmental sustainability. The Government of Indonesia should aim to develop a national government-level common vision and goals statement for Indonesia's lowland management and incorporate it into formal planning instruments such as a National Action Plan, National or Subnational Development Plans, provincial spatial plans, and green growth plans. Key sustainability indicators for lowland development could include (1) enhancement of regional economic prosperity and of the livelihoods of lowland populations by stimulating development of local economic activities consistent with local conservation aims; (2) reduction of investments in lowlands leading to lowland vulnerability to subsidence, flooding, and climate change-related risks such as sea level rise through improved land and water management; and (3) reduction of greenhouse gas emissions in lowland regions, particularly through effective prevention of land and forest fires on

peatlands, requiring improved land and water management. The cumulative impact of sectoral policy targets on the lowlands should be assessed against these sustainability criteria. Since it will be practically impossible to achieve several Sustainable Development Goals, such as Zero Hunger (Goal 2), Zero Poverty (Goal 1), and Climate Action (Goal 13), without addressing the sustainability challenges in the lowlands, the Government of Indonesia could formulate the lowland sustainability indicators to be explicitly linked to the relevant Sustainable Development Goals (Dewi et al., 2019).

A common lowland vision should also consider alternative options to promote lowland sustainability according to the above indicators. Key considerations should be the role of alternative crops, green business models (for example, tourism, protected area management, sustainable fisheries), and the role of economic and fiscal incentives (for example, payments for ecosystem services, performance-based payments) to reward the lowland provinces and districts in reducing negative externalities from lowland development.

5.2.2. A paradigm shift toward a landscape approach

The Government of Indonesia could consider taking the following steps to promote a paradigm shift toward a landscape approach, which requires that each government agency view the lowland areas as an integrated unit. First, based on the macro-zoning principle discussed in Chapter 2, a master plan for land-use zoning of lowland hydrological units (that is, PHUs in coastal/tidal lowlands, and watersheds in non-tidal lowlands) could be developed, covering conservation, development, and adaptive

development zones. This will require preparation of the macro-zone maps, and subsequently meso-zone maps (for land use within each macro-zone), of the lowland areas. Second, water management standards required for the hydrological functioning of each zone could be set (for example, stricter standards are required for the conservation zone). In parallel to these two steps, an integrated regional economic development plan based on hydrological units could be developed for each lowland region. This, in turn,

Spatial planning must play a central role in institutionalizing lowlands in government policy and future investment planning.

requires that lowland boundaries within each region will need to be established using both scientific evidence and stakeholder consultations. Such a regional economic development plan should also contain lowland sustainability indicators, and consider livelihood development options, including, among others, agriculture, agroforestry, social forestry, fisheries, agritourism, and ecotourism, in conservation, development, and adaptive development zones.

Spatial planning must play a central role in institutionalizing lowlands in government policy and future investment planning.

As an agency whose spatial planning mandate covers all lowlands, the ATR/BPN is well-placed to do this. The recent integration of peatlands with a protective function as protected areas in national spatial planning (MoEF Regulation No. 71/2014) is an important start. This could be strengthened by (1) defining entire lowland landscapes as “strategic areas”²³ in national, regional, and local spatial plans, but also ensuring that land-use planning in the lowlands is integrated with the broader landscape of the province; (2) developing a comprehensive approach

to spatial planning in the lowlands by applying the macro-zoning principle (that is, conservation, adaptive management [buffer], and development zones); this would require the revision of existing spatial plans, based on a soil map showing peat and peat depth, mineral soil, present land use and infrastructure, the planned mid -and long-term development vision and its consequences for lowlands, and the potential impacts of the spatial plans on water security, land subsidence, and other socioeconomic conditions; (3) developing specific guidelines on land use in tidal and non-tidal lowlands based on the macro-zoning; and (4) incorporating the macro-zones into national, regional, and local spatial planning regulations. Areas with spatial plans to be revised in the next five years could be considered for an integrated lowland spatial planning pilot exercise. In addition to spatial planning, the landscape approach based on macro-zoning could also guide the integration of development and spatial planning over a jurisdiction such as a province through a provincial-level landscape management strategy and/or provincial green growth initiatives.

5.2.3. Enhancing coordination and monitoring mechanisms in the lowlands

A formal and permanent lowland governance mechanism should be created to foster the shared development vision and ensure that the necessary policy and regulatory steps are taken. There are many design options for this mechanism that Government of Indonesia could consider. First, this mechanism could be instituted in a national-level, cross-sectoral body, which could be existing or newly created, which has a mandate and the authority to decide on actions to

be taken to implement the sustainable lowland development vision. Second, it could take the form of a committee with the participation of different government agencies, building on the experiences and lessons learned from the WACLIMAD project's cross-sectoral collaboration. Third, this formal and permanent national lowland governance mechanism could be embedded within a coordinating agency (for example, the Coordinating Ministry of Economic Affairs - CMEA), with a planning

23 Current spatial planning regulations allow the designation of significantly important ecosystems as Strategic Areas (such as national parks, disaster-prone areas, and critical or unique ecosystems) in national, regional, and local spatial plans.

At the local level, a bottom-up institutional mechanism for participatory lowland governance should be identified and piloted.

agency (for example, BAPPENAS), with a peat agency (for example, BRGM), with a land management authority (such as ATR/BPN), or with a water management authority (such as the Ministry of Public Works and Housing). Deciding on these options requires broad consultation within Government of Indonesia and other lowland stakeholders (such as local governments, local communities, and the private sector). The consultation process should also aim to involve ministries not traditionally included in lowland-related planning processes but that have important roles to play in sustainable lowland management such as the Ministry of Home Affairs; the Ministry of Villages, Underdeveloped Regions, and Transmigration; and the Geospatial Information Agency. The consultation process and the chosen lowland coordination mechanism could be facilitated by a Presidential Regulation to promote coordination among ministries and agencies with clear mandates for each.

Processes for integrated planning and coordinated management of the lowlands also need to be developed.

For example, a forward-looking spatial planning process could be envisaged that incorporates not only the existing basin planning instruments but also land-use zoning and spatial plans. This would help address several pressing nexuses of issues where the effectiveness of solving them depends on coordination between basin management and the management of

- (a) upland watersheds and catchments;
- (b) lowlands overall, and peatlands, in particular;
- (c) urban development; and
- (d) coastal zones (for example, mangroves).

Spatial plans for lowlands must also reflect projections of subsidence and sea level rise and associated changes in flooding regimes.

At the local level, a bottom-up institutional mechanism for participatory lowland governance should be identified and piloted.

Such mechanism is needed to promote land-use planning that combines flexibility and local innovation but is guided by mandatory lowland sustainability principles. Links between local lowland governance and other local mechanisms currently under development in lowland landscapes could be explored. Such mechanisms include regional and local government processes in each lowland region including the Peat Villages Program (*Desa Peduli Gambut*) supported by BRGM and its partners, prototype clusters for integrated fire management promoted by the CMEA, or a jurisdictional approach to performance-based forest carbon finance in East Kalimantan. Alternatively, as proposed during the WACLIMAD project, coordination mechanisms such as Swamp Commissions (*Komisi Rawa*) in agricultural landscapes and Peat Swamp Forest Commissions (*Komisi Hutan Rawa Gambut*) in peat swamp forest landscapes, each with farmer, private sector, government, and nongovernment representation, could be formed to promote local problem solving among stakeholders. Such integrated field-level organizations may not be needed in all lowland areas, and can cover more than one hydrological unit (WACLIMAD, 2012d).

Opportunities should be created for community and nongovernmental organization participation in many aspects of the lowland policy cycle, including lowland planning and management. Government agencies could promote integrated community-based spatial land-use and development planning and institutional strengthening for agricultural and economic development in lowland rural communities. These could be supplemented by increasing the provision of key services to communities, including agricultural and forestry

An effective monitoring system will be useful for overall resource-based policymaking in the lowlands.

participatory extension services, based on an agreed definition of these services and key standards for land and water management.

An effective lowland monitoring system must be established at both the national and subnational levels. Existing parameter-specific monitoring systems, such as the Peatland Ground Water Information System (SIMATAG) and the Peatland Water Monitoring System (SIPALAGA) for water levels (peatland cultivation), and the Peatland Restoration Information Monitoring System (PRIMS) for decrease of land cover (peatland protection) should be strengthened. However, new capacities should be developed so that existing monitoring systems feed into an overall lowland monitoring system. Such an overall lowland monitoring system should focus on (1) monitoring and control of activities that cause damage to the lowland ecosystems; and (2) evaluation of whether the proposed outcomes of integrated management plans are being achieved, and if not, the corrective actions that need to be taken. An effective monitoring system will be useful for overall resource-based policymaking in the lowlands.

Such a lowland monitoring system requires a government-wide data sharing platform that collates and synthesizes the data for lowland management that currently exist across many agencies.

The WACLIMAD project has established the Lowland Database for data storage and management and the Lowland Data Catalogue for providing access to data stored in the Lowland Database and on third-party data servers. This work could be revived and transferred to the permanent lowland governance mechanism. Several recent initiatives implemented by government agencies and development partners can also contribute data to the lowland data-sharing platform. These include the Government of Indonesia's One Map Policy Initiative and the nongovernmental organization Alliance of Indigenous Peoples of the Archipelago (*Aliansi Masyarakat Adat Nusantara* – AMAN) database on land conflicts.

5.2.4. Establish a clearer lowland management mandate for subnational and local government

Subnational authorities in the lowland provinces and districts should be given a clearer mandate and incentives to promote sustainable lowland management. For example, village funds and other fiscal transfers could be used to incentivize natural resource management, peatland restoration and management,

and fire management in lowland areas. Coordination mechanisms could also be developed to improve the synchronization of central and local governments' land-intensive goals.

There is an urgent need to enforce the protection of deep peat areas as a key lowland policy priority.

5.2.5. From peatland restoration to peatland management

There is an urgent need to enforce the protection of deep peat areas as a key lowland policy priority. With some exemptions,²⁴ environmental regulations are consistent in prioritizing the protection of deep peat areas, giving rise to an overall national framework for peatland protection. Enforcing such legal protection of peatlands requires at least four immediate actions:

- (1) translation of the national policy on peatland management into subnational regulations;
- (2) improved monitoring of the condition of peat areas and drainage activities, both around peat domes and buffer zones, based on agreed maps ;
- (3) implementing fire prevention activities in peat districts, particularly those with extensive deep peat areas; and
- (4) strong enforcement of regulations on peat drainage and land clearing with fire, and periodic assessment of the impact of the regulations.

While current government actions focus on conserving deep peat and restoring degraded (burned) peatlands, future actions should expand the current approach to incorporate a landscape approach for integrated peatland management, which will require regulatory changes. While Government Regulation No. 71/2014 covers both the protection and management of peat ecosystems peatland management, current MoEF peat-related regulations still offer only a partial framework to manage peatlands, as they largely focus on regulating the peat domes, but not the broader PHUs. Given the hydrological connectivity within a PHU, the peat

dome center can hydrologically be maintained only when the margins of the dome also remain undrained. Draining the margins lowers the water table across the entire landscape, resulting in the inevitable collapse of peat domes over the longer term.

Future MoEF peat-related regulations could, therefore, consider enacting more explicit and landscape-wide measures to phase out drainage activities in peatlands. Such regulations should use the entire PHU as a management unit and incorporate the lowland macro-zoning approach discussed in this study. The Peat Ecosystem Protection and Management at both the national and provincial levels could be finalized, and a blueprint of PHU-based management could be developed, followed by accompanying regulations and technical guidance.

The Ministry of Public Works and Housing (MoPWH) can play a stronger role in water management in peatlands, but this will require a shared mandate, a paradigm shift, and clear peat-related targets and budgeting for the MoPWH, as well as increased institutional coordination with BRGM. Getting the water right is at the heart of peatland management, and as the institution with a water resource management mandate at its core, the MoPWH could play a more active role in supporting other agencies such as BRGM to meet their peat-related targets. However, some key changes are required for MoPWH to perform such a role. First, MoPWH should be given a “shared mandate” for water management in the peatlands. This would lead to more institutionalization of the peat agenda

24 See MoEF Regulation No. P.10 / MENLHK / SETJEN / KUM. 1/ 3/2019 concerning Identification, Determination and Management of Peat-Based Hydrological Units of Peat Dome.

within its work program and necessitate the allocation of appropriate budgets. Second, this shared mandate must also be accompanied by a paradigm shift within the MoPWH, from focusing on irrigation and draining in the lowlands toward supporting rehabilitation of the

peatlands through rewetting. Third, the macro-zoning principle should be used as an entry point for synchronizing peatland restoration actions between the BRGM and the MoPWH, as well as between other agencies such as the MoA, based on the PHU as a joint planning unit.

Scaled up actions are required to advance implementation of the One Map Policy Initiative so it can directly benefit sustainable land management in the lowlands.

5.2.6. Improving land management in the lowlands

Sustainable land allocation in the lowlands requires more accurate maps that are commonly used across government agencies. This challenge is being addressed by the Government of Indonesia's One Map Policy Initiative. In 2011, Presidential Regulation No.85 was issued regulating the National Spatial Data Network, which was later updated through Presidential Regulation No.27/ 2014 on National Geospatial Information Network that includes the One Map Policy Initiative, aiming to establish a unified-based set.²⁵ Progress includes a common geospatial reference system called the Indonesian Geospatial Reference System (Sistem Referensi Geospasial Indonesia),²⁶ a publicly available portal (INA-Geoportal), and a One Map Policy coordination mechanism led by the Coordinating Ministry for Economic Affairs (CMEA). However, only a limited range of geospatial data is accessible, and there are significant inconsistencies among geospatial datasets of key line ministries.²⁷ In 2017, CMEA compiled 1:50,000 scale One Map databases on Kalimantan and Sumatra with 80 thematic land-use datasets from

over 20 Indonesian authorities. While this is an important step forward, the data have not been field-verified, and the resulting One Map shows overlaps and has not been released for public use.

Scaled up actions are required to advance implementation of the One Map Policy Initiative so it can directly benefit sustainable land management in the lowlands. These actions should include, among others,

- (1) participatory mapping including fit-for-purpose mapping of parcels, land use, indicative village administrative boundaries, and other land-use occupation (for example, Forest Area boundaries and mining concessions) in lowland districts;
- (2) land rights regularization and registration in the Electronic Land Administration System (eLand);
- (3) enhancing the availability of and access to up-to-date geospatial information;
- (4) promoting access to and availability of electronic land administration services; and
- (5) improving the capacity, procedures, and legal framework for accelerating

25 Indonesia adopted a National Spatial Data Infrastructure framework in 2007 (through Presidential Decree 85/2007) instating the Geospatial Information Agency (BIG) as the lead agency.

26 BIG and ATR/BPN operate separate Continuously Operating Reference Station (CORS) systems to facilitate accurate surveys in the Indonesian Geospatial Reference System, but aim to unify them in a national CORS network.

27 The National Spatial Data Infrastructure line ministries and key agencies include the Ministry of Agrarian and Spatial Planning/National Land Agency; the Geospatial Information Agency; the Ministry of Environment and Forestry; the Ministry of Energy and Mineral Resources; the Ministry of Public Works and Human Settlements; the Ministry of Villages, Disadvantaged Regions, and Transmigration; Center for Maritime Meteorology-the Agency of Meteorology, Climatology, and Geophysics; the Central Bureau of Statistics; the Institute of Sciences; the Ministry of Marine Affairs and Fisheries; the Ministry of Transportation; the National Agency for Disaster Management; and the Meteorological Agency.

implementation of Agrarian Reform, the One Map Policy Initiative, and modern e-Land Administration.

The activities should target the Government of Indonesia's priority fire-prone lowland provinces in Sumatra (Jambi, Riau, and South Sumatra) and Kalimantan (East, Central, South, and West).

Rational land allocation in the lowlands also requires the rationalization of land classifications to optimize land use in the conservation, adaptive management, and development zones. In the lowlands, this could be achieved through collaboration among MoEF, ATR/BPN, MoA, and BRGM. In particular, this will require an in-depth analysis of how much of deep peat areas, which are currently protected by existing MoEF regulations, have actual land classifications that still leave them

vulnerable to drainage activities and should therefore be reclassified and returned to conservation. In addition to peat protection, rationalized land classification could also guide the establishment of new agricultural plantations on suitable, non-forested land while respecting local rights. Three methods could facilitate such exercise and should be explored: (1) single reclassifications (change of the land-use classification of a single area); (2) multiple reclassifications (simultaneous change [or "swap"] of the land-use classifications of multiple areas); and (3) local or special designations (change the allowable land uses in a designated local area without changing the land-use classifications) (Rosenbarger et al., 2014). Moratorium on new licenses of peatlands and primary forests could be considered to be extended until the rationalized land classification is in place.

5.2.7. Improving water management in the lowlands

"Getting the water right" is key for the sustainable management of the lowlands and requires better operational coordination across agencies.

"Getting the water right" is key for the sustainable management of the lowlands and requires better operational coordination across agencies. In practice, this means protecting environmental flows to ecosystems and improving conjunctive surface and groundwater management, through aligning incentives for conservation and development to address drivers of land-use change. Policy directives and fiscal incentives can play a key role in standardizing institutional operating procedures of ministries and agencies core to lowland land and water use, such as MoA, MoEF, MoPWH, BRGM, and provincial and district authorities. Given the need to align outcomes across multiple agencies, results-based financing (such as through fiscal transfers) might be a useful tool.

Future water regulations should set water management standards for all the three macro-zones of the lowlands, which should be adopted and monitored across public and private lands regardless of the Forest or Non-Forest Area status. These standards should differentiate between the requirements of tidal and non-tidal lowlands. While the water management standards for the hydrological functioning of each macro-zone are required, stricter standards are needed for conservation zones. For forest areas, the implementation of such water management standards could be strengthened by the harmonization of forest and water management units (such as increasing the consistency between Forest Management Unit boundaries and river-to-river Peat Hydrological Units in tidal lowlands), and of forest and water sectoral regulations. Coordination between MoEF and MoPWH water monitoring systems, as

well as between river basin organizations (RBOs) of the two ministries, could also be strengthened. For agricultural areas, this requires incorporation of lowland water management standards into agricultural regulations and concession licenses. Coordination among MoA, MoPWH, and private concession holders in implementing harmonized water management standards must be strengthened, potentially by establishing a coordinating mechanism. The mechanism could also help identify more roles for the MoPWH in enhancing water management in areas under private concessions, where it is not currently active.

Water monitoring systems are critical to improved lowland monitoring, and there is an urgent need to modernize existing monitoring and information systems.

Indonesia has a long history of investment in water monitoring and information systems but could still benefit significantly from investing in water monitoring modernization, analytical tools, and water

knowledge. Such efforts are key to water resource planning and risk management, including reinforcing and broadening data gathering and building a water information system ideally into a robust, easily accessible, and transparent national water information system covering all land areas and classifications. Apart from water and hydrology, regular monitoring is needed for both sea level rise and subsidence as part of a lowland water monitoring system. LiDAR—Light Detection and Ranging²⁸—can be used to detect changes in land subsidence over regular intervals. Such a comprehensive information system will catalyze good lowland restoration and management programs and will help agencies and stakeholders collaborate more effectively. In addition, this can provide consistent information for benchmarking the performance of managed peatland schemes (that is, at the scale of a Peat Hydrologic Unit) over space and time.

5.2.8. Improving management of forest and land fires

The sustainable management of lowlands requires a lowland-wide fire monitoring system with a robust capacity for early warning and detection of land and forest fires.

The sustainable management of lowlands requires a lowland-wide fire monitoring system with a robust capacity for early warning and detection of land and forest fires. Key aspects of such a system that need technical strengthening and adequate financing are the daily monitoring of data derived from the Fire Danger Rating System (*Sistem Peringkat Bahaya Kebakaran*), including hotspot data, weather, incidents, and activities that have the potential to cause forest and land fires. Also important is the monitoring of peat water levels, which is a strong indicator of the likelihood of peat fires. Having a robust fire monitoring system will reinforce the overall lowland

monitoring system, with the two systems using common data and integrating the findings of each other.

Although a National Grand Design for Fire Prevention is in place, local systems for preventing and responding to fires remain underdeveloped and must therefore be strengthened and adequately funded. Fire management is currently not a priority in many rural villages that lack incentives, finance, and capacity. More resources are needed for district (*kabupaten*) or city (*kota*) level government agencies to build local capacities for fire prevention and management in villages throughout its territory through training and media

28 LiDAR is a surveying method that uses a remote sensing method to examine the surface of the Earth.

campaigns. These local agencies also need support to maintain an inventory of water sources and have available fire-danger maps along with land-use maps for the different landholding systems in its territory.

Through local regulations and communication, provincial and local governments can promote alternative land-clearing methods that do not require the use of fire. Some communities in remote areas may not be aware of alternative methods of land clearing,

and hence there is a need for local governments to develop guidelines for villagers and to educate local officials such as those in Forest Management Units about the need to continuously communicate these alternative methods to communities and small and midsize concessionaires. Government campaigns that raise community awareness of forest and land fires could be conducted through social, religious, and school forums and mass media, and through a land preparation without burning (*Pengolahan Lahan Tanpa Bakar*) program.

5.2.9. Performance-based private concession licensing

The concession licensing criteria to incentivize sustainable practices by private concessionaires in lowland areas should be reformulated.

The concession licensing criteria to incentivize sustainable practices by private concessionaires in lowland areas should be reformulated. Performance indicators can be used as one of the criteria for renewing the licenses of private concessionaires operating on lowlands. These criteria should be developed and accepted by all key lowland stakeholders in each sector (for example, forestry, agriculture, mining). To promote agricultural intensification and

improve land-use efficiency, yield per unit of cultivable (non-deep peat) land can be used as one of the performance indicators for extending licenses. Performance monitoring cannot rely solely on self-reporting by private concession holders; an independent monitoring and evaluation system is needed, so that self-reporting can be cross-verified.

Annexes

Annex 1.

Delineation of Indonesia's lowland boundaries for this study

This annex describes the process by which this study has delineated Indonesia's lowland boundaries. It first describes how the original Indonesian lowland maps were produced during the Water Management for Climate Change Mitigation and Adaptive Development in the Lowlands (WACLIMAD) project (2010–2012). Using those maps as a starting point, the study uses new data to update the maps to produce a set of new lowland maps.

A1.1. Original WACLIMAD lowland maps

The 2010–2012 WACLIMAD project was an effort to foster cross-sectoral policy dialogue on Indonesia's lowlands based on a common conceptualization and delineation of lowland boundaries. Funded by the World Bank, WACLIMAD's overall long-term goal was to develop a formal national lowland development strategy. A key premise of WACLIMAD was that the unique characteristics of lowlands, and particularly the peat ecosystems, must be accounted for in the multisectoral planning process. This in turn requires a common understanding of the definition and terminology of lowlands as a starting point for dialogue and interagency coordination. To facilitate such a dialogue, the WACLIMAD project, in consultation with multisector government agencies, developed a national lowland map and a set of individual lowland maps for the islands of Sumatra, Kalimantan, and Papua.

The WACLIMAD lowland maps were developed using comprehensive datasets available at the time (WACLIMAD, 2012c), namely the **Nationwide Study on Coastal and Near-coastal Lowlands (Nedeco/Euroconsult, 1984)**; the **1990 Regional Physical Planning Project for Transmigration (RePPPProt) database**,

which covers only Sumatra and Kalimantan; **Wetlands International's Peatland Atlas (2002–2006)**; digital topographic data from the **Shuttle Radar Topography Mission (2000)**; and a map of **Peatland Hydrological Units in Indonesia from the Ministry of Forestry (MoF, 2009)**. The most important criteria for the delineation of the lowlands were low elevation and drainage defined by sea level, management along landscape boundaries following the “river-to-river” approach, and the integrity of peatland with the coastal lowlands. An additional set of complementary factors was also considered in determining the lowland boundaries, such as the fact that peat areas may become part of the coastal- and near-coastal lowland systems, even though their elevation is far above tidal water levels, since they fit the lowlands from a parental material perspective.

Using the above delineation criteria, the WACLIMAD lowland mapping process followed four steps:

- (1) development of a consensus on the boundary between lowland and upland land systems²⁹;
- (2) delineation of the boundary between coastal and near-coastal lowlands, where this is relevant for

29 Three main types of boundaries were considered: (a) coastal plain–upland boundary, usually sharp; (b) peatland–upland boundary, gradual; and (c) floodplain–upland boundary, transitional.

30 In relation to this step, the broader floodplains are included in the lowland delineation only if their drainage is dependent on the tidal fluctuations and sea level, and if they are vulnerable to sea level rise.

the hydrology and differences in land and water management³⁰;

- (3) delineation of independent hydrological units, including those for peatland management, in both the coastal and the near-coastal zones, following hydrological boundaries formed by the sea, rivers, larger canals, and upland formations; and
- (4) classification of relevant landforms, depending on the management purpose, for example, peat domes for conservation (figure A1.1).

Based on the above process, the WACLIMAD project delineated Indonesia's lowlands in the coastal and near-coastal areas of the islands of Sumatra, Kalimantan, and Papua. These lowlands cover around 31.6 million hectares, comprising approximately 9.4 million hectares (30%) in Sumatra, 11.7 million hectares (37%) in Kalimantan, and 10.5 million hectares (33%) in Papua. Within these lowland boundaries are

- (1) coastal landforms such as tidal and freshwater swamps, deltas, mangroves, and estuaries;
- (2) near-coastal landforms such as low-lying floodplains with river levees and back swamps; and
- (3) peatlands overlying the coastal or near-coastal landforms.

These coastal- and near-coastal lowlands are nearly flat, situated at or just above mean sea level and, hence, under tidal influence for at least part of the year. In the context of swamp management, these lowland delineations mean that the WACLIMAD lowland boundaries include mostly tidal swamps (*rawa pasang surut*), which are under tidal influence in the main rivers for a larger part of the year, while excluding much of non-tidal swamps (*rawa lebak*), which are located far from the coasts and are influenced by the overflow of rivers or rainfall periodically or continuously throughout the year.

Figure A1.1. Delineation Criteria Used in Development of WACLIMAD Lowland Maps

A1.2. Updated lowland maps for this study

Starting with the original WACLIMAD lowland maps, this study integrates the most up-to-date scientific data and governance considerations to produce updated lowland maps (table A2.1). We do not advocate that new physical lowland boundaries are absolute, undisputed, and legally binding. The objective of this mapping exercise is to develop analytical boundaries to the lowland system as a landscape unit with a set of

unifying physical and hydrological characteristics that distinguish it from upland systems. The updated maps help in visualizing the overlapping institutional mandates and sectoral operational boundaries within the lowland boundaries, thus enabling analysis of governance risks and opportunities to achieve sustainable development outcomes.

Three developments since the conclusion of WACLIMAD in 2012 inform the updated lowland boundaries. First, new and improved data are available to verify and improve the delineation of the lowlands. These include new data on peat distribution, elevation, tidal influence and salinity intrusion, land use and land cover, and Forest Areas (*Kawasan Hutan*) and Non-Forest Areas (*Areal Penggunaan Lain*). Second, new government policies, regulations, and institutions have been established since 2013. These governance instruments are accompanied by new maps reflecting the most recent government delineation of the key ecosystems that form Indonesia's lowlands. Third, the 2015 fire and haze crisis led to the

formulation in 2017 of the Grand Design for Forest, Plantation and Land Fire Prevention in Indonesia. As the Grand Design focuses on eight fire-prone provinces in the islands of Sumatra, Kalimantan, and Papua, where the lowlands are, it is important to understand the extent of overlap between the priority provinces and lowland boundaries to maximize the contributions of sustainable management of lowlands to the Grand Design.

We adopted the approach of the MoPWH Lowland Mapping Project (2013–2015) to produce updated lowland maps for this study. Most recent data on lowland-related boundaries, elevation, peat distribution,

Table A1.2. Data Used in this Study to Update the WACLIMAD Lowland Maps to Produce New Lowland Maps

Data	Source	Remark
Recent lowland-related boundaries	MOPWH, MoA, BRG	MoPWH (2015) – Tidal lowlands, inland lowlands MoA (2012) – Tidal lowland, inland lowlands, peatland lowlands BRG (2017) – Peatland Hydrological Units (PHUs)
Elevation/topography	Shuttle Radar Topographic Mission (SRTM) resolution 30/90 meters	< 35-meter elevation cutoff for Kalimantan and Papua < 20-meter cutoff for Sumatra Mission started in 2000, but since November 2012 free global coverage at 3 arc seconds (resolution 30 meters) has been available
Tidal influence and salinity intrusion	MoPWH	MoPWH lowland mapping project 2013–2015
Peat distribution	MoA (Indonesian Center for Agricultural Land Resources Research and Development)	New peat map produced in 2013 (obtained through BRG in 2017)
Land system	MoA	Alluvium or organic matter
Land use and land cover	MoEF	Multitemporal (2000–2016)
Satellite images	LAPAN	Low-medium-resolution satellite images (e.g., Landsat) – multiyear
Results of ground check	MoPWH	MoPWH Lowland Mapping Project 2013–2015
Fire incidents	BRG, MoEF	Focus on 2015–2016 fires
Other related data	Various	E.g., canal network, public works swamp irrigation schemes

Note: BRG = Peatland Restoration Agency; LAPAN = National Institute of Aeronautics and Space (*Lembaga Penerbangan Dan Antariksa Nasional*); MoA = Ministry of Agriculture; MoEF = Ministry of Environment and Forestry; MoPWH = Ministry of Public Works and Housing.

satellite images, and land systems were collected from relevant agencies. The WACLIMAD boundaries were compared with these recent data. Based on the comparison, we initially redelineated the boundaries between lowland and upland systems using a cutoff of 35 meters below mean sea level for Kalimantan and Papua and 20 meters below mean sea level for Sumatra. The 35-meter threshold is consistent with the WACLIMAD maps, and, based on the most recent data, covers most (more than 90%) of the peat distribution within lowlands and most of the land systems with lowland parent materials (alluvium and organic matter). However, the 20-meter cutoff was used for Sumatra to exclude two areas of higher-elevation drylands that are distinct from the surrounding lowland areas. Given the initial redelineation of lowland boundaries, hydrological, land system, and ground data collected during the MoPWH Lowland Mapping Project were used to further distinguish between tidal lowlands and non-tidal lowlands.

The above process led to the new lowland maps used in this study. The updated total lowland area is approximately 33.9 million hectares, comprising 12.3 million hectares (36%) in Sumatra, 11.9 million hectares (35%) in Kalimantan, and 9.7 million hectares (29%) in

Papua. Together, these lowland areas cover roughly 15% of total land area of Indonesia. In terms of land composition, the lowlands are composed of 18 million hectares of mineral soils (53%), 13.8 million hectares of peat soils (41%), and 2.15 million hectares of mangroves (6%).³¹ Ninety-two percent of these peatlands, equivalent to 13.8 million hectares (including 99% of deep peat areas more than 3 meters deep), are found within the lowland boundaries delineated in this study.

While this new map updates the WACLIMAD lowland boundaries, the newly delineated lowland areas (33.9 million hectares) are more extensive than those delineated by WACLIMAD (31.6 million hectares) because they include both tidal and non-tidal lowlands, while the WACLIMAD map included mostly tidal lowlands. Using improved digital elevation data and peat data, the study identifies non-tidal lowlands, amounting to approximately 3.8 million hectares, which are further from the coasts but are at low elevations and contain peat. They were added to the lowland boundaries as they fit with the lowland systems from the elevation and parental material perspectives. However, inland swamps at high elevation, even ones that contain peat, are considered part of the upland systems and remain excluded as per the WACLIMAD maps.

A1.3. Different sources of data on peatlands in the WACLIMAD Lowland Maps compared to Updated Lowland Maps

The Updated Lowland Maps differ from the original WACLIMAD Lowland Maps in terms of the sources of data on peatland; each uses different peat maps, which employ different peatland classifications. The size of the peatland area calculated by the WACLIMAD Lowland Maps was based on the Wetland International Peat Atlas from 2003, which uses the following peat depth classification: (1) 50 centimeters (cm) to 100 cm, (2) 100 cm to 200 cm, (3) 200 cm to 400 cm, and (4) more than 400 cm. Based on this classification scheme, the WACLIMAD study found that 76% of all Indonesia's peatland is in the tidal lowlands, and 90% of all deep peat, defined as more than 4 meters deep, is in the tidal lowlands. In this study, we used updated peatland data from the 2017 peat map produced by the Ministry of Agriculture's research agency (Indonesian Center for Agricultural Land Resources Research and Development,

Balai Besar Litbang Sumberdaya Lahan Pertanian), which uses different polygons and different depth classifications as follows: (1) 50 to 100 cm, (2) 100 to 200 cm, (3) 200 to 300 cm, and (4) more than 300 cm. These more recent data show that around 92% of all Indonesia's peatland at all depths is found within the tidal and non-tidal lowland boundaries. In line with the current legal requirement to protect peatland, we defined deep peat as over 3 meters deep and find that 99% of Indonesia's deep peat areas lie within the lowland boundaries.

31 Peat data from the 2017 MoA Peat Map (Indonesian Center for Agricultural Land Resources Research and Development).

Annex 2.

Key government agencies with mandates and operational boundaries involving Indonesia's lowlands

Sustainable development outcomes in the lowlands are significantly shaped by six policy areas: spatial planning, forestry, climate change, peatland restoration, agriculture, and water management. These policy areas roughly correspond to the mandates of five government agencies: the Ministry of Agrarian and Spatial Planning/National Land Agency (Spatial Planning), the Ministry of Environment and Forestry (forestry and climate change), the Peatland and Mangrove Restoration Agency (peat restoration), the Ministry of Agriculture (agriculture), and the Ministry of Public Works and Housing (water management). This section summarizes the key mandates of these five agencies and the spatial coverage of their operational boundaries in the eight fire-prone lowland provinces.

A2.1. Ministry of Agrarian and Spatial Planning

The Ministry of Agrarian and Spatial Planning/National Land Agency (ATR/BPN) has two key mandates: spatial planning and land administration. The national spatial planning mandate covers all of Indonesia including 100% of its lowlands. Based on the Basic Agrarian Law (Law No. 5 Year 1960), which requires the registration of all land and the issuance of various types of land tenure rights, the ATR/BPN's administration mandate also covers all land in Indonesia, including those with forest cover. However, as explained in Chapter 3, actual land administration in Indonesia is based on a dual practice that segregates the administration of the country's land into Forest Area (*Kawasan Hutan*) and Non-Forest Area (*Areal Penggunaan*

Lain). Such dual land administration has led the ATR/BPN to in practice exercise its land administration mandate only in non-forest areas. Given this dual land administration practice, this report assumes that the 72% (21.3 million hectares) of lowland areas in the eight-fire prone provinces, which are classified as Forest Area, are administered by the Ministry of Environment and Forestry, while the remaining 28% (8.3 million hectares), which are classified as non-Forest Area, are administered by ATR/BPN. This ATR/BPN-administered non-Forest Area within the fire-prone lowlands is equivalent to around 14% of all non-Forest Area in Indonesia (8.3million hectares out of 56 million hectares).

A2.2. Ministry of Environment and Forestry

The Ministry of Environment and Forestry (MoEF) is in charge of forest management and also plays a key role in climate change policy goals in Indonesia. Its mandate to administer forest areas was established under Basic Forestry Law No. 19 Year 2004, which amends Basic

Forestry Law No. 41 Year 1999, which in turn replaces the older Basic Forestry Law No. 5 Year 1967. Based on this law, forest areas are managed according to three possible functions: production forests (*Hutan Produksi*), covering a total area of 68.8 million hectares, or 57% of

the Forest Area; conservation forests (*Hutan Konservasi*), covering a total area of 22.1 million hectares or 18% of the Forest Area (with an additional 5.3 million hectares of marine conservation areas); and protection forests (*Hutan Lindung*), with watershed functions, covering the remaining 29.7 million hectares or 25% of all forested area (MoEF, 2018). Current forestry policy aims to improve transparency and accountability in forest governance through the creation of Forest Management Units, and building partnerships with communities for forest management. In addition, MoEF is also a main agency in implementation of the National Action Plan for Reducing GHG Emissions (RAN-GRK) (2010) and the National Action Plan for Climate Change Adaptation (RAN-API) (2013).

This study overlaid the lowland boundaries in the eight fire-prone provinces in Sumatra, Kalimantan, and Papua over the 2017 MoEF official map of forest areas, and found that 72% of all fire-prone lowlands, or 20.6% of their 28.7 million hectares, is legally classified as Forest Area. Per island, the percentage of Forest Area is 21% in Sumatra, 19% in Kalimantan, and 28% in Papua. From the perspective of lowlands as a landscape unit, the spatial coverage of MoEF's forest management mandate in the lowlands is substantial (72%), making it a key lowland player. From the MoEF's institutional perspective, lowland Forest Area (21.5 million hectares) in these fire-prone provinces accounts for 16% of the national Forest Area (around 131 million hectares) that MoEF administers.

A2.3. Peatland Restoration Agency

The Peatland Restoration Agency (BRG, now BRGM, or Peatland and Mangrove Restoration Agency) is tasked with coordinating and facilitating the restoration of more than 2.5 million hectares of peatlands across seven priority provinces: Central Kalimantan, Jambi, Papua, Riau, South Kalimantan, South Sumatra, and West Kalimantan.³² The BRG has developed a map of Peat Hydrological Units (PHUs), which serve as spatial units for peatland restoration in the seven priority provinces. BRG estimates that there are 22.7 million hectares of PHUs, comprising 15.9 million hectares of peatland (70%) and

6.7 million hectares of non-peat area (30%) (Wardhana, 2016). By laying the BRG map of PHUs over the lowland boundaries in the seven provinces, this study finds that 18.5 million hectares, or 81%, of all PHUs are within the lowland boundaries, of which around 12 million hectares are peatland (64%) and 6.5 million hectares are non-peatland (36%). This suggests that the fire-prone lowlands dominate BRG's institutional mandate as they account for 81% of the area BRG must cover to achieve its peatland restoration objectives.

A2.4. Ministry of Agriculture

The Ministry of Agriculture's (MoA's) agricultural and food security mandates influence agricultural crops, particularly rice and oil palm, which are major users of lowland. The MoA has its own map of the lowlands (2012), which segregates lowland areas into three land classifications: tidal lowland (*rawa pasang surut*), non-tidal (inland) lowland (*rawa lebak*), and peat lowland (*rawa gambut*). Based on these categories, the MoA's lowland map identifies 31.6 million hectares of lowlands nationally. Overlaying this MoA lowland map over a map of the lowland boundaries in the eight fire-prone provinces finds that the overlap amounts to 21 million hectares,

comprising 10.2 million hectares of peatland lowlands, 5.6 million hectares of non-tidal lowlands, and 5.3 million hectares of tidal lowlands. From a lowland landscape perspective, these 21 million hectares account for 70% of all lowlands within the eight provinces (29.6 million hectares), and for 67% of all lowlands nationally (33.9 million hectares). This makes the MoA another important institution in terms of spatial coverage of the lowlands: from its institutional perspective, the 21 million hectares amount to 66% (31.6 million hectares) of all the lowlands that it has mapped, making the fire-prone lowlands important to its own agricultural development objective.

³² This list of provinces is the same as those for the Grand Design, excluding East Kalimantan.

A2.5. Ministry of Public Works and Housing

The Ministry of Public Works and Housing (MoPWH) has a mandate to support irrigation and management of water resources to achieve water security for food security while improving the economic conditions of farmers. The MoPWH developed its own National Swamp Map in 2015 to accompany swamp-related regulations for water resource management in the lowlands. Covering both tidal and non-tidal swamps, the map covers 31.5 million hectares nationally. The mapped swamps represent what is considered lowland from the water management perspective, and the map is used by the MoPWH's Directorate of Irrigation and Lowlands (Irigasi dan Rawa) under the Directorate General of Water

Resources. This study overlays the MoPWH's National Swamp Map over a map of the lowland boundaries in the eight fire-prone provinces. The analysis suggests that 26.7 million hectares, or 90% of the fire-prone lowlands, are covered by the MoPWH swamp map. From a lowland landscape perspective, this makes the MoPWH the prime governance actor in lowland spaces. From the MoPWH's institutional perspective, the 26.7 million hectares of swamp in the fire-prone lowlands amount to 85% of all the swamps it has mapped (31.5 million hectares). This also makes sustainable water management in the fire-prone lowlands fundamental to achieving the MoPWH's water mandate.

Annex 3.

Indonesia's lowlands: policies and developments

The significant land-use change in Indonesia's lowlands began in the 1970s as result of government policies that encouraged agricultural expansion in lowland areas (see figure A3.1). In the 1970s and 1980s, a government-sponsored swamp reclamation program supporting a transmigration program aimed to improve food crop production and create food security (Whitten, 1997). Following this transmigration program, in the 1990s two main government policies further changed the landscape of Indonesia's lowlands. One was the Mega Rice Project, which converted 1 million hectares of peatland in Kalimantan to rice paddy fields. The other was the issuance of plantation licenses in the lowlands to private companies interested in producing pulpwood (acacia) and palm oil since the 1990s. Plantation licenses were issued for about 7 million hectares of peatland across Sumatra and Kalimantan, of which half are on deep peat (more than 2 meters). The remaining 2.5 million hectares of peatland across Sumatra and Kalimantan are mostly on shallow peatland cultivated by smallholders (Miettinen and Liew, 2010). Abood et al. (2015) analyze a more recent concession dataset (2010–13) to find the relative extent of industrial concessions on peatland, adding new concession data from Papua to that for Sumatra

and Kalimantan. They adjust the definition of deep peat (more than 3 meters) to match the legal definition and find that the fiber (pulp and paper) plantations are the biggest users of peatland, followed by oil palm and timber (logging) plantations.

Since the 1990s, these large plantations have continued to drive developments in Sumatra and Kalimantan peatlands, with smallholders playing an increasingly important role. Smallholders³³ accounted for approximately 41% of total oil palm area in Indonesia in 2014, up from 2% in 1980.³⁴ The development of peatland areas in Sumatra and Kalimantan increased by 6% per year between 2007 and 2015, driven by an almost doubling of the operation of industrial pulpwood and palm oil plantations (a 97% increase), followed by smallholder production, which increased by 32% during the same period (McKinsey & Company, 2015).

Between 1975 and 2004, the government introduced several policies to protect parts of the lowlands, but their implementation has been neither strongly monitored nor enforced. One such policy, known as the Greenbelt Policy, aims to protect the mangroves, which are found

³³ Smallholders are farmers with a planted area under 50 hectares that produce oil palms both as independent farmers and as plasma farmers associated with a corporate organization or mill.

³⁴ Data from Directorate General of Estate Crops (2014) quoted in INOBU (2016)

mostly in the lowlands of Papua, followed by Sumatra and Kalimantan. The policy defines a coastal greenbelt (*jalur hijau* or *zona penyangga*) as a mangrove protection zone along the coast where the trees cannot be cut, and land conversion and degradation are forbidden. The greenbelt is to protect the coast against erosion and maintain the fish and shellfish nursery and breeding function of the forest. The greenbelt policy was developed and applied by the central government between 1975 and 1990, but responsibility for interpreting and implementing it was relegated to the provinces following an increase in government decentralization in the late 1990s and early 2000s. Since then, the greenbelt policy has been neither confirmed nor applied by provinces such as by Central Kalimantan, Jambi, and South Kalimantan, while the South Sumatra provincial government states that most mangroves are protected, although implementation of the policy is often not well-monitored or enforced (WACLIMAD, 2012b).

During the same period, Indonesia's mangrove landscapes have been under significant pressure from various forms of exploitation. The key driver of mangrove conversion is the development of brackish-water fishponds (*tambak*), particularly for shrimp production, and logging, each of which accounts for almost half of all mangrove loss. The Water Management for Climate Change Mitigation and Adaptive Development in the Lowlands (WACLIMAD) project (2010–2012) assessment of mangrove conversion from 2000 to 2006 finds that most of the remainder is degraded, unproductive habitat, with only a small percentage (2% to 3%) converted to rice paddies, coconut groves, and other uses (Giesen, Gevers, and Ilman, 2013). In 2018, the MoEF estimated that roughly half of Indonesia's mangroves were in good condition while the other half was degraded, with a degradation rate of 250,000 hectares per year.³⁵ More recently, the tourism industry and coastal pollution have put additional pressure on Indonesia's mangrove ecosystem.

A series of policies were developed in the late 2000s to protect and restore degraded lowlands following the United Nations Framework Convention on Climate Change's Conference of Parties (COP) 13 in Bali. Recent lowland policies, significantly shaped by the climate change agenda, focus on peatland. The COP marked a turning point in Indonesia's policy on the management of lowlands, and particularly the conservation of peatlands. At the G-20 Summit in Pittsburgh, Pennsylvania, in the United States in September 2009, former Indonesian president Susilo Bambang Yudhoyono committed the country to lowering Indonesia's carbon emission level by 26% by 2020, and to 41% with international support. Most (87%) of these targets were intended to be met by reducing emissions from deforestation and through peatland conservation. The first REDD+ and forest governance initiatives were subsequently pursued in the context of these emission goals.

At the same time, government agencies started a dialogue on developing a roadmap toward a strategy for all Indonesia's lowlands. The government requested expert assistance in assessing how to better manage its vast forest and peatland resources and to combine economic development with low carbon emissions (BAPPENAS et al. 2013). The WACLIMAD and Quick Assessment and Nationwide Screening (QANS) projects took place in this context. The development of WACLIMAD and QANS accelerated further after the fire and haze crisis in 2015, which precipitated the development of a policy for preventing man-made fires to clear land for conversion and expand plantations.

35 Rough estimate by MOEF staff of Directorate for Soil and Water Conservation under the Directorate General of River and Protected Forest Management during an interview for this study.

Figure A3.1. Policy Developments Affecting Indonesia's Lowlands

2015

POLICY

- Extension of 2013 Moratorium on New Licenses in Primary Forests and Peatlands (Presidential Instruction No. 8/2015)
- COP 21 announcement of commitment to stop fire and haze (Presidential Instruction No. 11/2015)

2017

REGULATIONS

Protection of peatland in spatial planning process under Government Regulation No. 13/2017; technical guidance through four ministerial regulations for (1) inventory and determining peatland function designation, (2) measurement of water table in peatland landscape, (3) peatland ecosystem function recovery, and (4) timber plantation development, to assist and complement operating regulations.

POLICY

Grand Design for Fire Prevention issued (April), efforts to improve fire management in place; extension of Moratorium on Primary Forest and Peatland Moratorium (since 2011); progress on Global Climate and Environment Funds.

MAP

National Map of Peatland Hydrological Units and National Peatland Ecosystem Functions

2016

INSTITUTION

- Establishment of Peatland Restoration Agency (BRG) tasked with restoring 2.1 million hectares of peatlands

POLICY

- Moratorium and Evaluation of Palm Oil Licenses and Improvement of Productivity (later issued through Inpres No. 8/2018); Moratorium on Peatland Conversion, including on existing concessions (December); acceleration of One Map Policy Initiative; Paris Agreement and Nationally Determined Contributions submission ratification

REGULATION

- Peatland Protection and Restoration Regulations

2019

POLICY

Determination and Management of Peat-Based Hydrological Units of Peat Dome

MONITORING PLATFORMS

- Peatland Ground Water Information System (SIMATAG),
- Peatland Water Monitoring System (SIPALAGA),
- and Peatland Restoration Information Monitoring System (PRIMS) were established under the Peatland Restoration Agency (BRG)

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