LEDS GLOBAL PARTNERSHIP

Role of agriculture, forestry, and other land use mitigation in INDCs and national policy in Asia

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About this report

This paper analyzes how low emission development strategies (LEDS) for agriculture, forestry, and other land use (AFOLU) are included in the Intended Nationally Determined Contributions (INDCs) and national development plans and strategies of seven countries in Asia with different AFOLU emission profiles and development priorities: Bangladesh, Cambodia, India, Indonesia, Lao PDR, Thailand, and Viet Nam. It is intended to assist national policymakers and other decisionmakers who seek to understand and strengthen the connection between the current roles AFOLU LEDS is expected to play and the mitigation potential from AFOLU.

October 2017

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Contents

Key messages

- This paper reviews LEDS for AFOLU in seven countries in Asia: Bangladesh, Cambodia, India, Indonesia, Lao PDR, Thailand, and Viet Nam.
- AFOLU is a key contributor to greenhouse gas emissions in the selected countries and is included in all seven countries' national socioeconomic development, climate change, and green growth strategies and plans. However, national AFOLU strategies take a variety of forms and are not always directly aimed at reducing emissions. Many are designed to achieve development or adaptation objectives that may have mitigation co-benefits.
- INDCs do not comprehensively include AFOLU mitigation targets. Only two countries (Indonesia and Viet Nam) include both agriculture and forestry mitigation targets and measures in their INDCs. Neither sector is included in Thailand's or Bangladesh's INDC mitigation commitments. However, Thailand includes a forest cover target in its adaptation strategy, and Bangladesh indicates AFOLU measures as "possible further mitigation actions" that are conditional on international support. India, Cambodia, and Laos include forestry targets in their INDCs while leaving out agriculture, which is covered in adaptation measures only.
- In both national plans and INDCs, agriculture emission reduction targets and measures are not as well covered as those in forestry. In national plans, quantifiable targets are much more common in the forestry sector than in the agriculture sector. In INDCs, only Indonesia and Viet Nam include agriculture as key mitigation priorities, while India explicitly excludes the sector from its mitigation commitments, and other countries mention agriculture only in the context of adaptation.
- Most countries indicate in their INDCs that they require international support in the form of finance, technology, and capacity building, while some also state estimated costs and the level of support required. However, some countries, including Thailand, Indonesia, and Bangladesh, do not provide cost estimates of AFOLU mitigation measures in their INDCs.
- None of the INDCs reviewed explicitly mentions the role of private sector sustainability commitments or financial services in reducing emissions. None of the INDCs mentions commitments by private companies engaged in large scale production, trade, and manufacturing of timber and agricultural commodities to reduce their impact on deforestation. Nor do the INDCs consider the growing trend for financial service providers to finance AFOLU investments that mitigate greenhouse gas emissions, potentially at very large scale. The potential of private sector finance for emission reductions in the AFOLU sector could be more clearly addressed in future Nationally Determined Contributions (NDCs).
- There may be scope for increasing the mitigation contribution from AFOLU, but more work is needed to help refine—and in some cases enhance—a number of countries' mitigation contributions from AFOLU. Contributions from the private sector—both companies and financial institutions—could help scale up mitigation contributions. Increased mitigation may be expressed within domestic policy and internationally communicated contributions.

Introduction

At the 21st Conference of the Parties (COP21) to the United Nations Framework Convention on Climate Change (UNFCCC), 195 nations agreed on a historic agreement to combat climate change and unleash actions and investment towards a low carbon, resilient, and sustainable future. The Paris Agreement[1] aims to keep the increase in the global average temperature to well below 2°C above preindustrial levels and to pursue efforts to limit the temperature increase to 1.5°C above preindustrial levels.

The Paris Agreement was built on the submission of INDCs by individual countries, in which nations indicate the actions they intend to take under the new global climate agreement. The INDC is a key vehicle for governments to communicate contributions towards greenhouse gas emission reductions in ways tailored to national priorities, capabilities, and responsibilities. To date, 188 countries have submitted their INDCs.[2] Analysis of the INDCs indicates that there is still a gap between current contributions and emission reductions needed to stay below 2°C warming.[3] The complete implementation of conditional and unconditional elements of the 147 INDCs communicated to the secretariat by October 1, 2015 is estimated to result in aggregate global emission levels of 55.2 (52.0–56.9) gigatons of carbon dioxide equivalent (Gt CO_2eq) in 2025 and 56.7 (53.1–58.6) Gt CO_2eq in 2030. According to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change, the least cost trajectory with a greater than 66% likelihood of staying below 2°C corresponds to 44.3 (38.2–46.6) Gt CO_2eq emissions in 2025, and 42.7 (38.3–43.6) Gt CO_2eq emissions in 2030.[4] Scenarios that follow an economically optimal emission trajectory from 2020 onwards with a greater than 66% likelihood of staying below 2°C correspond to 49.7 (46.2–51.6) Gt CO_2eq emissions in 2025, and 38.1 (30.3–45.0) Gt CO_2eq emissions in 2030.[5] This represents a mitigation gap of approximately 8.7 Gt CO_2eq in 2025 and 15.1 Gt CO_2eq in 2030 in order to have at least a 66% chance of staying below 2°C of warming.

The Paris Agreement recognizes this gap and establishes a process to enhance ambition after the agreement comes into effect, which is expected to be in 2020. Current INDCs, unless revised, will become countries' NDCs between now and 2030. Countries are required to submit updated NDCs every 5 years, and future plans are expected to be an improvement on previous contributions. There will be periodic global stocktaking to assess collective progress towards achieving long term goals and objectives. The global stocktake will occur first in 2023 and then every 5 years thereafter. Countries are required to consider the outcome of the stocktake in updating and enhancing their national plans.

Agriculture, forestry, and other land use represents 20–24% of global greenhouse gas emissions, the largest emitting sector next to energy.[6] Most INDCs submitted to date include the land use sector, and 39 INDCs from developing countries include REDD+.[7] The Paris Agreement formally recognizes the role of the AFOLU sector in climate change mitigation and states that all Parties should take action to conserve and enhance greenhouse gas sinks and reservoirs. The agreement also makes explicit reference to forests and encourages Parties to implement and support REDD+ and joint mitigation and adaptation approaches in the sustainable management of forests, while reaffirming the importance of noncarbon benefits.

The AFOLU sector is particularly important in Asia, which accounted for the largest proportion of global AFOLU emissions during 1990–2010.[8] As in other regions, many Asian countries have included AFOLU within their INDCs along with national development plans and strategies. Understanding the relationship between current treatment of AFOLU in INDCs and national planning, and the amount of emissions from the AFOLU sector in Asia, will help inform policymakers about the current role of AFOLU as part of the 8.7–15.1 Gt CO_2eq mitigation wedge needed to stay below a 2°C threshold.

The objective of this paper is to understand the current role AFOLU LEDS[9] is expected to play in mitigation compared with potential for mitigation from AFOLU, based on case studies of selected countries from Asia. The paper analyzes how AFOLU is included in the INDCs and national development plans and strategies of Bangladesh, Cambodia, India, Indonesia, Lao PDR, Thailand, and Viet Nam. These seven countries were selected due to their representation of different AFOLU emission profiles and development priorities, and their inclusion in the USAID Lowering Emissions in Asia's Forests (LEAF) program, under which an earlier analysis for this paper was conducted. National plans,[10] nationally appropriate mitigation actions (NAMAs), and INDCs are used to produce a picture of a country's intended plans and contribution of emission reductions through its AFOLU sector. This is then compared with the country's emission profile, which is assessed via a combination of national communications to UNFCCC and other national and global databases. Opportunities for additional mitigation efforts are then identified along with a broader discussion on finance, with third party estimates of costs and financing instruments provided where available.

Summary of findings

The AFOLU sector is a **key contributor to greenhouse gas emissions** in the selected countries: AFOLU accounted for about 11% of total net emissions in India, 20–30% in Thailand and Viet Nam, 50–60% in Bangladesh and Indonesia, and 90% in Lao PDR.[11] For Cambodia, land use, land use change, and forestry (LULUCF) was a large net carbon sink that offset almost all agricultural and other sectors' emissions in 2000.[12] In terms of absolute emissions, India had the highest emissions from agriculture (355.6 million t CO_2eq in 2000), while Indonesia had the highest emissions from forestry and land use (821.3 million t CO_2eq in 2000). Within the agriculture sector, **rice cultivation accounted for the largest proportion** of agricultural emissions in Cambodia (nearly 70%); Viet Nam, Thailand, and Indonesia (around 50%); and Lao PDR (around 38%). In India, the largest source of agricultural emissions was enteric fermentation (around 60%), while in Bangladesh it was manure management (around 40% of total agricultural emissions).

AFOLU initiatives are included in all seven countries' national plans—socioeconomic development, sectoral development, climate change, and green growth strategies and plans. However, these initiatives take a variety of forms and are **not always directly aimed at reducing emissions**. Many are designed to achieve development and adaptation objectives and may have mitigation co-benefits. For example, sustainable agricultural intensification can improve productivity and reduce emissions. New climate resilient crop varieties and improved cropland management can reduce the need to increase inputs such as water, fertilizers, and pesticides to maintain the same level of production. Coastal mangrove protection and restoration to lessen the impacts of flooding, storm surge, and sea level rise also help to increase carbon stock and sequestration.

Nevertheless, quantifiable targets (e.g. in terms of t CO_2eq or areas of forests or sustainable agriculture) more clearly signify the role attributed to AFOLU in countries' climate change mitigation strategies. Table 1 summarizes the coverage of AFOLU emission reduction targets and measures in INDCs and national plans of the selected countries. It can be seen that **in national plans, quantifiable targets are much more common in the forestry sector than in the agriculture sector**—the former are present in all countries, while the latter are found in three countries only: Indonesia, Thailand, and Viet Nam.

A **comparison between national plans and INDCs** shows that while agriculture and forestry mitigation targets and measures are covered in all seven countries' national plans, only two countries (Indonesia and Viet Nam) include both sectors in their INDCs. Neither agriculture nor forestry is included in Thailand's and Bangladesh's INDC mitigation commitments. However, Thailand includes a forest cover target in its

Table 1 Coverage of AFOLU emission reduction targets and measures in National Plans and INDCs of selected Asian countries

Country	Inclusion of AFOLU emission reduction (ER) targets/measures in National Plans		INDCs economy-wide ER target (unconditional)	INDCs economy-wide ER target (conditional)	Inclusion of AFOLU ER targets/ measures in INDCs	
	Agriculture	Forestry and other land use/LULUCF			Agriculture	Forestry and other land use/ LULUCF
Bangladesh	**Yes**	**Yes** e.g. increase forest cover from 13% in 2010 to 15% in 2015; increase protected areas by 15% by 2015; mangrove planting along nearly 9,000 km of shoreline by 2015	5% below 2030 business as usual (BAU) scenario (or 12 Mt CO_2eq) in power, transport, and industry sectors	15% below 2030 BAU scenario (or 36 Mt CO_2eq) in power, transport, and industry sectors	**No** though included as "possible conditional contributions" and in Adaptation	**No** though included as "possible conditional contributions" and in Adaptation
Cambodia	**Yes**	**Yes** 60% forestry cover by 2015	None	27% below 2030 BAU scenario	**No** though included in Adaptation	**Yes** 60% forest cover by 2030 from about 57% in 2010 or ER contribution of 4.7 t CO_2eq per ha per year, but LULUCF not included in overall 27% target
India	**Yes**	**Yes** e.g. increase forest cover from 23% (current) to 33% by 2020; annual C sequestration of 50–60 Mt CO_2eq by 2020; improved quality of forests on 5 million ha	Reduce emission intensity of GDP by 33–35% by 2030 from 2005 level	None	**No** though included in Adaptation	**Yes** additional carbon sink of 2,500–3,000 Mt CO_2eq by 2030 through increased forest cover
Indonesia	**Yes** 26–41% or 811 Mt CO_2eq by 2020	**Yes** 26–41% or 672–1,039 Mt CO_2eq by 2020 e.g. 95% reduced forest fire spots compared with 2006 level; reduce total number of forest fire hotspots by 20% per year	26% below 2020 and 29% below 2030 BAU levels	41% below 2030 BAU level	**Yes** though unclear whether AFOLU ER target is the same as economy wide, as in national plans	**Yes** though unclear whether AFOLU ER target is same as economy wide, as in national plans
Lao PDR	**Yes**	**Yes** e.g. 70% forest cover by 2020; regeneration of natural forest in 3.9 million ha and reforestation of 200,000 ha by 2015	None	None though identified a number of conditional mitigation actions	**No** though included in Adaptation	**Yes** 70% forest cover by 2020 and maintain this through 2030, conditional target

Country	Inclusion of AFOLU emission reduction (ER) targets/measures in National Plans		INDCs economy-wide ER target (unconditional)	INDCs economy-wide ER target (conditional)	Inclusion of AFOLU ER targets/ measures in INDCs	
	Agriculture	Forestry and other land use/LULUCF			Agriculture	Forestry and other land use/ LULUCF
Thailand	**Yes** expand sustainable agricultural areas by at least 5% per year	**Yes** e.g. 40% forest cover by 2020; increase mangrove reforestation of 800 ha per year; increase conservation forest area to 19% by 2015	20% below 2030 BAU scenario (or by 111 Mt CO_2eq); inclusion of LULUCF to be considered later	25% below 2030 BAU scenario (or by 139 Mt CO_2eq); inclusion of LULUCF to be considered later	**No** though included in Adaptation	**No** though included in Adaptation: 40% forest cover
Viet Nam	**Yes** e.g. 20% by 2020	**Yes** e.g. reduce emissions from agriculture and rural development sector by 20% or 18.9 Mt CO_2eq by 2020	8% below 2030 BAU scenario (or by 62.9 Mt CO_2eq)	25% below 2030 BAU scenario (or by 196.8 Mt CO_2eq)	**Yes** agriculture and forestry are two key mitigation sectors	**Yes** 45% forest cover by 2030, unconditional target

adaptation strategy, and Bangladesh indicates AFOLU measures as "possible further mitigation actions" that are conditional on international support. The three remaining countries—India, Cambodia, and Laos—include forestry targets while leaving out agriculture, which is covered under adaptation measures.

As with national plans, in **INDCs agriculture emission reduction targets and measures are not as well covered as those in forestry**. Only Indonesia and Viet Nam include agriculture as key mitigation priorities, while India explicitly excludes the sector, stating that "India's INDC do not bind it to any sector specific mitigation obligation or action, including in agriculture".[13] The other countries mention agriculture only in the context of adaptation. India's exclusion of agriculture is particularly notable as it is one of the largest agricultural emitters in Asia and the sector is a significant contributor to the country's total national emissions (23% of total emissions without land use change and forestry in 2000). The relatively poor coverage of agriculture shows technical potential for Asian countries in general, and India in particular, to consider including agriculture in future conditional and unconditional commitments, taking account of potential synergies between agricultural mitigation and increased productivity and resilience.

The AFOLU **mitigation strategies** included in national plans and INDCs of the selected countries **cover a broad range of activities** as shown in Figures 1 and 2.[14] The lower coverage of AFOLU activities in INDCs compared with national plans reflects the fact that INDCs often mention only broad strategies and refer to the relevant national plans for specific activities. Overall, reducing deforestation, forest restoration, and reforestation/afforestation are the most widely cited forestry mitigation activities. Cropland management—which includes a variety of measures such as crop varieties and patterns, nutrient management (e.g. fertilizers, tillage, and residue management), water management, rice management, and rewetting peatlands drained for agriculture—is the most common category of agricultural mitigation actions. This reflects the sectoral emission composition, with rice cultivation and agricultural soils accounting for a large proportion of agricultural emissions in the selected countries. Other measures, such as livestock management and manure management/bioenergy, are less well covered and may deserve further consideration in the future, especially given the projected increase in meat consumption in Asian countries.

Figure 1 Types of forestry mitigation activity included in National Plans and INDCs of the selected countries

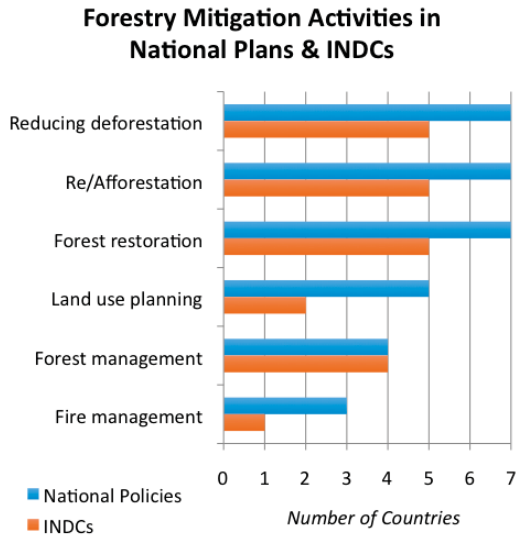
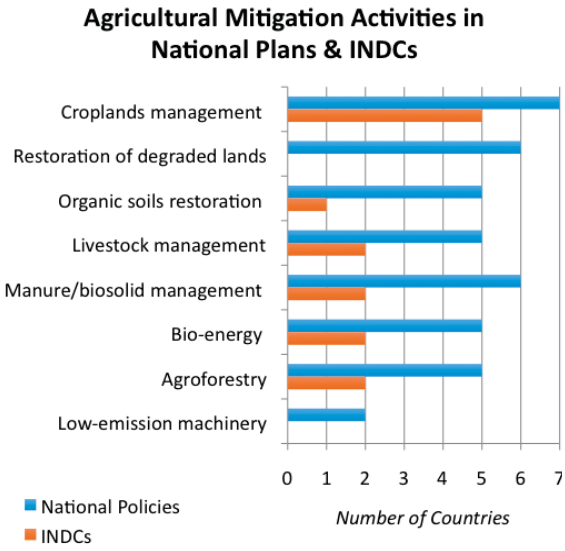


Figure 2 Types of agricultural mitigation activity included in National Plans and INDCs of the selected countries



However, even in countries with comprehensive and ambitious targets, there may be a gap between planning and implementation. For example, Viet Nam has a comprehensive program to reduce emissions in the AFOLU sector with an ambitious goal of reducing emissions by 20% by 2020, but is currently lacking financial resources to implement it. Indonesia has fallen short of achieving its fire targets in recent years (reducing forest fire spots by 95% compared with the 2006 level, and reducing the total number of forest fire hotspots by 20% per year). This shows the importance of feedback mechanisms to evaluate countries' progress as well as international support to help countries achieve the targets and commitments set in their INDCs and national plans. Countries will also need to update INDCs over time to better reflect developments in their emission reduction efforts.

Country findings

Bangladesh

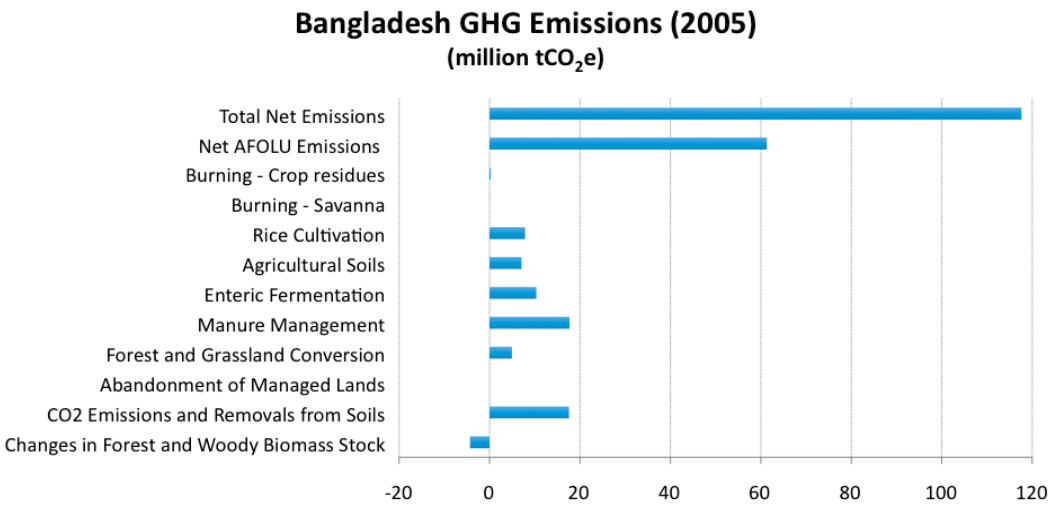
Emissions profile

In 2005, Bangladesh's net AFOLU emissions were 61.3 million t CO_2eq, accounting for over 52% of total net national emissions.[15] Agriculture emitted 43.1 million t CO_2eq, or about 35% of all emissions and 66% of AFOLU emissions, while LULUCF constituted the remaining 34% of AFOLU emissions with a net emission of 18.2 million t CO_2eq. The three most important emission sources in the agriculture sector were manure management (representing 41% of agricultural emissions), enteric fermentation (24%), and rice cultivation (18%) (Figure 3).

National plans, programs, and commitments on AFOLU

Bangladesh is considered the world's most vulnerable country to the negative impacts of climate change, facing particularly high risks from tropical cyclones and floods. In response, the country has prioritized adaptation and has invested over US$10 billion of its own resources to increase its climate resilience.[16] Bangladesh has also implemented mitigation activities, including in the AFOLU sector. Current and planned

Figure 3 Distribution of Bangladesh's greenhouse gas emissions by AFOLU subsector (2005)



AFOLU mitigation activities include afforestation/reforestation, REDD+, climate resilient agriculture, lowering methane emissions in agricultural production, crop diversification, fertilizer management, and improved livestock management. The country has several NAMAs under development in the industry and waste sectors, and is exploring potential in other sectors.[17]

Bangladesh's INDC proposes an unconditional target of reducing emissions by 5% or 12 million t CO_2eq, and a conditional target of 15% or 36 million t CO_2eq, by 2030 in the power, transport, and industry sectors.[18] The INDC prioritizes these sectors as they are projected to represent about 69% of the country's emissions in 2030 — Bangladesh recognizes that in order to meet the 2°C objective, all countries will need to undertake mitigation. The INDC lists a few AFOLU related measures as potential mitigation activities that the country intends to achieve by 2030, which are conditional on the availability of international support. A mix of quantified targets from agriculture and unquantified targets from LULUCF are indicated, including increased mechanization to reduce draft cattle by 50% (thereby reducing associated methane emissions), increased share of organic fertilizer by 30%, scale up of alternative wetting and drying irrigation of all rice fields by 20%, and promotion of afforestation/reforestation and mangrove plantation. Additionally, the INDC prioritizes ecosystem based adaptation, including forestry co-management and community based conservation of wetlands and coastal areas.

Implementation of the mitigation measures included in the INDC is estimated to cost about US$27 billion; however, this estimate covers activities in the power, transport, and industry sectors only. The INDC acknowledges the need for further study to identify the mitigation potential, costs, and co-benefits of AFOLU emission reduction measures, particularly those in the LULUCF sector.

Analysis

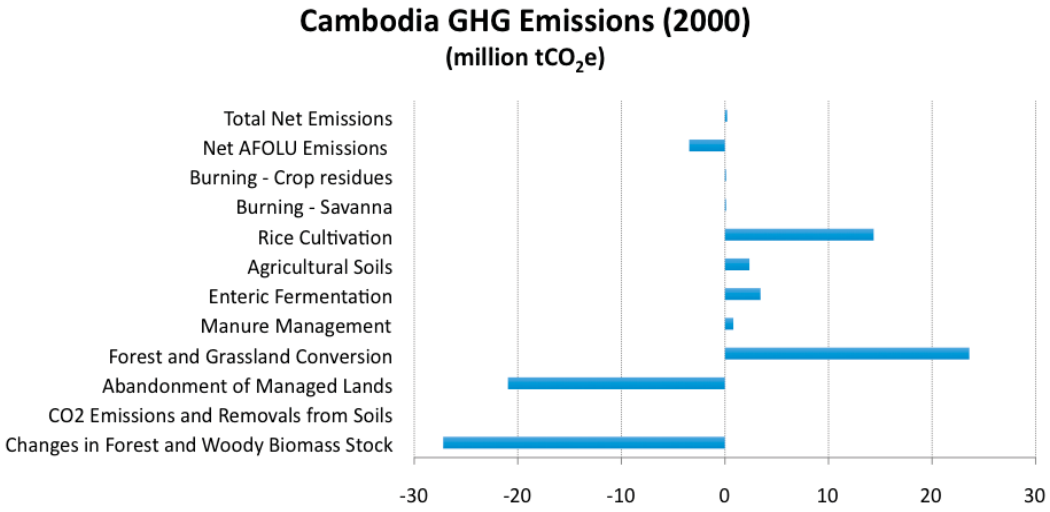
Bangladesh's INDC is built on key national strategies and plans such as the Bangladesh Climate Change Strategy and Action Plan. Similarly to the national plans, the INDC identifies AFOLU mitigation measures and recognizes the importance of creating synergies between adaptation and mitigation in the AFOLU sector. Given the government's interest in pursuing AFOLU mitigation activities, further analysis to quantify the mitigation potential along with adaptation links should be seen as a priority going forward.

Cambodia

Emissions profile

In 2000, Cambodia's agricultural sector emitted about 21.1 million t CO_2eq, while LULUCF was a net sink of about 24.6 million t CO_2eq, resulting in a net AFOLU removal of 3.5 million t CO_2eq. This removal offset most of the emissions from other sectors, leading to a net total national emission of only 0.2 million t CO_2eq.[19] Within agriculture, the most important emission sources were rice cultivation (accounting for 68% of total agricultural emissions), enteric fermentation (16%), and agricultural soils (11%) (Figure 4).[20]

Figure 4 Distribution of Cambodia's greenhouse gas emissions by AFOLU subsector (2000)



National plans, programs, and commitments on AFOLU

Cambodia is considered one of the 10 countries most vulnerable to climate change due to its subsistence agriculture and low climate adaptive capacity. Cambodia's AFOLU mitigation measures are outlined in its Climate Change Strategic Plan,[21] which builds on the national socioeconomic development and green growth plans.[22] The Strategic Plan puts forward eight strategic objectives, including several AFOLU related plans such as watershed and ecosystem management, promotion of payment for ecosystem services including REDD+, promotion of participatory land use planning, and increased agricultural productivity through crop and livestock diversification. Additionally, Cambodia's NAMAs include an intention to pilot REDD+ as a framework for reducing emissions.

Cambodia's INDC proposes a conditional 27% emission reduction by 2030 from the energy, industry, transport, and waste sectors. In addition, Cambodia intends to undertake voluntary and conditional actions to increase forest cover to 60% of the national land area[23] from an estimate of 57% in 2010.[24]

The specific list of activities the country intends to implement along with their greenhouse gas impacts will be updated once the national REDD+ strategy is finalized. Agriculture is mentioned only under adaptation activities being planned by the government.

The INDC estimates a total cost of US$1.27 billion for prioritized climate change action plans up to 2018. About 40% of this is expected to come from international finance, while the government plans to increase its national climate expenditure from 1.39% of GDP in 2015 to 1.5% in 2018. Details on how these funds will be spent are not included in the INDC.

Analysis

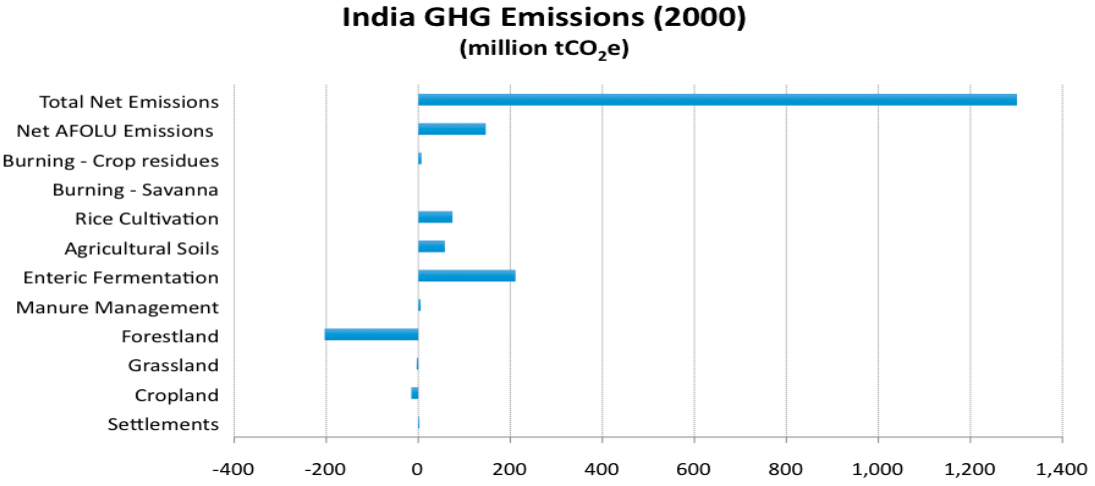
Cambodia's AFOLU sector was a net sink in 2000. However, AFOLU removals have decreased by 94% between 1994 and 2000, from 64.9 million to 3.5 million t CO_2eq, due to increased deforestation along with increased agricultural emissions. Cambodia's national plans outline a number of natural resource management activities, including increased agricultural diversification and productivity. National mitigation contributions, however, focus on LULUCF, with agriculture mentioned only in the context of adaptation. Including mitigation from agriculture that does not reduce overall productivity could help further reduce emissions from AFOLU. Given the growing trend in forest loss and increased agricultural emissions, Cambodia may be able to do more to counter this trend.

India

Emissions profile

India is the world's fourth largest economy and fifth largest global greenhouse gas emitter.[25] In 2000, India's net AFOLU emissions were 146.7 million t CO_2eq, accounting for about 11% of total net national emissions.[26] Although AFOLU is not the largest emitting sector in India, forestry and other land use (previously LULUCF) is an important sink, with net removals of 236 million t CO_2eq in 2000. Meanwhile, for the same period, India's agricultural emissions were 355.6 million t CO_2eq, accounting for 23% of gross national emissions and 96% of gross AFOLU emissions. Emissions from agriculture originated primarily from enteric fermentation, rice cultivation, and agricultural soil (Figure 5).

Figure 5 Distribution of India's greenhouse gas emissions by AFOLU subsector (2000)



National plans, programs, and commitments on AFOLU

India has two core national mitigation missions focused on AFOLU: creation of a 'Green India' through increasing forest cover to 33% by adding 20 million ha of forests by 2020, and implementing sustainable agriculture through the promotion of micro-irrigation on 40 million ha of land.[27] Other specific AFOLU related mitigation actions include improved crop varieties, crop insurance, sustainable forest management, afforestation and reforestation, REDD+, and ecosystem and biodiversity conservation through wetland restoration and agroforestry practices.

India pledged under the Copenhagen Accord to reduce its emissions intensity per GDP by 20–25% by 2020 compared with the 2005 level, but excluded emissions from the agricultural sector.[28] The pledge is aligned to what the country considers as voluntary emissions reductions under its NAMAs.[29] India communicates in its

INDC a goal to reduce the emission intensity of its GDP by 33–35% by 2030 from the 2005 level.[30] The INDC indicates increased forest area through afforestation[31] as a key climate action, with a target of creating additional carbon sink of 2.5–3 billion t CO_2eq by 2030. India's INDC also emphasizes promoting a sustainable way of living based on traditions and values of conservation and moderation while adopting a climate friendly path. India indicates that its INDC will cost at least US$2.5 trillion to implement. However, the INDC does not explicitly state how it arrives at that estimate. There is also no indication as to how much of that cost is expected to come from international sources and how much from domestic budget.

Analysis

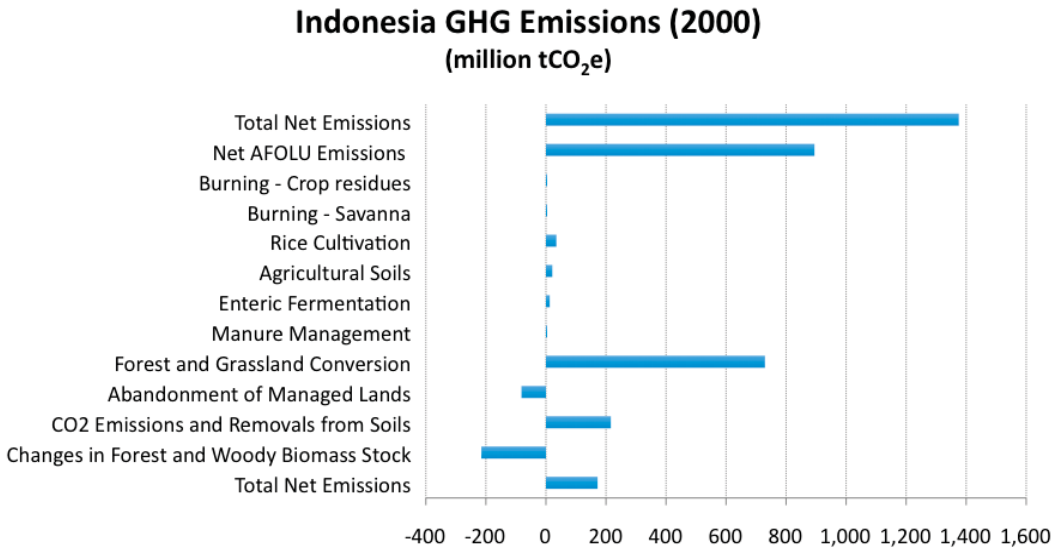
Agriculture in India is vulnerable to climate change and is a significant source of emissions. Development plans include agricultural programs with adaptation outcomes, but agriculture is explicitly excluded from national mitigation contributions. The main sources of agricultural emissions include enteric fermentation from livestock, methane emissions from irrigated rice production, nitrous oxide from the use of nitrogenous fertilizers, and the release of CO_2 from energy sources used to pump groundwater for irrigation. There appears to be mitigation potential in India's agriculture sector that can go hand in hand with increased productivity, including opportunities to reduce nitrous oxide emissions from overfertilization and methane emissions from rice cultivation.[32] If current emissions from agriculture were reduced by 33%, this would generate an additional reduction of approximately 117 million t CO_2eq.

Indonesia

Emissions profile

According to CAIT data,[33] Indonesia was the world's sixth largest greenhouse gas emitter in 2011 (total greenhouse gas emissions including LULUCF). Indonesia's deforestation contributes to a large share of global deforestation emissions at around 30–40% for the period 2000–2010.[34] In 2000, Indonesia's total emissions were 1,375 million t CO_2eq, a large portion of which (60%) came from LULUCF, particularly land use change, and peat and forest fires. In comparison, agriculture constituted a relatively small portion of Indonesia's total emissions at around 5% in 2000 (Figure 6).[35] However, agricultural expansion is the leading cause of deforestation in the country.

Figure 6 Distribution of Indonesia's greenhouse gas emissions by AFOLU subsector (2000)



National plans, programs, and commitments on AFOLU

AFOLU emission reduction targets and activities are emphasized in all major national climate change policies.[36] Most recently, the National Action Plan Addressing Climate Change (2011) commits to reducing economy wide and each sector's emissions unconditionally by 26% and conditionally by 41% by 2020. This translates to an emission reduction target of 8–11 million t CO_2eq for the agriculture sector, and 672 million to 1,039 million t CO_2eq for the forestry and peat land sectors.

Key forestry mitigation strategies include peat management, REDD, sustainable forest management, land and water resources optimization, increased and improved quality of conservation areas, forest planting, and application of land management and farming technologies that have the lowest greenhouse gas emissions and can absorb CO_2 optimally. In the agricultural sector, priority emission reduction strategies include development of plantations (oil palm, rubber, cacao) on nonforest, abandoned, degraded, or other use areas; climate resilient crop production; use of organic fertilizers and biopesticides; and use of livestock and agricultural waste for biogas. Additionally, one of Indonesia's NAMAs is related to AFOLU and focuses on community forest partnership for wood biomass based energy.[37]

Reflecting the commitments in its National Action Plan, Indonesia's INDC sets an unconditional emission reduction target of 26% by 2020 and 29% by 2030, along with a conditional target of 41% by 2030. The INDC identifies agriculture and forestry as two of the five key mitigation sectors. It indicates that AFOLU emission reduction targets will be met through effective land use and spatial planning, sustainable forest management including social forestry, restoration of functions of degraded ecosystems, and improved agricultural and fisheries productivity. Indonesia does not provide cost estimates in its INDC.

Analysis

AFOLU is well covered in Indonesia's national climate change policies and INDC. The emission reduction targets and measures cover the entire AFOLU emission profile of the country, with emphasis on land use change and peat and forest fires as the largest emission sources.[38] However, some independent scientific sources have reported higher historical deforestation data and emissions than recorded in national data, suggesting that Indonesia's INDC BAU level may potentially be underestimated and that the country may be able to do more to reduce emissions in the AFOLU sector.

Lao People's Democratic Republic

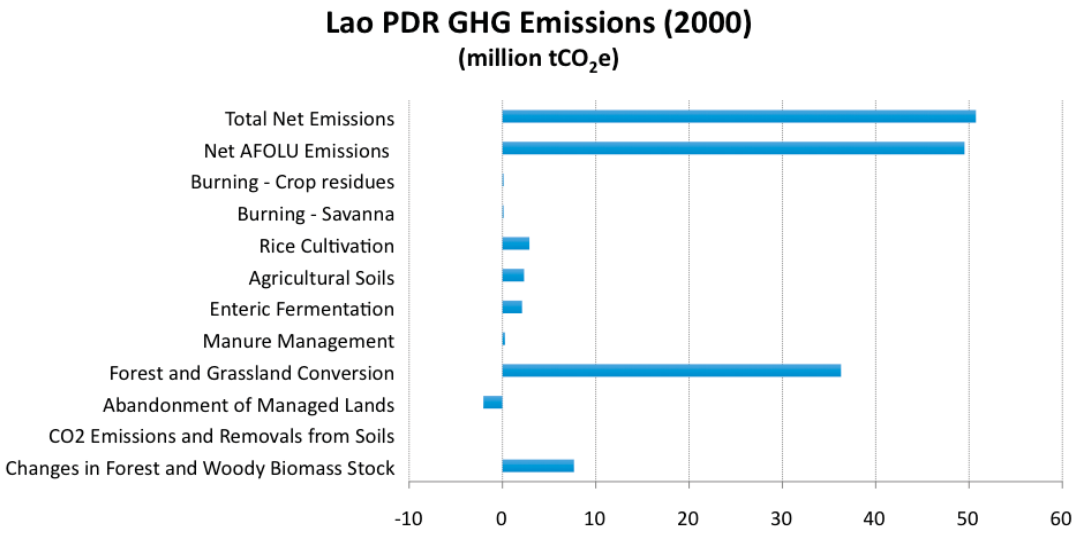
Emissions profile

Lao PDR's net AFOLU emissions were 49.5 million t CO_2eq for the base year 2000, accounting for over 97% of total net emission. LULUCF comprised approximately 83% of total net emissions, and agriculture 15%.[39] Conversion of forest and grassland was the most important source of emissions under LULUCF, while rice cultivation (representing 38% of agricultural emissions), agricultural soils (30%), and enteric fermentation (28%) were the most important sources of emissions in the agriculture sector (Figure 7).

National plans, programs, and commitments on AFOLU

Lao PDR's long term national development plan sets the vision to achieve middle income status by 2030. The country also establishes the overarching national strategy for tackling climate change with a goal of increasing forest cover to 70% of the total land area by 2020, among other targets.[40] Additionally, the national agricultural policies promote agricultural and food security programs with mitigation objectives, including climate smart land use planning,[41] mobilization of climate related finance mechanisms such as the Clean Development Mechanism and REDD+, and piloting community based forest management and forest

Figure 7 Distribution of Lao PDR's greenhouse gas emissions by AFOLU subsector (2000)



co-management.[42] While Laos is yet to submit its list of NAMAs to the UNFCCC, NAMAs in the energy sector are under development and feasibility studies are under way for NAMAs in the transport sector. There is, however, currently no NAMA in the AFOLU sector.

Lao PDR's INDC identifies a number of mitigation actions the country intends to undertake by 2030 that are conditional on the availability of international support. AFOLU, especially the forestry sector, is strongly represented in these target activities. As in national plans, the INDC sets a target of increasing forest cover to 70% of land area (to 16.58 million ha) by 2020,[43] from an estimated level of 40% in 2010.[44] The INDC also highlights a preliminary estimate of emission reductions in the range 0.06–0.07 million t CO_2eq[45] that will occur as a result of the mitigation measures (once the target has been met post-2020). The INDC also includes adaptation measures to promote climate resilience in farming systems and agriculture infrastructure, including technologies for climate change adaptation.

The INDC estimates that the country will require international financial support of about US$1.4 billion for mitigation and US$0.97 billion for adaptation, which may include market based international climate finance, particularly for REDD+.

Analysis

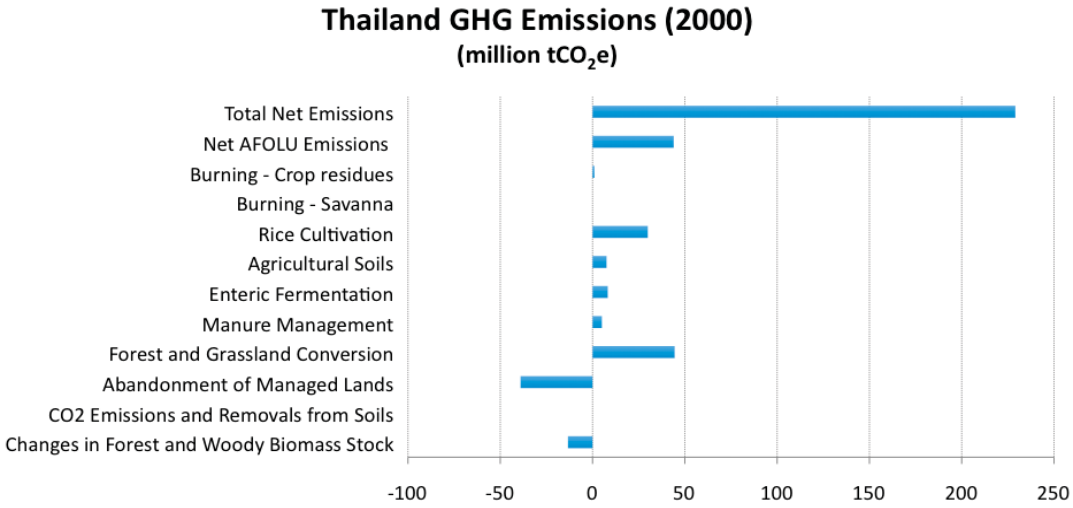
Lao PDR intends to implement policies that support the long term goal of limiting its greenhouse gas emissions. AFOLU is the most important source of greenhouse gas emissions in the country, covering almost all national emissions. The national strategies on climate change and agricultural development explicitly highlight mitigation measures in the AFOLU sector, which adequately cover both agriculture and forestry sectors. The INDC, however, focuses on mitigation in the forestry sector and mentions agriculture only under adaptation measures. Furthermore, while the INDC proposes to increase forest cover to 70% by 2020 compared with a level of 40% in 2010, the preliminary estimates of projected emissions do not appear to reflect this target. Given that AFOLU emissions cover over 97% of total national emissions, and assuming the proposed increase in forest cover that will be achieved by 2020, the estimated emission reductions would be higher than stated in the INDC. Additionally, the INDC does not explicitly describe the analytical method used to calculate the post-2020 projected emission reductions.

Thailand

Emissions profile

Thailand's net AFOLU emissions were about 44 million t CO_2eq, or 19% of total net emissions, in 2000. Agricultural emissions totaled nearly 52 million t CO_2eq, of which rice cultivation was the largest source (accounting for 58% of agricultural emissions), followed by enteric fermentation (16%), agricultural soils (15%), and manure management (10%). LULUCF, on the other hand, was a net carbon sink of about 7.8 million t CO_2eq (Figure 8).[46]

Figure 8 Distribution of Thailand's greenhouse gas emissions by AFOLU subsector (2000)



National plans, programs, and commitments on AFOLU

Thailand has set several targets related to mitigation in the AFOLU sector, including increasing forest cover to 40% by 2020, increasing conservation forest area to 19% of total area by 2015, attaining at least 5,000 rai (or 800 ha) per year of mangrove coastal reforestation, and expanding sustainable agriculture areas by at least 5% per year.[47] From the forestry sector, mitigation measures include forest protection and sustainable utilization, reforestation/afforestation, and development and promotion of financial mechanisms such as payments for ecosystem services (PES), REDD+, and forest bonds. Mitigation measures in the agricultural sector include zero waste agriculture (generating energy from agricultural and agroindustrial wastes and byproducts), agricultural intensification, soil conservation and restoration, land use zoning, fertilizer management, climate resilient crops, and crop insurance.

Thailand's INDC sets an unconditional emission reduction target of 20% (or 111 million t CO_2eq) and a conditional target of 25% (or 139 million t CO_2eq) below 2030 BAU level. Emission reduction strategies in the INDC focus on energy, transportation, industry, and waste. Agriculture and forestry are mentioned only in the context of adaptation,[48] including a target to increase national forest cover to 40%.[49] However, the INDC indicates that Thailand will consider including LULUCF at a later date. Thailand does not provide cost estimates in its INDC. In addition, none of the country's submitted NAMAs is related to AFOLU.

Analysis

Thailand's national plans include AFOLU as mitigation measures with a few quantified targets. However, the sector is reflected rather as adaptation measures in the INDC, although the protection and expansion of

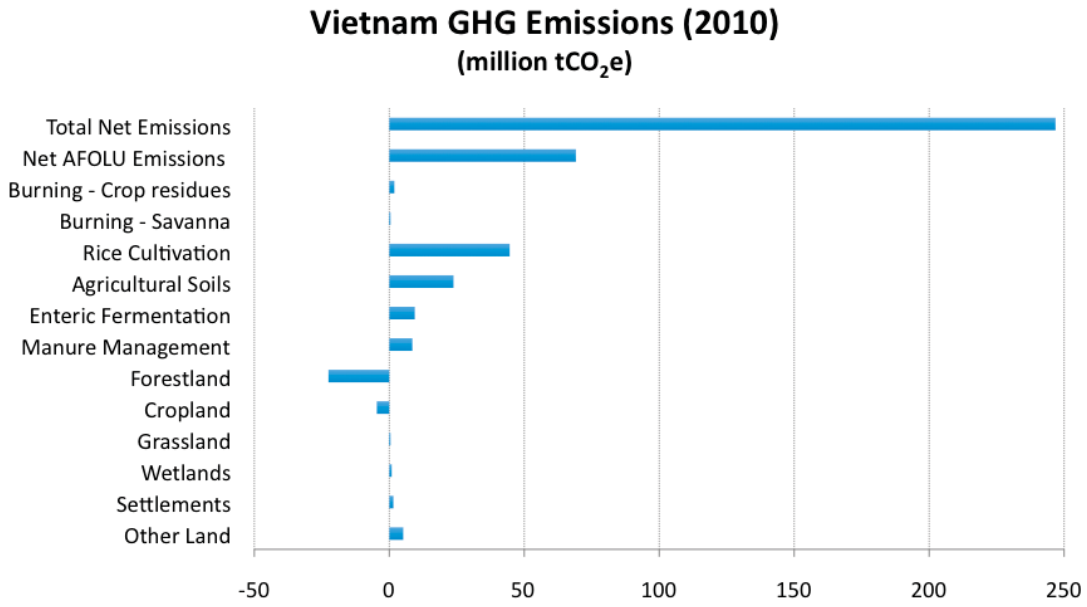
forest areas is included. There may be potential for reducing emissions in agriculture, particularly rice cultivation, which accounts for about half of Thailand's agricultural emissions.

Viet Nam

Emissions profile

Viet Nam's net AFOLU emissions were about 69 million t CO_2eq or 28% of total net emissions in 2010. Agriculture emitted 88.4 million t CO_2eq in 2010, of which the main sources were rice cultivation (representing 50% of total sector emissions), agricultural soils (27%), enteric fermentation (11%), and manure management (9.7%). The LULUCF sector changed from an emission source in 2000 to a sink of 19.2 million t CO_2eq in 2010, mainly due to decreased deforestation and increased reforestation and afforestation (Figure 9).[50]

Figure 9 Distribution of Viet Nam's greenhouse gas emissions by AFOLU subsector (2010)



National plans, programs, and commitments on AFOLU

Viet Nam has issued a number of national climate change policies and plans,[51] all of which include AFOLU as a key sector in both mitigation and adaptation. The country aims to reduce greenhouse gas emissions from the sector by 20% (or 18.87 million t CO_2eq) by 2020, while simultaneously ensuring the growth rate and poverty reduction targets according to sectoral development strategy (by 20% every 10 years).[52] Viet Nam has also specified AFOLU subsector emission reduction targets and activities, including in crop production, livestock, forestry, fisheries, irrigation, and rural activities such as waste and cooking fuels. Additionally, Viet Nam has a NAMA on biogas from medium sized pig farms that is undergoing feasibility studies.[53]

Specific forestry mitigation strategies in national plans include REDD, PES, afforestation/reforestation, fire management, agroforestry, and sustainable forest management to enhance carbon stock and sequestration. Mitigation strategies in the agriculture sector include crop management (e.g. reducing emissions from rice cultivation, enhancing effectiveness of nitrogen fertilizers, applying minimum tillage); livestock management (e.g. changing feed portions and composition); and manure management (e.g. waste collection and treatment, composting, and biogas).

Viet Nam's INDC sets an unconditional economy wide emission reduction target of 8% (or 63 million t CO_2eq) and a conditional target of 25% (or 197 million t CO_2eq) below the 2030 BAU level. Although the INDC does not provide a specific emission reduction target for the AFOLU sector, it unconditionally commits to increasing forest cover to 45% by 2030.[54] Agriculture and forestry are two of the five key mitigation sectors in the INDC. Additionally, an adaptation target is to increase the area of coastal protection forests to 380,000 ha, including 20,000–50,000 ha of additional mangrove planting by 2030.

Viet Nam's INDC does not provide any cost estimates. However, the AFOLU sectoral climate change strategy (Decision 3119)[55] estimates that implementation of the program to reduce emissions from the sector will require a total budget of 2,740 billion VND (US$120 million), of which 540 billion VND (US$20 million) is expected from state budget and 2,200 billion VND (US$100 million) from official development assistance (ODA). While Decision 3119 does not mention private finance, Viet Nam's INDC states that the country will develop mechanisms and policies to attract private sector investment for sustainable forest management activities.

Analysis

AFOLU is a priority sector in Viet Nam's INDC and national climate change policies, which include mitigation targets and activities covering the country's entire AFOLU emission profile. While the sector is well covered in Viet Nam's mitigation strategies, addressing the financing challenge will be critical for Viet Nam to meet its AFOLU mitigation objectives.

Funding and costs

Estimating the mitigation cost of AFOLU activities

Mitigation cost estimates vary greatly depending on country contexts, underlying assumptions regarding emission scenarios, time horizons, cost parameters, the type of technology employed, and the type of commodity, among other factors. Given such challenges, this section aims to give only rough order-of-magnitude estimates of the costs of selected AFOLU mitigation activities, including in rice cultivation, fertilizer management, enteric fermentation, and agricultural soils. The prioritization of these activities is partly informed by discussion outcomes from a regional workshop organized by the Asia LEDS Partnership in October 2015 on "Mobilizing investment on low-emissions development in Asia's agriculture sector."[56]

The Asia region is reported to have the largest technical and economic mitigation potential in the AFOLU sector.[57] Particularly, Southeast Asia is estimated to present the highest technical mitigation potential to reduce greenhouse gas emissions from agriculture than any other region, owing to the significance of the sector in the countries' economic and emission profiles and their vast area of croplands. The potential for emission reductions from using all technically feasible practices and covering all greenhouse gases is estimated to range from 550 to 1,300 million t CO_2eq per year by 2030. In particular, the region provides almost all of the global mitigation potential for rice cultivation, including the largest potential for restoration of organic soils (due to cultivated Southeast Asian peats). By 2030 the global economic potential for agricultural greenhouse gas reduction could reach 28% of its total technical potential at a carbon price of up to US$20/t CO_2eq and 46% at a carbon price of up to US$50/t CO_2eq.[58] Roughly applying the global proportions to Southeast Asia, by 2030 the region's economic potential for greenhouse gas mitigation in agriculture would be about 152 million t CO_2eq per year at a carbon price of up to US$20 per t CO_2eq and about 414 million t CO_2eq per year at a carbon price of up to US$50 per t CO_2eq.[59] A study for India puts marginal abatement costs for almost all AFOLU related mitigation activities at below US$107[60] per t CO_2eq.[61]

Table 2 summarizes the cost estimates of three agriculture mitigation options and presents selected cases. As stated above, cost estimates of mitigation potential in the AFOLU sector vary greatly depending on a number of factors, including limitations on empirical estimates of mitigation potential in the agriculture sector. More detailed and evidence based research will be needed to guide decisionmaking on the best fit mitigation activities.

Going forward, most countries will face both mitigation and adaptation challenges. It is important to assign high priority to mitigation actions that improve (or do not reduce) productivity and have strong adaptation benefits. Lower priority could be assigned to mitigation activities that have no adaptation benefits or reduce food productivity. Financing preferences should go to the former, and a top up based on the adaptation asset value could be considered.

Table 2 Mitigation options in agriculture in the Asian region and some selected countries

Mitigation option	Relative mitigation potential	**Opportunities** (cost effectiveness, feasibility, synergy with adaptation)	Specific country cases	Challenges/ barriers
Rice cultivation	In continuously flooded rice fields, reduce methane emission by 7–63% (with organic amendment) and 9–80% (with no organic amendment) Note: Methane emissions in rice fields vary over a wide range (5–634 kg CH_4/ha)[62] depending on the season (spring, fall, or winter) and management practices: (i) field drying at midtillering (midseason drainage); (ii) continuous flooding; or (iii) alternate flooding and drying	More effective rice straw management to reduce CH_4 emissions (e.g. as a biofuel)	**Viet Nam** • Alternate wetting and drying leads to emission reductions of 6–6.9 t CO_2eq per season per ha[63] • Reduction in methane emissions of 40 kg per ha per year with an increase in rice yield of 0.3 t/ha through an innovative water management method[64] **Philippines** • Use of ammonium sulfate as nitrogen fertilizer in place of urea resulted in a 25–36% reduction in methane emissions **Bangladesh** • Alternate wetting and drying offers largest greenhouse gas abatement potential in 2020 with a reasonable marginal abatement cost of US$15.72/t CO_2eq abated[65] • Total cost of production of a hectare of paddy rice under alternate wetting and drying increased by 34% from conventional price range of US$1,091–1,184[66] **India** • With one midseason drying, net revenue drops <5% while greenhouse gas emissions drop by almost 75 million t CO_2eq. Opportunity cost is US$1.20/t CO_2eq[67]	• Benefit in reducing emissions from methane may be offset by increase in nitrous oxide emission from application of nitrogen fertilizer • Practice may be constrained by water supply • Measures such as rice residue management and alternate wetting and drying may incur additional costs to farmers in the short run, which in turn may impact adoption of such practices

Mitigation option	Relative mitigation potential	Opportunities (cost effectiveness, feasibility, synergy with adaptation)	Specific country cases	Challenges/ barriers
Cropland management • Agronomy • Nutrient management • Tillage/residue management • Water management	Potential to sequester soil carbon by 0.55–1.14 tCO_2 per ha per year Potential to reduce nitrous oxide emissions by 0.02–0.07 t CO_2eq per ha per year[68] Improved nitrogen efficiency is suggested to reduce emissions of nitrous oxide while simultaneously reducing greenhouse gas emissions from nitrogen fertilizer	Use of improved varieties with reduced reliance on fertilizers and other inputs provides opportunity for better economic returns Reduced tillage will reduce use of fossil fuels thus lowering CO_2 emissions from energy use	**India** • Use of the GreenSeeker device[69] resulted in a greater fertilizer recovery efficiency of 6–22% compared with farmers' practices, and with no rice yield loss[70] • Estimated greenhouse gas reduction from such recovery ranges from 51 to 247 kg CO_2e/ha. Fertilizer saved is estimated to represent US$10.03–48.97 at current market price for urea fertilizer[71]	• Could be costly to implement and would need considerable effort to transfer, diffuse, and deploy • Some measures may challenge existing traditional practices
Livestock management feeding practices	Improved feeding reduces methane emissions from enteric fermentation by 1–22% (dairy cattle), 1–14% (beef cattle), 4–10% (dairy buffalo), and 2–5% (nondairy buffalo)[72] Urea–molasses multi-treatment block and urea treated straw feeding were found to increase milk production by as much as 25% and 30%, respectively	The measure depends on soil and climatic conditions, especially when dealing with grazing animals	**Bangladesh** • Urea-treated straw feeding has the highest marginal abatement cost/t CO_2eq with an estimated range of US$43.66–45.99, while for urea–molasses multi-treatment block it is US$13.51–14.66[73] **India** • Supplementing ruminant diets with urea–molasses multi-treatment block showed emission reductions by as much as 35%[74]	• The effect varies depending on management of animals—whether confined or grazing

Source: Adapted from ADB (2009)[75]

Financing AFOLU: The need to recognize the contribution of private sector finance to achieve AFOLU mitigation

Meeting greenhouse gas mitigation targets while adapting to climate change is a dual challenge. AFOLU mitigation and adaptation activities will require large amounts of capital. Given the scale of investment required and the diversity of financial services and products needed (long term investments, small scale credit, insurance, etc.), both private and public finance will be needed. The NDC process offers countries the opportunity to articulate their need for financing and to facilitate access to continuously evolving global climate finance by harnessing cost effective emission reductions in AFOLU.[76]

Most countries' INDCs indicate that they require international support in the form of finance, technology, and capacity building, while some further state estimated costs and the level of support required. Some countries, including Thailand and Indonesia, do not provide cost estimates in their INDCs. Bangladesh draws the economic assessment of its adaptation needs from various sources, while indicating the need for further study to estimate the mitigation potential and associated costs of the AFOLU sector.

Significantly, no INDCs reviewed make note of the potential contributions from private companies that have made commitments in recent years to reduce emissions associated with large scale production, trade, and manufacturing of timber and agricultural commodities. Nor do the INDCs consider the growing trend for

financial service providers to finance AFOLU investments that mitigate greenhouse gas emissions, potentially at very large scale.

Dozens of companies that produce, trade, and use palm oil, rubber, coffee, and other commodities in Southeast Asia have pledged to eliminate deforestation from their supply chains by 2020 (New York Declaration on Forests).[77] Signatories to the Declaration include several major palm oil companies that are also affiliated with the Indonesia Palm Oil Pledge. The Pledge provides a platform for engaging other stakeholders and implementing corporate zero deforestation commitments at the national level in Indonesia. Indonesia is the world's largest producer of palm oil, a significant driver of deforestation and greenhouse gas emissions in the region, and therefore a major target for climate change mitigation activities.

These and other commitments are being driven by consumer expectations in western countries that commodities be produced sustainably; by advocacy groups that catalyze consumer expectations by calling public attention to companies that do not meet sustainability standards; and by financial service providers who are reassessing their estimates of risk associated with investments that do not meet more rigorous social and environmental standards. There is evidence that higher reputational and market risks are being reflected in higher lending costs among some banks for companies and projects that do not meet environmental, social, and governance (ESG) lending standards, and lower costs for those that do. Major global banks have been leaders in ESG lending to date, and until recently skeptics have assumed that companies unwilling to take up ESG standards could secure loans at competitive rates from domestic banks. However, Singapore and Indonesian financial sector regulators have recently taken the first steps toward ensuring that their national commercial banks apply ESG lending standards to projects they finance, with a particular focus on the AFOLU sector.[78] If successfully implemented, this has the potential to significantly reduce greenhouse gas emissions from the land use sector.

Private sector commitments are largely responses to market expectations that key commodities be produced sustainably, and not to public sector land use regulations, which have had generally poor results in reducing AFOLU emissions. The scope and scale of private sector investment in sustainable AFOLU practices will vary from country to country, as will its scope to leverage changes in land use practices that mitigate greenhouse gas emissions. But in several countries, the impact of private sector finance that applies sustainability standards could be significant, and greater in impact than public regulation alone.[79] The potential of private lending to leverage marked reductions in greenhouse gas emissions, in concert with national and ODA investment policies, infrastructure, and capacity development, should be addressed in the NDCs.

While some regional financial service providers are beginning to respond to market signals by increasing their investment in sustainable AFOLU projects, the potential role of financial regulators in helping accelerate ESG lending practices by investors should not be overlooked. The financial sector will benefit from clarity on the direction of future regulation and policy as well as encouragement, in the form of both carrots and sticks. In addition, given the linkages between countries in the region (e.g. the Malaysia, Singapore, and Indonesia investment triangle), it would make sense for countries to cooperate on a regional route to sustainable finance and create a more level playing field.

Historically, private investment in unsustainable AFOLU practices has been a principal driver of landscape degradation.[80] Various market factors, including consumer expectations that commodities be produced sustainably, have increased the portion of bank portfolios dedicated to ESG lending globally, and have heralded a shift away from BAU lending practices. By following the example of Singapore and Indonesia, national banking regulators in Southeast Asia can accelerate these trends in the AFOLU sector by

encouraging domestic banks to direct more finance to forestry and agricultural projects that contribute to national greenhouse gas emission mitigation goals.

It is crucial for countries to pay due attention to the role of finance, as it is a key factor that will bridge achievements in mitigation between what most countries have proposed as unconditional and conditional contributions. It is also critical for countries to start developing a comprehensive sector based climate finance strategy that articulates their financial needs to enable implementation of INDCs and AFOLU related mitigation activities. INDCs have set the trend for countries towards introducing national climate and development policies to low emission development strategies. To capture this opportunity, developing countries in Asia may need guidance on how to effectively access international public and private climate finance to achieve their mitigation objectives as outlined in the INDCs.

Next steps

Current INDCs do not bring us to a 2°C warming scenario. The UNFCCC estimates that, in order to have at least a 66% chance of staying below 2°C of warming, the current mitigation gap is approximately 8.7 Gt CO_2eq in 2025 and 15.1 Gt CO_2eq in 2030. AFOLU is one area with significant mitigation potential—particularly in Asia, reported to have the largest technical and economic mitigation potential in the AFOLU sector.[81]

The current INDCs are a starting point for understanding countries' potential contributions to climate mitigation. In many cases they are also an expression of adaptation needs. More work is needed to help refine—and in some cases enhance—a number of countries' mitigation contributions from AFOLU. This may occur within domestic policy and internationally communicated contributions. Both refining current estimates and exploring the potential for expansion can be challenging, for the following reasons.

- **Greenhouse gas estimates** are several years old in a number of countries. A lack of clarity over the starting point makes it hard to estimate emission reduction potential.

- **Cost estimates for AFOLU mitigation** need to be developed further. Cost estimates need to be developed for specific activities in specific countries, and be accompanied by estimates of emission reduction and/or removal. The potential for banks and investors to promote greenhouse gas mitigation through application of ESG standards should be recognized and expanded through supportive banking regulations and incentives.

- **Feasibility studies** and stakeholder consultations need to be undertaken to assess whether it is practical to implement wide scale mitigation and adaptation projects or programs.

Low emission development strategies that target the AFOLU sector can help with this. Such strategies involve an inclusive process of collecting information on current sources of emissions; identifying, analyzing, and prioritizing opportunities to reduce emissions; followed by implementation and ongoing adaptive management. A number of tools and resources for developing AFOLU LEDS have already been developed[82] along with a number of example AFOLU LEDS in the region.

Going forward, integrating LEDS into national planning processes and revisions of INDCs will help improve our understanding of current mitigation contributions and establish the foundation for implementation of mitigation and adaptation efforts.

Annex 1: Documents reviewed, including national plans, NAMAs, and INDCs

Country	National development plan	Climate change strategy	Green growth strategy	INDC	NAMA
Bangladesh	6th Five Year Plan (2011–2015)	Climate Change Strategy and Action Plan (2009)	–	✓	✓
Cambodia	National Strategic Development Plan (2014–2018)	Climate Change Strategic Plan (2014–2023)	National Green Growth Roadmap (2009)	✓	✓
India	12th National Development Plan (2012–2017)	National Action Plan on Climate Change (2008), including National Mission for a Green India, National Mission on Sustainable Agriculture	National Mission for a Green India	✓	✓
Indonesia	3rd National Medium Term Development Plan (2015–2019)	National Action Plan Addressing Climate Change (2007), Climate Sectoral Roadmap (2009), National Action Plan Addressing Climate Change (2011)	–	✓	✓
Lao PDR	7th National Socioeconomic Development Plan (2011–2015)	National Climate Change Strategy (2010), National Strategy for Agricultural Development (2011–2020)	–	✓	✓
Thailand	11th National Economic and Social Development Plan (2012–2016)	National Master Plan on Climate Change 2013–2050 (2014 Draft)	Green Growth Strategy (2014 Draft)	✓	✓
Viet Nam	Ten-year Socioeconomic Development Strategy (2011–2020)	National Climate Change Strategy (2011), National Target Program in Response to Climate Change (2008), Decision 3119 of the Ministry of Agriculture and Rural Development (2011)	National Green Growth Strategy (2012)	✓	✓

Annex 2: AFOLU mitigation activities included in countries' national plans and INDCs

Mitigation activity category[83]	Examples	Bangladesh	Cambodia	India	Indonesia	Lao PDR	Thailand	Viet Nam
Forestry								
Reducing deforestation	Conserve existing forests, increase forest reserve and protected areas, reduce illegal logging	✓	✓•	✓	✓•	✓•	✓•	✓•
Reforestation/ afforestation	Plant trees on nonforested lands	✓•	✓	✓•	✓	✓•	✓•	✓•
Forest restoration	Increase carbon densities in secondary and other degraded forests through natural or artificial regeneration, rehabilitation of degraded lands, long term fallows	✓	✓	✓•	✓•	✓•	✓•	✓•
Land use planning	Land use classification/zoning, development of agricultural plantations on nonforest/abandoned/ degraded lands		✓		✓•	✓•	✓	✓
Forest management	Sustainable forest management to increase stand level and landscape level carbon density		✓•		✓•	✓•		✓•
Fire management	Reduce frequency and intensity of forest fires, improve fire control				✓•	✓		✓
Agriculture								
Cropland management	Plant management, nutrient management including fertilizers, tillage/residue management, water management, rice management, rewetting peatlands drained for agriculture, set aside	✓•	✓	✓•	✓	✓•	✓•	✓•
Restoration of degraded lands	Land reclamation, afforestation, soil fertility management/erosion control, water conservation, soil nutrient enhancement, improved fallow land		✓	✓	✓	✓	✓	✓
Organic soils restoration	Soil carbon restoration on peatlands, avoided net soil carbon emissions using improved land management			✓	✓	✓•	✓	✓
Livestock management	Improved feeding, breeding, and other long term management	✓•	✓	✓		✓		✓•
Manure/ biosolid management	Improved storage and handling, anaerobic digestion, more efficient use as nutrient source	✓•	✓		✓	✓	✓	✓•
Bioenergy	Energy crops, solid waste, liquid waste, biogas, residues		✓		✓	✓•	✓	✓•
Agroforestry	Agroforestry		✓	✓•	✓	✓•		✓
Low emission machinery	Low emission agriculture and aquaculture machinery			✓				✓

✓ Included in national plans, policies, or programs.
• Included in INDC.

This paper was commissioned by the **AFOLU Working Group** http://ledsgp.org/working-groups/agriculture-forestry-and-land-use, part of the Low Emission Development Strategies Global Partnership (LEDS GP http://ledsgp.org). The AFOLU Working Group provides technical assistance, tools, training, and platforms to support low emission development across the agriculture, forestry, and other land use sector. Contact: afolu@ledsgp.org

The **Low Emission Development Strategies Global Partnership (LEDS GP)** was founded in 2011 to enhance coordination, information exchange, and cooperation among countries and international programs working to advance low emission, climate resilient growth. LEDS GP currently brings together LEDS leaders and practitioners from more than 160 countries and international institutions through innovative peer to peer learning and collaboration via forums and networks. www.ledsgp.org

The USAID funded **Lowering Emissions in Asia's Forests (LEAF) Project** provided technical and financial support for this publication. The authors' views expressed in this publication do not necessarily reflect the views of the United States Agency for International Development or the United States Government.

Endnotes

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8 Smith et al. (2014) Op cit.

9 Low Emission Development Strategies (LEDS) are understood as a "strategic framework that articulates concrete actions, policies, programs and implementation plans to advance economic growth, improve environmental management, and meet development objectives. This framework provides a foundation for achieving long term, measurable greenhouse gas emission reductions as compared to a business-as-usual development pathway". LEDS Global Partnership, www.ledsgp.org

10 The national plans include national development plans, national climate change strategies, and green growth strategies that are publicly available in English. See Annex 1 for a list of all national plans that were reviewed for this paper.

11 See 'Country findings' below for the years of these emission data.

12 However, due to deforestation and forest degradation, Cambodia's AFOLU sector has reduced from a net sink of 64.9 million t CO_2eq in 1994 to just 3.5 million t CO_2eq in 2000.

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Front cover photo: Duy Doan/istockphoto.com
Editing, design and layout: Green Ink (www.greenink.co.uk)