

Info Note

Rice cultivation ambition in the new and updated Nationally Determined Contributions: 2020-2021

Analysis of agricultural sub-sectors in countries' climate change strategies

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Key messages

- The share of countries that referenced rice cultivation actions in new and updated NDCs has increased since the previous round of NDCs.
- Among the top 10 countries with the highest mitigation potential for rice cultivation, 4 countries mentioned rice mitigation actions.
- Seventeen countries quantified measures for rice cultivation in their new and updated NDCs, for the first time.
- 14% of the countries that have signed the US-EU Methane Reduction Pledge have rice mitigation actions in their NDC (15 countries out of 105).
- A number of countries mentioned limitations in GHG measurement and inventory as well as methods and data for calculating mitigation potential of different actions in rice, leading to the lack of specifying tangible actions and indicators in the rice sub-sector.

Rice cultivation is the third largest source of non-carbon dioxide (CO₂) greenhouse gas (GHG) emissions in agriculture globally, next to livestock and croplands (EPA, 2019). Although livestock contributes 40-50% of food system emissions compared to rice at 6-8%, the relative mitigation potential for rice (27%) is much higher than that of livestock (6%), resulting in a similar global mitigation potential for both (FAO, 2021; Roe et al., 2021; EPA, 2019). However, far more countries (35%) have mentioned livestock mitigation actions in their first submission of Nationally Determined Contributions (NDCs) and Intended NDCs (INDCs) as compared to those that mentioned rice actions (9%). Clear commitments in NDCs that are supported by sound data

- 16% of countries included rice-specific mitigation actions (11 countries specified mitigation only and 13 specified combined mitigation and adaptation for a total of 24 out of 148) in new and updated NDCs compared to 9% of previous NDCs (18 out of 192).
- 3% specified only rice-specific adaptation actions in new and updated NDCs (5 out of 148) compared to only 0.5% in the previous round of NDCs (1 out of 192 countries).
- 50% of the countries mentioning rice mitigation actions prioritized water management (12 of 24 countries), 33% mentioned rice management packages (8), 33% mentioned land use management (8), and 33% mentioned by-product and residue management (8).
- 56% of countries mentioning adaptation actions in rice prioritized water management (10 of 18 countries), 33% mentioned System of Rice Intensification (SRI) (6), and 33% mentioned variety development (6).

and estimations are crucial for countries to mobilise resources and take action to meet global climate targets by 2030. As of November 1, 2021, 148 countries have submitted or updated their NDCs (UNFCCC, 2021); 29 of which included mitigation, dual mitigation and adaptation, or adaptation only actions in rice cultivation.

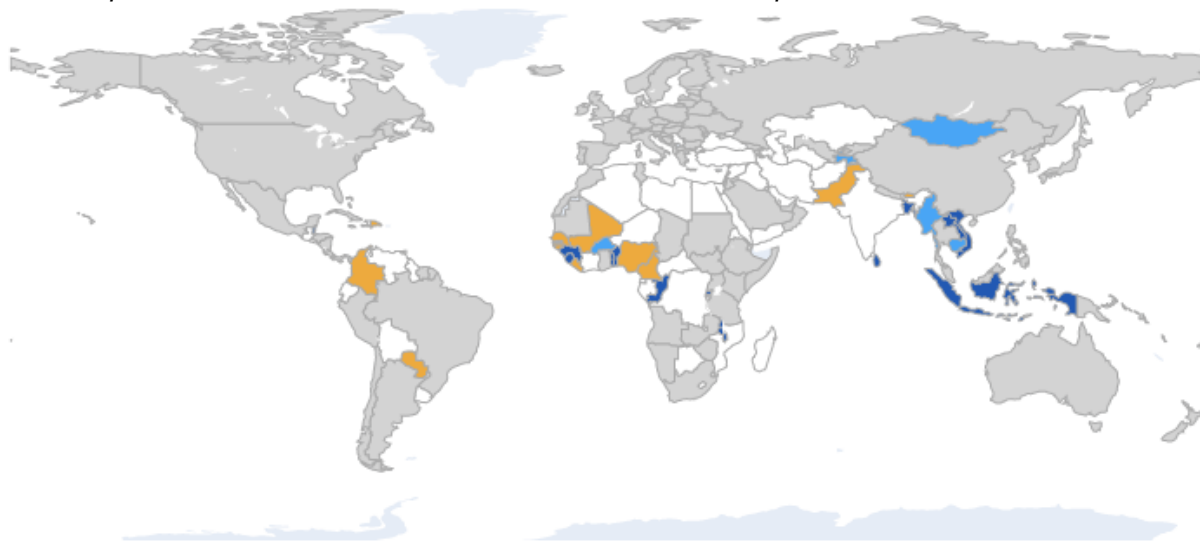
In this policy brief we evaluate the inclusion of rice commitments in new and updated NDCs. This evaluation includes comparing the level of ambition with the previous

NDCs,¹ assessing ambition among countries with the highest mitigation potential for rice cultivation, highlighting examples of domestic policies for implementation, and summarizing needs for support of implementation. We conclude with recommendations to enhance ambition and improve transparency. The analysis aims to enhance the information necessary for clarity, transparency and understanding (ICTU) of NDCs by identifying gaps in targets, finance needs and policy.

Progress and ambition in rice cultivation

As of November 1, 2021, 148 countries (122 Parties including the EU) submitted new or updated NDCs to the

Figure 1. Map of countries with reference to rice actions in new and updated NDCs



Rice cultivation in new and updated NDCs

- Both mitigation and adaptation measures in new or updated NDC
- Adaptation measure in new or updated NDC
- Mitigation measure in new or updated NDC
- No rice measure in new or updated NDC
- No new or updated NDC

Note: Mitigation and adaptation includes Bangladesh, Belize, Benin, Congo, Guinea, Indonesia, Lao People's Democratic Republic (PDR), Malawi, Rwanda, Sierra Leone, Sri Lanka, Togo, Viet Nam; Mitigation includes Bhutan, Cameroon, Colombia, Dominican Republic, Guinea-Bissau, Liberia, Mali, Nigeria, Pakistan, Paraguay, Senegal; Adaptation includes Burkina Faso, Cambodia, Mongolia, Myanmar, and Tajikistan

Of the 29 countries that included rice production system actions⁴ in the new and updated round of NDCs, 11 mentioned only mitigation actions, 5 included only

UNFCCC. Of these, 29 countries specified some mitigation or adaptation action in rice cultivation; representing 19 percent of new or updated NDCs (see Figure 1). This is an increase from the first round of NDCs and INDCs, where 18 countries (including only the EU member states that grow rice) referred to rice cultivation in agricultural mitigation actions (9% of 192 countries).² Another 10 countries in the first round mentioned rice without any action or measurable indicator,³ which are both crucial to track NDC progress and ambition. Therefore, a mention of rice alone is not counted as a statement of rice-related ambition in the first or the new or updated NDCs in this analysis.

adaptation actions, and 13 had both mitigation and adaptation actions.⁵ The most frequent mitigation actions were water management (12 countries), rice

¹ Previous NDCs include 190 I/NDCs submitted as of November 24, 2019, Turkey's first NDC submitted on October 11, 2021, and Iraq's first NDC submitted on October 15, 2021, for a total of 192 NDCs. EU countries are counted individually. The analysis of rice in previous NDCs is based on Richards et al. (2016).

² 18 countries that referred to rice cultivation in agricultural mitigation actions from the first NDC/INDC submission: Afghanistan, Bangladesh, Benin, Burundi, Cameroon, Côte d'Ivoire, Egypt, France, Gambia, Greece, Hungary, Italy, Madagascar, Mali, Myanmar, Senegal, Togo, Uruguay

³ 10 countries that only mentioned rice farming without any action or measurable indicator from the first NDC/INDC submission: Bulgaria,

Chad, China, Japan, Mexico, Portugal, Romania, Spain, Vietnam, Zambia

⁴ The term 'action' refers to the specific mention of a mitigation or adaptation activity as defined in Footnote 5. The term 'quantified measure' refers to countries that have quantified GHG (tCO₂e) or non-GHG measures (number of hectares or percentage of area) for rice-specific activities.

⁵ Mitigation and adaptation actions relevant to rice production systems include: changing water management (alternate wetting and drying, intermittent drainage, mid-season drainage, etc.); rice management packages (System of Rice Intensification, Sustainable Rice Platform, Direct Seeded Rice, Climate-smart rice, Good Agricultural Practices, etc.); managing residue and by-products; varietal improvements;

management packages (8), by-product and residue management (8), and land use management (8). The most frequent adaptation actions were water management (10 countries), followed by SRI (6), and variety development (6) (see Table 1). It should be noted that mitigation and adaptation are coupled in these actions so it is the choice of the country of how they want to identify the action, even though both mitigation and adaptation will be achieved by implementing these actions.

Commitments in the first round of NDCs mainly considered actions in water management (6 countries, 3

of which specified alternate wetting and drying) and varietal improvements (5 countries). Changing from continuously flooded management to periods of intermittent drainage (also known as “alternate wetting and drying”) achieves the most significant reduction of GHG emissions in rice cultivation so this is a crucial practice to highlight in rice-specific mitigation actions. A significant change in the new and updated NDCs is that eight countries focused on complete management packages (which incorporate water management into a whole agronomy and sustainability approach) rather than individual practices, indicating a more comprehensive approach in this sub-sector.⁶

Table 1. Summary of countries with rice actions in new and updated NDCs

Rice actions	Mitigation actions (No. of countries)	Adaptation actions (No. of countries)	Mitigation or adaptation actions (No. of countries)
Total rice actions	24	18	29
Agribusiness and rice value chain	2	3	5
Rice by-products and residue management	8	4	12
Climate-smart agriculture	2	4	6
Organic rice	1	1	2
Direct-seeded rice	0	1	1
Fertiliser, nutrition management	5	2	7
Land use management	8	3	11
Post-harvest and processing of rice	1	2	3
Rice management packages	8	4	12
<i>One Must - Five Reductions (1M5R) (Vietnam)</i>	1	0	1
<i>Three Reductions Three Gains (3R3G) (Vietnam)</i>	1	0	1
<i>Good Agricultural Practices (GAP)</i>	1	1	2
<i>Integrated Crop Management (ICM)</i>	1	4	5
<i>System of Rice Intensification (SRI)</i>	3	6	9
<i>Sustainable Rice Platform (SRP)</i>	0	1	1
Rice varieties	3	6	9
Water management	12	10	18
<i>Alternate Wetting and Drying (AWD)</i>	3	0	3

Out of the 29 countries that described specific actions in the rice sub-sector, 17 countries⁷ quantified measures for their ambition for rice mitigation and/or adaptation: 14 of them including measurable indicators for the first time. Only five countries specified a numeric goal for GHG mitigation in the rice-sub-sector: Benin, Colombia, Lao PDR, Liberia, and Mali (see Table 2). Twelve countries

referred to non-GHG indicators only, such as the area or the percentage of rice land or rice production (see table 3 for examples).

A quantified GHG (i.e., tCO₂e reduced) or non-GHG (i.e., number of hectares targeted) measure in an NDC improves clarity and transparency, which facilitates

fertilizer management; land use management (rotation, diversification, integration, reduce rice area, etc.); and post-harvest processing/value chain improvements.

⁶ A detailed comparison of rice actions between the first round and second round of NDCs is included in a database available for download at <https://cgspace.cgiar.org/handle/10568/115962>.

⁷ Countries with quantified measures in new or updated NDCs: Bangladesh, Belize, Benin, Bhutan, Burkina Faso, Cambodia, Colombia, Congo, Dominican Republic, Indonesia, Lao PDR, Liberia, Mali, Nigeria, Paraguay, Senegal, Sri Lanka

accountability and tracking of progress. While some countries may refrain from providing a concrete number to have more flexibility in planning and implementation of the overall agriculture targets or because of the difficulty of MRV, it is important to note that 88% of the countries

that quantified measures (15 out of 17), represent less than 5% of the total global mitigation potential for rice (Roe et al. 2021). For the most part, countries that have strong mitigation potential in rice are rather ambiguous in specifying quantified measures.

Table 2. Examples of quantified rice GHG measures in new and updated NDCs

Country	Mitigation/ Adaptation	Rice mitigation potential ⁸	GHG quantified measure
Benin	Mitigation	0.03 MtCO _{2e}	Development and irrigation of rice fields with water control on 52,000 ha (22,000 ha of rice fields developed and irrigated with water control; An additional 30,000 ha of rice fields developed and irrigated with water control). Development of rice-growing areas with water control (0.2 MtCO _{2e} eq) or 0.6%.
Colombia	Mitigation	0.72 MtCO _{2e}	0.08 MtCO _{2e} (only due to reduction of N ₂ O emissions due to lower consumption of fertilizers (in rice production))
Lao PDR	Mitigation	0.63 MtCO _{2e}	50,000 hectares adjusted water management practices in lowland rice cultivation. Average target between 2020 and 2030 (ktCO _{2e} /y): 128
Liberia	Mitigation	0.05 MtCO _{2e}	Reduce agricultural GHG emissions by 40% below BAU levels by 2030 (reduction of 13 GgCO _{2e}) through promoting low-emissions rice cultivation and reducing the burning of field residues
Mali	Mitigation	0.63 MtCO _{2e}	Promote intermittent aeration of irrigated rice fields (839 kilo tons)

Table 3. Examples of quantified rice non-GHG commitments in new and updated NDCs

Country	Mitigation/ Adaptation	Rice mitigation potential ⁸	Non-GHG quantified measure
Bangladesh	Mitigation	21.89 MtCO _{2e}	Upscaling alternate wetting and drying (AWD) in dry season rice field in 150,000 ha of crop lands, rice varietal improvement for 3,240,000 ha crop lands, improvement of fertilizer management (deep placement of urea in rice field) on 200,000 ha
Burkina Faso	Adaptation	0.09 MtCO _{2e}	Development project of 35,000 ha of lowlands and irrigated areas and their development through the intensive rice cultivation system (USD 160 million).
Cambodia	Adaptation	1.84 MtCO _{2e}	Development of rice crops for increase production, improved quality safety; harvesting and post harvesting technique and agrobusiness enhancement (37 mil. USD) Baseline: 11.51 million tons of rice in 2020 Target: 3% increased production/year Improvement of support services and capacity building to crop production resilient to climate change (69 mil USD)
Sri Lanka	Mitigation	2.2 MtCO _{2e}	Increase rice / paddy sector land-use productivity (paddy yield tons/ha) by 10% unconditionally and 5% conditionally

Of the 105 countries that have signed on to the US-EU Methane Reduction Pledge as of November 4, 2021, 15 have rice mitigation actions in their NDC, and 10 of those

have quantified measures in their new and updated NDCs.⁹

⁸ Roe et al. 2021

⁹ Countries that have signed the US-EU Methane Reduction Pledge that have rice mitigation actions, including those that have quantified measures (QM), in new or updated NDCs: Belize (QM), Benin (QM), Burkina Faso (QM),

Cameroon, Colombia (QM), Dominican Republic (QM), Indonesia (QM), Liberia (QM), Malawi, Mali (QM), Nigeria (QM), Pakistan, Rwanda, Senegal (QM), and Togo

Alignment between mitigation ambition and mitigation potential

We examined the 10 countries with the highest mitigation potentials for rice cultivation according to the meta-assessment on global mitigation potential by Roe et al. (2021). Of the top ten rice producing countries, four countries (Bangladesh, Indonesia, Vietnam, and Pakistan) provided rice-specific mitigation actions, but none of the countries quantified measures in terms of GHG reduction targets.

Some comparisons were difficult to interpret based on the NDC alone. Bangladesh's aim for "possible mitigation actions in rice" changed from 'conversion of 20% of rice area to AWD' in the INDC to 'conversion of 150,000 ha of rice area to AWD' in the updated NDC. Twenty percent of the irrigated rice land area converted to AWD is estimated to be 830,000 ha. Therefore, the updated version of the NDC represents a conversion of only 3.6% of irrigated rice land area to AWD. Although this may be a more realistic goal, this example shows the ambiguity of NDC measures where consistent actions and indicators are not used.

Indonesia referred to water management in agricultural mitigation actions, which likely includes rice given the predominance of irrigated rice cultivation in the country

and as water management is the most effective mitigation action for rice. China only mentions rice once in their updated NDC (no change from their first NDC submission), and no actions or quantified measures were specified. In India's INDC, they did not mention rice and stated that no targets will be made as they do not want to be bound to sector-specific mitigation actions. As of November 1, 2021, India has yet to submit their new or updated NDC. Vietnam mentioned detailed rice-specific activities for mitigation and adaptation, but these were not linked to any quantified measures for rice. The remaining top rice-producing countries either did not mention rice or have yet to submit their updated NDC by the date of this article publication (Table 4).

Several other countries were relatively advanced in quantifying their ambitions, such as Cambodia, Lao PDR, Sri Lanka, and Benin. Some associated their actions with respective GHG or non-GHG indicators and financial needs. For instance, Benin specified water management for irrigated rice on 52,000 ha with an estimated budget of 283.64 million USD (50% unconditionally and 50% conditionally) to avoid 0.2 MtCO_{2e}. Liberia aimed to reduce agricultural GHG emissions by 40% below BAU levels by 2030 (equivalent to 13 GgCO_{2e}) using low-emissions rice cultivation and reduced burning of field residues.

Table 4. Countries with the highest climate change mitigation potential from rice production (top ten listed in order from highest to lowest)

Country	Sector coverage ¹	Cost-effective mitigation potential, rice cultivation (Mt CO _{2e} /year)	Rice in mitigation actions in new or updated NDC	Previous NDC/INDC	New or updated NDC
India	NA	35 ²	NA	No mention of rice or paddy "It is clarified that India's INDC do not bind it to any sector specific mitigation obligation or action, including in agriculture sector."	Not submitted as of November 1, 2021
China	Economy-wide	25 ²	No	"To control methane emissions from rice fields and nitrous oxide emissions from farmland"	No
Indonesia	Economy-wide	13 ³	Refers to "crops" in quantified measures	"Implementation of water-efficient concept in water management on 820,000 ha by 2030." (agriculture)	"Implementation of water-efficient concept in water management on 820,000 ha by 2030." (agriculture)
Vietnam	Economy-wide	12 ²	No quantified measures for rice	"Contribution to GHG emissions mitigation: Rice cultivation; Field burning of agricultural residues."	<ul style="list-style-type: none"> ■ Replacing long-duration rice varieties with short-duration ones. ■ increasing areas with mid-season water drainage and alternating wet and dry irrigation techniques. ■ increasing areas with integrated crop management (ICM) or areas with the

					<ul style="list-style-type: none"> ■ “3 decrease 3 increase (3G3T)” and “1 must 5 decrease (1P5G)”; ■ converting inefficient rice growing models to the rice - shrimp model and converting the rice - rice model to the upland crop model. ■ reducing the rate of field burning of rice straw from 90% to less than 30%
Bangladesh	Economy-wide	11 ³	Quantified measures for rice	<ul style="list-style-type: none"> ■ “Scale up rice cultivation using alternate wetting and drying irrigation” ■ “20% of all rice cultivation uses alternate wetting and drying irrigation” 	<ul style="list-style-type: none"> ■ Upscaling alternate wetting and drying (AWD) in dry season rice field in 150,000 ha of crop lands ■ Rice varietal improvement for 3,240,000 ha crop lands ■ Nitrous oxide emission reduction from nitrogen-based fertilizer on 836,000 ha crop land ■ Improvement of fertilizer management (deep placement of urea in rice field, training, awareness) in 200,000 ha
Myanmar	Energy, Agriculture, FOLU, Transport	8.5 ²	No quantified measures for rice	“To mitigate GHG emissions from the agriculture sector from combustion of agricultural residues and growing rice in paddy fields.”	<ul style="list-style-type: none"> ■ Implementing System of Rice Intensification and improvement of Salinity tolerance and Submergence tolerant rice varieties ■ Multiplication and distribution of climate resilient rice
Thailand	Economy-wide	8 ²	No	No mention of rice or paddy	No
Philippines	Economy-wide	5.4 ²	No	No mention of rice or paddy	No
Brazil	Economy-wide	3.6 ²	No	No mention of rice or paddy	No
Pakistan	Economy-wide	2.6 ²	No quantified measures	“Manage water in rice cultivation to control release of methane from agricultural soils and introduce low water dependent rice varieties”	“Complete ban on open burning of rice stubble, solid waste and other hazardous materials”

¹NDCs, WRI Climate Watch (2021); ²Roe et al. 2021; ³Griscom et al. 2017

Policies for NDC implementation

National policies relevant to the implementation of NDC commitments in the rice sub-sector fall into two groups, (1) agriculture development and food policies and plans, and (2) climate action plans and programs. Agricultural policies include for example, Congo’s National Food Security Policy, Lao PDR’s Agriculture Development Strategy to 2025 and Vision to 2030, Cambodia’s Agriculture Sector Development Plan, Paraguay’s Marco de Política del Sector Agropecuario, and Sri Lanka’s Overarching Agriculture Policy. These documents provide high-level policy frameworks to develop concrete climate-smart agriculture programs, particularly for infrastructure, technology development, capacity building and knowledge management to improve food security, nutrition and resilience.

The common climate-focused policies are climate action plans, such as Bhutan’s Low Emission Development Strategy (LEDS) for Food Security 2021, Cambodia’s

Climate Change Strategic Plan (2019-2023), and Vietnam’s Target Programme on Climate Change Response and Green Growth 2016-2020. Some policies provide actions by geographic area such as the Bangladesh Delta Plan 2100 and Colombia’s Regional Plan Integral Change Climate for Orinoquia (PRICCO) 2018-2040. There are also policies that govern particular practices of rice production, i.e., water management (Cambodia’s Strategic Framework for irrigation sector and National Water Resources Management and Sustainable Irrigation Road Map and Investment, or the Climate smart agricultural water management of Bangladesh). Bangladesh also issued policies that specifically target methane emissions such as Bangladesh’s National Action Plan for Reducing Short-Lived Climate Pollutants.

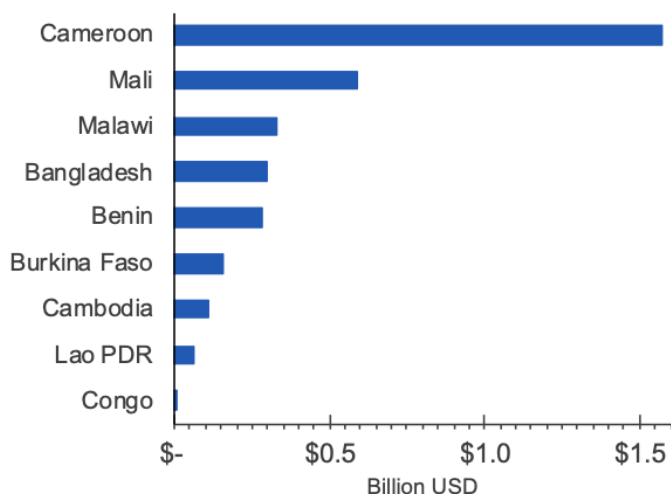
In light of the diversity in policies and plans aimed at climate actions in rice cultivation, it is crucial that the respective plans of each country are designed and implemented in harmony with the NDCs and with close

collaboration among stakeholders to optimise the use of resources within the constraint of time to achieve the nation's climate goals and commitments in their NDC.

Means of implementation

Finance. Although 28 countries included rice-specific mitigation and adaptation actions in their new or updated NDCs, only nine reported the estimated funding needed to realise their aims, ranging from 2.7 million USD to over 1.5 billion USD (Figure 2).

Figure 2. Financial needs for rice commitments in new and updated NDCs



Regarding finance, five countries (Bangladesh, Benin, Burkina Faso, Lao PDR, and Malawi) specified financial needs from domestic resources (unconditional) and/or international financing (conditional). Cambodia, Cameroon, and Congo did not specify the conditionality of finances but did define clear amounts for rice-specific actions rather than for agriculture (Table 5). Specifying finance amounts for actions and quantified measures could help countries in mobilizing domestic and international funding for reducing emissions in the rice sub-sector.

Table 5. Financial needs for rice actions in new and updated NDCs (million USD)

Country	Unconditional	Conditional	Not specified	Total
Bangladesh	99.7	196.3		296.0
Benin	141.8	141.8		283.6
Burkina Faso		160.0		160.0
Cambodia			111.7	111.7
Cameroon			1,570.0	1,570.0
Congo			2.7	2.7
Lao PDR		65.0		65.0
Malawi	233.0	100.0		333.0
Mali			590.0	590.0

Bangladesh is a typical case of how financial needs were presented for rice actions. Within 2021-2030, Bangladesh estimated budgets for three specific measures:

- Implement AWD in dry season rice fields: 17.65 million USD unconditionally and 35.29 million USD conditionally.
- Varietal improvement: 79.65 million USD unconditionally and 153.82 million USD conditionally.
- Fertilizer Management (deep placement in rice field): 2.4 million USD unconditionally and 7.2 million USD conditionally.

Capacity building and technology transfer. These cross-cutting matters were commonly discussed for the agriculture sector in general rather than particularly for rice. Colombia is noteworthy because they aimed at mass adoption of technology for rice production to improve rice yield, competitiveness and producer profitability while reducing costs.

Other countries included relevant capacity and technology enhancement in agriculture, rather than specific actions for rice. For example, Congo mentioned the importance of training and information and knowledge management for smallholder farmers to improve food security, nutrition and build resilience. To boost the adoption of climate resilient agriculture, Cambodia identified the need to enhance institutional capacity building and extension services, produce crop production manuals, and promote the transfer of climate-smart technologies, crop diversification, and rice seed purification techniques to farmers. Lao PDR emphasised strengthening capacity building at all levels and incentives for behaviour change in water management practices, while promoting agro-climate information services. These last two countries also mentioned the need to upgrade agricultural infrastructure, machinery and tools.

Social considerations

Most countries mainstreamed gender and social inclusion in their NDCs without specific mention of rice actions related to gender and social inclusion. Cambodia specifically mentioned gender and youth inclusion mainstreamed in various programs that included climate actions in rice and “crops” that can be assumed to include rice:

- Improvement of Agricultural Productivity and Diversification and Agri-Business Development of rice crops for increase production, improved quality and safety; harvesting and post harvesting technique and agribusiness enhancement.
- Improvement of support services and capacity building to crop production resilient to climate change by promoting research, trials and up-scaling climate-smart farming systems that increase resilience to climate change and extreme weather events.
- Research for the development and enhancement of agricultural productivity, quality, and transfer through

strengthening of crop variety conservation and new crop variety release responding to the impacts of climate change.

- Development of new technologies and increased yields by using new crop varieties which adapt to climate change.

Gender was specifically mentioned in the NDCs with regards to enhancing and ensuring women's economic empowerment and active participation in decision-processes within the value chain. NDCs emphasised post-harvesting opportunities and agro-business capacity building, including women in rice agriculture cooperatives (ACs), capacity development for leadership roles within ACs. Gender-related targets included Cambodia's NDC, which provided for (1) equal representation of women and men (50% women) participating in stakeholder consultations; (2) female farmers representing 35% (and up to 50% to be equal with men) of the total project beneficiaries of extension services, training and inputs, and (3) 50% of women beneficiaries self-reporting a reduction in their work burden as a result of project activities. Cambodia goes further by recommending women's active involvement in the research process, technology development and dissemination to enhance agriculture productivity and improve quality, although these are not rice-specific mentions. Other gender considerations in the NDCs included strengthening women's leadership roles and knowledge sharing to improve women's opportunities within the value chains or sustainable markets.

Youth-specific inclusions and targets related to rice were only mentioned by Cambodia. These included mentions that the 47% of youth who are involved in the agriculture sector will be provided with capacity development, technology transfer in various forms of sustainable agriculture including Climate Smart Agriculture (CSA), Sustainable Rice Platform (SRP) and Good Agriculture Practice (GAP).

Transparency challenges

Most of the NDCs that referred to rice actions specified the methodology of calculation, planning process, and assumptions following the UNFCCC's framework for information necessary for clarity transparency and understanding (CTU). Several countries, for instance Lao PDR and Paraguay, proposed mechanisms for monitoring and evaluation of NDC implementation. Notably, a number of countries such as Cambodia, Tajikistan, and Vietnam showed progress in designing or improving monitoring, reporting, and verification (MRV) systems for NDC implementation covering the rice sub-sector.

On the other hand, a number of countries mentioned limitations in GHG measurement and inventory as well as methods and data for calculating mitigation potential of

different actions in rice, leading to the lack of specific actions and quantifiable measures in the rice sub-sector.

Conclusion and recommendations

The majority of the top rice-producing countries, which also have the highest mitigation potential in the rice sub-sector, did not include quantified measures for the rice sub-sector in their NDCs. While 40% of countries in the world (101 countries out of 250 total) have potential mitigation opportunities in the rice sub-sector (Roe et al. 2021), only 24% of those with rice mitigation potential (24 out of 101) mentioned rice mitigation actions in their NDC commitments. The cost-effective annual global mitigation potential for rice is estimated to be 171 MtCO_{2e} (Roe et al. 2021) while the total quantified GHG reduction of the new and updated NDCs is 1.26 MtCO_{2e} (table 2). Only a few countries (17) quantified measures in the rice sub-sector. Without clearly quantified measures and transparent means to monitor, report, and verify reductions, it seems unlikely that we will be able to realize even a small fraction of the global rice mitigation potential. This is compounded by the fact that many of the countries that have the highest mitigation potential have not specified quantified measures in the rice sub-sector. Considering the most recent IPCC AR6 (2021) projections of global warming and sea level rise, it is imperative that we, as a global community, reduce emissions now, and in the future, to avoid a catastrophic climate path.

Parties need to increase their ambition and specify clear and quantified measures in rice, especially those countries with higher mitigation potentials. We recommend that countries aim for more ambitious, but still realistic and achievable targets in rice. These should be measurable targets, such as goals for specific amounts of GHG reduction from rice or a quantified area under low-emission rice production. These should be accompanied by estimates for both conditional and unconditional financing, and transparent MRV systems.

However, it is overwhelmingly clear that countries lack the expertise and resources to develop rice-specific quantified measures, financial investment plans, and MRV systems for the rice sub-sector. Linking experts and research to support countries in the development of their NDCs for the rice sub-sector is critical to advancing commitments and slowing the pace of climate change. Specifically, there is a need to focus on calculating GHG inventories and mitigation potential for different rice actions, establishing sound baseline data to measure change, supporting the development of MRV systems, developing financial investment strategies for rice, and strengthening links to global climate finance opportunities from both public and private sources.

Other NDC Research

- Briefs, maps & data: [Agriculture's prominence in the INDCs: data and maps](#) (2016)
- Wiese L, et al. 2021. [Countries' commitments to soil organic carbon in Nationally Determined Contributions. Climate Policy.](#)
- Wiese et al. 2019. [Enhancing Nationally Determined Contribution \(NDC\) ambition for soil organic carbon protection and sequestration.](#) CCAFS Info Note.

Further reading

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This series of briefs summarizes findings on livestock from an analysis of the nationally determined contributions to the Paris Agreement submitted between 2020-2021. This brief is one of a series on this analysis. The other Info Notes focus on the NDC's inclusion of SOC, livestock and policies related to soil organic carbon commitments in NDCs. This work was conducted as part of the CCAFS Low-Emissions Development Flagship.

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