

# Sectoral implementation of nationally determined contributions (NDCs)

May 2017

## AGRICULTURE

This publication forms part of a series of NDC sectoral overviews, which provide information about current sectoral contributions to global greenhouse gas emissions and prospects for implementing NDCs in these sectors.

Each briefing paper presents concrete options for integrating sectoral measures in future NDCs, as well as more general cross-sectoral recommendations for moving forward with emissions-reductions measures.

Written primarily from the perspective of climate change experts, with input and suggestions from sector colleagues, the briefing series' intended target audience is twofold: first sectoral experts, who are facing the challenge of implementing the NDCs and related climate policies in their respective sectors; and second climate change experts, highlighting the relevance of the sector for NDC implementation.

This briefing paper presents the situation and prospects for implementation of NDCs in the agriculture sector. As far as agriculture affects deforestation and / or overlaps with land-use change policies and measures, those aspects are covered in a separate briefing paper on forestry and land-use change.

## Agriculture and climate change

The scope of this paper covers the direct emissions of agriculture, and excludes (indirect) energy-related emissions that occur in the agriculture sector, for example, through the use of machinery. Energy-related agriculture emissions are equivalent to approximately 8% to 10% of direct agriculture emissions, and are normally addressed in climate change planning and reporting within the energy sector (Smith et al. 2014). In accordance with common emissions accounting practices by the FAO and the UN-FCCC for direct emissions from agriculture, emissions from forest-based land use change for agricultural expansion are not included in this paper.

### Implications of the Paris Agreement targets for the agriculture sector

The agriculture sector is one of the most vulnerable sectors to climate change, with significant impacts on agricultural yields, post-harvest losses and food security. Impacts are already happening in many countries, particularly in the tropics (IPCC 2014). However, the sector also is a major contributor to greenhouse gas emissions, accounting for approximately 5.2 GtCO<sub>2</sub>e emissions in 2014 (FAOSTAT 2016).

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Climate change in conjunction with soil erosion poses serious threats to agriculture.

Figure 1 shows that more than half of these emissions came from enteric fermentation and manure in the live-stock sector, with direct emissions from arable agriculture and the burning of savanna and crop residues accounting for the remainder (FAOSTAT 2016). Figure 1 also shows that the majority of emissions from the agriculture sector are from developing countries and that emissions from these countries are forecast to continue to increase under current policies<sup>1</sup>. Agricultural emissions from developed

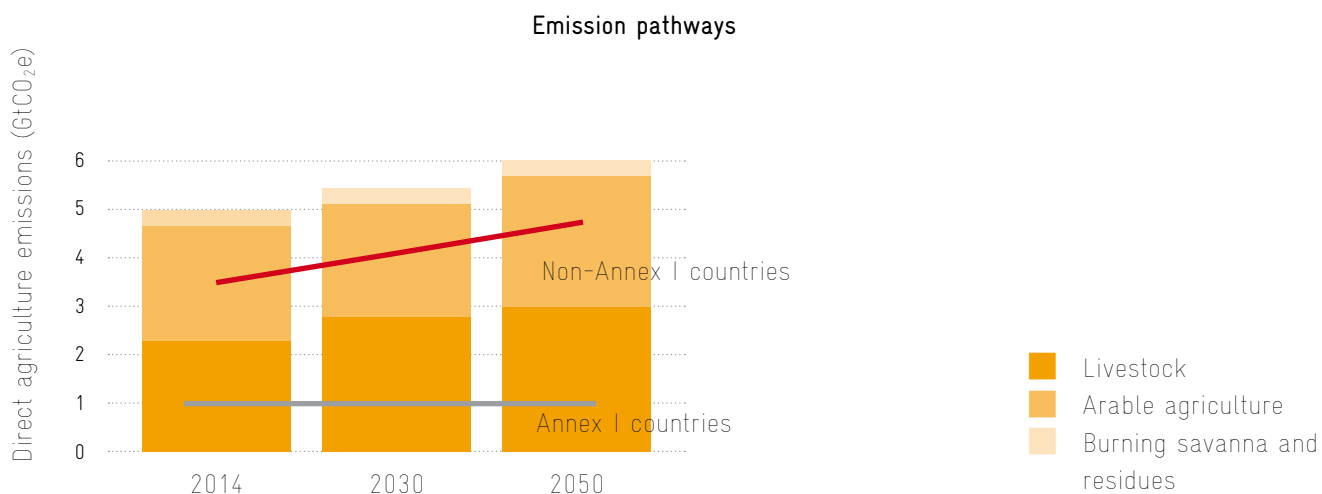
countries, in contrast, are forecast to remain relatively constant for the foreseeable future under current policies. A key driver of emissions in the agricultural sector is population dynamics, which is associated with increases in food demand, resource use and changing consumer behaviors. Population growth and meat consumption is generally increasing much faster in developing than in developed countries; China and Brazil have nearly doubled their per capita meat consumption in the past two decades (Climate Action Tracker 2016a).

Agricultural expansion is also a key driver for emissions related to land-use change, for example through deforestation driven by commercial agriculture products like palm oil (considerations on land use change and forestry are discussed in a separate briefing paper of this briefing series, which focuses on the forestry sector).

Achievement of the long-term target of the Paris Agreement – to limit temperature increase to “well below 2°C” – requires faster developments towards reducing greenhouse gas (GHG) emissions in the sector, as presented in Table 1.

#### Approaches and opportunities for mitigation in the agriculture sector

Three overarching mitigation strategies can be considered for the agriculture sector: supply-side strategies, demand-side strategies, and cross-cutting strategies (Dickie et al. 2014; FAO 2010; Lipper et al. 2014).



**FIGURE 1:** Projected emission pathways from direct agriculture emissions. Authors’ own elaboration, based on FAOSTAT (2016).

<sup>1</sup> Current policy pathways consider the likely trajectories under existing policies and major targets, and assumes that these policies and targets are not further built upon. These trajectories are determined by independent third parties and may deviate from nationally determined baseline scenarios, the definitions of which are variable across countries.

TABLE 1: Selected implications of the Paris Agreement targets for the agriculture sector

| INDICATOR / SUBSECTOR   | SELECTED IMPLICATIONS OF PARIS AGREEMENT FOR REQUIRED PATHWAYS  |
|---|---|
| <b>Emissions</b><br>(whole sector, direct (non-CO <sub>2</sub> ) emissions)           | <p><b>2°C:</b> Global annual agriculture emissions must decrease by approximately 11-13% by 2030, compared to BAU projections (Wollenberg et al. 2016). Non-CO<sub>2</sub> emissions, including those from the agriculture sector, should be net-zero by around 2085 (UNEP 2016a).</p> <p><b>1.5°C:</b> Global annual agriculture emissions must decrease by approximately 30-50% by 2030, compared to BAU projections (Wollenberg et al. 2016). Non-CO<sub>2</sub> emissions, including those from the agriculture sector, should be net-zero by 2060-2080 (UNEP 2016a).</p> |
| <b>Emissions intensity</b><br>(whole sector, direct (non-CO <sub>2</sub> ) emissions) | <p><b>2°C:</b> Emission reduction targets can be met by 2025 if producers would adopt the best practices currently applied by 10-25% of producers that have the lowest emissions intensities (Climate Action Tracker 2016b).</p>  |
| <b>Research and development</b>   | <p>Many of the potential technologies and practices for broader emission reductions are not yet available; significant resources should be invested in continued research and development of these technologies and practices (Climate Action Tracker 2016b).</p>   |

» **Supply-side mitigation strategies** focus on practices that aim to reduce emissions from crop and livestock production. Some of these measures, which have been successfully implemented – albeit with limited uptake – include improving efficiency through intensification, reducing emission intensity of production through improved nitrogen fertilizer management for crops, reducing emissions from enteric fermentation, sequestering carbon in agricultural systems, reducing methane emissions from rice cultivation, and managing manure. Between 1990 and 2010, the emissions intensity of the agriculture sector — greenhouse gas emissions per value added (% of GDP) — decreased by 25% (Climate Action Tracker 2016a). In comparison, the intensity of CO<sub>2</sub>e emissions from all sectors, relative to GDP, fell by approximately 50% in the same period (World Bank 2016). The limited progress in reducing emissions in the agriculture sector compared to other sectors is partly due to the relatively slow dispersion of best practices. The limited or uncertain mitigation potentials from currently known practices also are a factor in the slow uptake of emissions-reducing measures.

» While most existing strategies for emissions reductions in the agriculture sector to date have been aimed at supply-side mitigation, there is an even greater potential to reduce emissions through **demand side strategies**. Changing diets (specifically through the reduction of meat consumption),

reducing food waste and reducing food losses are some examples. In contrast to the moderate mitigation successes on the supply side, trends from the demand side show continuous emission increases. Worldwide meat consumption per capita increased by 30% between 1990 and 2010, and continues to grow at a similar rate (Climate Action Tracker 2016a).

» **Cross-cutting strategies** affect both supply side mitigation and demand-side improvements. This may include, for example, certification systems and emission-tracking for supply-side entities, which could influence consumer preference on the demand side. Such approaches are not in common usage for climate-related indicators.



Capacity building is key for making agricultural practices climate-resilient. Here, Jordan farmers are attending a consultative meeting on irrigation.



Although net-zero emissions should be achieved across all sectors within this century, there is currently no common consensus on how this should happen for non-CO<sub>2</sub> emissions from agriculture. Even with thorough implementation of technical mitigation potential for the supply side, based on current available technologies and practices, absolute emissions from the sector may still increase up to 2030 (Dickie et al. 2014). The fact that there are currently no clear technology options for long-term net-zero emissions on the supply side, indicates that demand-side mitigation strategies and cross-cutting measures are especially relevant if progress is to be made on long-term mitigation.

Conflicts often arise when considering how to merge the climate change and food production agendas. On the one hand, food production has been increasing to ensure food security. On the other hand, the production practices are often detrimental in terms of the associated increases in emissions and harm to the environment. Climate smart agriculture (CSA) focuses on ensuring sustainable food security under climate change and calls for approaches that address three objectives: sustainable increase of agricultural productivity and incomes, adapting and building resilience to climate change, and reducing and/or removing GHG emissions where possible<sup>2</sup>. These objectives are further reflected in the Sustainable Development Goals (particularly SDG2 – hunger and food security, SDG12 – sustainable production and consumption, SDG13 – climate change and SDG15 – protection of terrestrial ecosystems).

Non-state actors, including private sector entities, are playing an increasingly important role on climate change mitigation and adaptation in many sectors. In the agriculture sector, there is significant potential for private sector entities and farmers to optimize supply chains for climate resilience, with associated benefits for mitigation outcomes (UNFCCC 2016; Hsu et al. 2016). Across international cooperative initiatives (ICIs)<sup>3</sup> agriculture was the third most frequently covered sector in 2015, after energy supply and transport, and is also covered under many more forestry-oriented initiatives (UNEP 2016b). Such initiatives are increasingly catalyzing action in both commercial and small-holder agriculture.

<sup>2</sup> See FAO (2016a) for further information on the CSA perspective.  
<sup>3</sup> See further information on ICIs at the UNFCCC portal: <http://unfccc.int/focus/mitigation/items/7785.php>

## Agriculture sector in NDCs

That 78% of Parties' mitigation contributions included the agriculture sector, is not a clear indication of the extent to which agriculture sector strategy plans are generally integrated with and represented in the NDCs. Figure 2 shows that although 78% of NDCs (representing 148 Parties) do include agriculture in the mitigation component of their NDC, just 36% of NDCs (representing 68 Parties) make explicit reference to targets, policies and measures or actions for the agriculture sector specifically, whilst for the remainder, agriculture is included in broader economy-wide targets, often just implicitly (FAO 2016b). From those NDCs that specify measures more clearly, the following trends are apparent:

- » Only supply-side mitigation measures are included in NDCs. There are no significant references to demand-side measures, which appear to remain considerably underrepresented in climate change planning, perhaps due to the political and cultural sensitivity of such measures.
- » Measures related to cropland management are much more frequent than those related to grazing-land management or livestock in mitigation contributions, although there is considerable mitigation potential in the livestock sector.

Although agriculture targets are generally included in the NDCs of developed countries more often than for developing countries, a far greater proportion of developing country NDCs refer to concrete policies and measures for mitigation in agriculture (FAO 2016b). Similar to other sectors where climate has not yet been mainstreamed, the agriculture sector's comparatively low level of integration



Agriculture and forests are both important sources of GHG emissions and carbon sinks.

## Coverage of the agriculture sector in NDCs

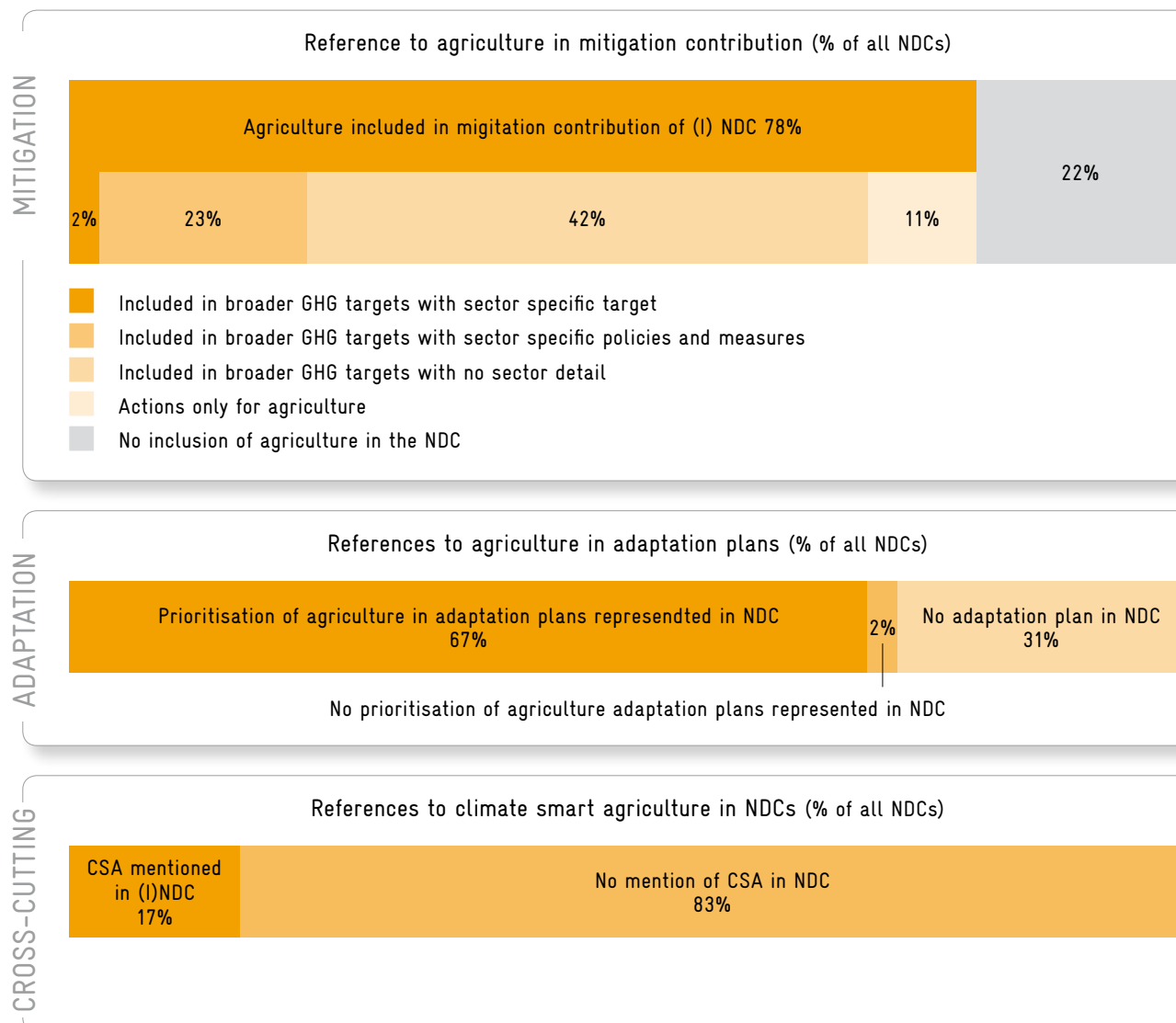


FIGURE 2: Overview of agriculture sector coverage in NDCs. Authors' own elaboration, based on FAO (2016b).

in the mitigation contributions of NDCs may be due to a lack of political will and difficulties with engaging sectoral experts and decision-makers during the INDC's development. Reported difficulties related to the availability of climate-related information and data in the sector, along with the inherent technical uncertainty related to mitigation options for the sector, may also be technical barriers that are preventing agriculture from being more prominently represented in mitigation aspects of NDCs.

In contrast, the integration of agriculture in climate change adaptation plans is far more comprehensive, particularly for developing countries; Figure 2 shows that 67% of the 131 Parties that submitted adaptation plans

in their NDCs referred to cropland and/or livestock as a priority area for adaptation (FAO 2016b). Food security, in particular, is a key concern for most countries. Reflecting an integration of their planning processes for climate change mitigation, adaptation and development objectives, 32 countries made explicit reference to climate smart agriculture (CSA) in their NDCs.

Some countries specifically mention cost estimates in their INDCs. However, there is a general lack of information on costs. Where information is given, it remains unclear how such estimates were calculated. This has possibly to do with methodological challenges to economically assess policies and measures.

## Key steps for moving towards sector-driven implementation and ambition raising

Many of the key steps for moving ahead with NDC implementation and ambition raising are relevant for all sectors. They are summarised in this box. Further details on the individual steps can be found in the overview briefing paper of this briefing series.

**Establishment of institutional bodies for oversight of implementation and monitoring of progress:** Alignment of institutions based on optimisation of existing mandates, to include broader levels of governance in strategy making including finance and planning ministries, and devolvement of responsibilities to line ministries and agencies with most sector influence. Approaches developed should be resilient to government staff turnover.

**Development and dissemination of knowledge on climate requirements and benefits:** Enhancing understanding on the implications of the Paris Agreement for the sector, and the social and economic benefits of climate change mitigation and adaptation measures.

**Plans for achievement of sector targets, and review of potential for increasing ambition in specific sub-sectors:**

Stock-take and integration of subnational, national and non-state action, translation to subsector targets, determination of long-term full decarbonisation targets for the sector, and collation of this information into a target-based roadmap. Potential for ambition raising can be analysed based on regional best practice policies and consideration of targets for sub-sectors not covered in climate strategy.

**Planning and implementation of instruments to leverage investments:**

Evaluation of investment requirements and the role of private and public finance for leveraging those investments. Analysis of persisting barriers and development of concepts for projects/programmes that can address those barriers through unilateral action or international support (e.g. NAMAs).

**Revision of NDC:** Update content of NDC for greater transparency, clarity and in line with aligned national strategy and identified ambition raising potential.

**Introduction of policy packages and programmes to kick-start action:** Introduction of new policies and strengthening of existing policies, in accordance with sector planning process, and development and submission of proposals for internationally supported programmes (e.g. NAMAs).

## Moving ahead with implementation and raising ambition

Actions should be taken in the immediate- to short-term to enhance the integration of the agriculture sector in climate change planning and to begin to implement measures. Although the immediate implementation of planned measures is the most important step now for many sectors, the agriculture sector needs to first focus its efforts in many countries on integrating climate and development considerations into its planning processes. Many potentially implementable actions exist but are not yet taken up by farmers and other stakeholders. Improved production and dissemination of technical information is needed.

Specific considerations for the agriculture sector are presented in the following.

- » ***The Paris Agreement and the NDCs should mark a shift towards the better integration of planning processes for climate change and development objectives.*** As a sector with very high relevance for both climate change and development, one should expect

greater synergies between the planning processes for agriculture and climate change. This merging of agendas should be reflected in future NDC revisions. Revisions should also consider potential conflicts between climate and development objectives, and should have greater clarity regarding sector and sub-sector targets. This might include the use of mitigation / net-zero emission indicators and specific targets related to these indicators. Improvements could also be made with regard to transparency in terms of what the agriculture targets cover, for example, do they include land use change emissions and carbon sinks?

- » ***Further integration of agriculture line ministries with climate change planning processes will be essential if mitigation options are to be mainstreamed throughout the agriculture sector.*** Line ministries responsible for agriculture and rural development have significant experience with the preparation and implementation of programs that aim to reach even the most remote stakeholders. The line ministries' should, therefore, be included in planning processes targeting climate change mitigation

and adaptation action. Ideally greater responsibility would be devolved to the line ministries to promote a more effective implementation of NDC action in the sector.

- » ***Information and data availability in the agriculture sector must be enhanced to support climate planning processes and implementation.*** Both planning and implementation remain hindered in the agriculture sector due to lack of data and lack of locally appropriate information on mitigation potentials. In particular, options for deep emissions reductions in the sector are not well understood for any regions or agricultural sub-sectors. There is a significant role here for the international community to play with regard to the provision of technical assistance for capacity building, as well as for increasing research and development efforts. Countries could also develop strategies to outline how they intend to ratchet up of ambition and address national concerns such as food security and economic pressures.
- » ***Capacity building is needed not only at the institutional level but also along the supply chain, upstream as well as downstream to farm managers.*** Enhanced understanding of the issues of climate change, the potential to apply certain technologies and practices, and the costs and benefits of mitigation measures for the supply chain, farmers and consumers (see, for example, New Climate Economy 2014), can increase the uptake of existing and available practices with co-benefits for adaptation, production and mitigation outcomes. Corporations also have an interest to implement measures in their agricultural supply chains to increase resilience and minimize profit risks. Information and even mechanisms for the delivery of technologies, could be provided by agricultural extension services, which are already established in rural areas.
- » ***Cost-sharing potential may exist in the agriculture sector through synergies with climate change plans related to forests, biomass energy and biofuels, amongst others.*** Further understanding of the commonalities between the plans for these sectors may reduce the costs of currently available measures and practices.
- » ***Public participation in planning of potential demand-side measures could be enhanced.*** The planning and implementation of such measures are often challenging due to barriers of political and

cultural acceptability. More research and understanding of what drives behavioral change may also serve to better inform demand-side strategies.

- » ***Regional best practices for proven measures should be replicated,*** particularly those related to incentive instruments for private sector leadership in the rollout of available supply-side and demand-side measures.

## FURTHER READING

Further details on the topics discussed in this briefing paper may be found in the following sources, amongst others:

### Emission scenarios for the agriculture sector

FAOSTAT provides a comprehensive overview of climate change statistics for the sector, included future projections based on current policies. The availability of statistical information related to emission projections for multiple scenarios remains highly limited, aside from individual studies.

- FAOSTAT → [Statistics from the Food and Agriculture Organisation](#) (statistical databases on food and agriculture, including historical and projected climate change indicators for agricultural subsectors).

### Long term implications of 2°C and 1.5°C for the sector

Reflecting uncertainty in the long-term technical options for achieving net-zero emissions in the agriculture sector, the availability of information related to 2°C and 1.5°C pathways for the sector remains highly limited. The following sources summarize some of the available information.

- UNEP, 2016 → [Emissions Gap Report 2016](#) (indication of timeline for reaching net-zero emissions from non-energy sectors).
- Climate Action Tracker, 2016 → [10 most important steps to limit warming to 1.5°C](#) (Chapter 8: requirements and feasibility of options for 1.5°C compatibility in commercial agriculture).

### Integration of agriculture sector in NDCs

Reflecting uncertainty in the long-term technical options for achieving net-zero emissions in the agriculture sector, the availability of information related to 2°C and 1.5°C pathways for the sector remains highly limited. The following sources summarize some of the available information.

- FAO, 2016 → [The agriculture sectors in the Intended Nationally Determined Contributions](#) (overview of the inclusion of various agriculture sub-sectors in INDCs, including statistical information on sector inclusion and target types for mitigation and adaptation).
- World Bank, 2016 → [NDC Platform](#) (searchable database of sector and sub-sector specific details in all NDCs).

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### About the GIZ Climate Policy Support Programme

GIZ Climate Policy Support Programme aims at developing and mainstreaming innovative approaches to tackle the challenges of climate change in the context of German Development Cooperation. On behalf of the Federal Ministry for Economic Cooperation and Development (BMZ), it supports developing countries in their efforts to mitigate climate change and to adapt efficiently to its impacts. Through conceptual and practical activities, the Climate Policy Support Programme actively contributes to the implementation of the Paris Agreement and the UN Sustainable Development Goals.

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Registered offices  
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Friedrich-Ebert-Allee 40  
53113 Bonn, Germany  
T +49 61 96 79-0  
F +49 61 96 79-11 15

E [climate@giz.de](mailto:climate@giz.de)  
I [www.giz.de/climate](http://www.giz.de/climate)

**Programme:**  
Climate Policy Support Programme

**Responsible/contact:**  
Axel Olearius  
E [axel.olearius@giz.de](mailto:axel.olearius@giz.de)

**Authors:**  
Briefing paper agriculture:  
Thomas Day, Maria Jose de Villafranca Casas,  
Katharina Lütkehermöller, Frauke Röser  
Broader briefing series:  
Frauke Röser, Thomas Day, Katharina Lütkehermöller, Markus Hagemann,  
Frederic Hans, Maria Jose de Villafranca Casas, Antoine Warembourg,  
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