



Food and Agriculture  
Organization of the  
United Nations

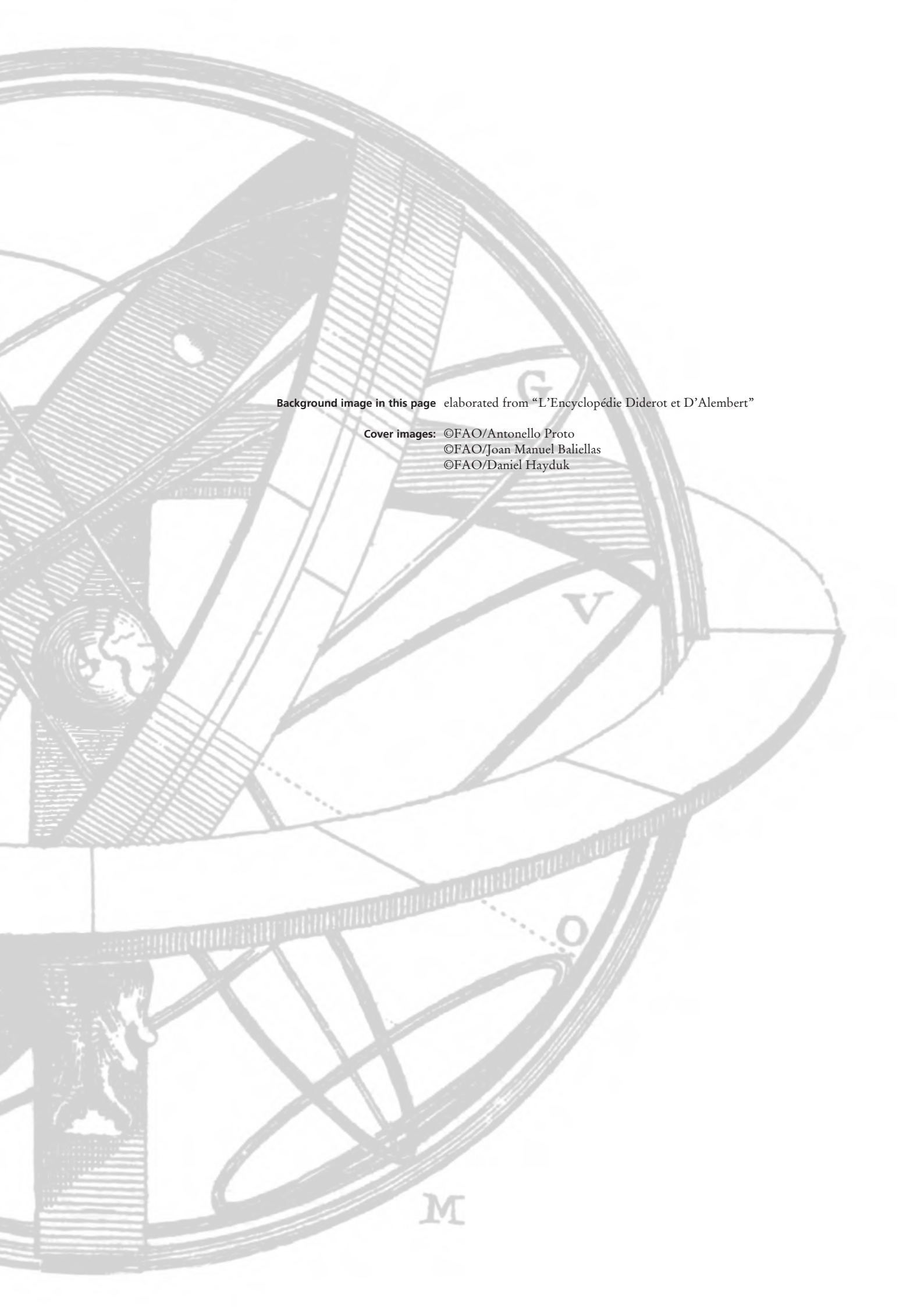
61

# THE AGRICULTURE SECTORS IN THE INTENDED NATIONALLY DETERMINED CONTRIBUTIONS: Analysis

ENVIRONMENT AND NATURAL RESOURCES MANAGEMENT WORKING PAPER

ENVIRONMENT [ CLIMATE CHANGE ]





**Background image in this page** elaborated from “L’Encyclopédie Diderot et D’Alembert”

**Cover images:** ©FAO/Antonello Proto  
©FAO/Joan Manuel Baliellas  
©FAO/Daniel Hayduk





# THE AGRICULTURE SECTORS IN THE INTENDED NATIONALLY DETERMINED CONTRIBUTIONS: Analysis

This draft working paper describes FAO's analysis of how the Intended Nationally Determined Contributions (INDCs) account for the agriculture sectors (crops, livestock, fisheries and aquaculture, as well as forestry). This working paper is open for public comment. Please send your comments to [INDC-Analysis@fao.org](mailto:INDC-Analysis@fao.org) by 15 July 2016.

Any mistakes or misinterpretations are the sole responsibility of the authors of this analysis. The reference shall be the INDCs as published on the UNFCCC website.

The designations employed and the presentation of material in this information product do not imply the expression of any opinion whatsoever on the part of the Food and Agriculture Organization of the United Nations (FAO) concerning the legal or development status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. The mention of specific companies or products of manufacturers, whether or not these have been patented, does not imply that these have been endorsed or recommended by FAO in preference to others of a similar nature that are not mentioned.

The views expressed in this information product are those of the author(s) and do not necessarily reflect the views or policies of FAO.

ISBN 978-92-5-109244-6

© FAO, 2016

FAO encourages the use, reproduction and dissemination of material in this information product. Except where otherwise indicated, material may be copied, downloaded and printed for private study, research and teaching purposes, or for use in non-commercial products or services, provided that appropriate acknowledgement of FAO as the source and copyright holder is given and that FAO's endorsement of users' views, products or services is not implied in any way.

All requests for translation and adaptation rights, and for resale and other commercial use rights should be made via [www.fao.org/contact-us/licence-request](http://www.fao.org/contact-us/licence-request) or addressed to [copyright@fao.org](mailto:copyright@fao.org).

FAO information products are available on the FAO website ([www.fao.org/publications](http://www.fao.org/publications)) and can be purchased through [publications-sales@fao.org](mailto:publications-sales@fao.org).

# CONTENTS

v	Acronyms
vii	Executive Summary
1	<b>1. INTRODUCTION AND METHODOLOGY</b>
1	1.1. Purpose and structure
2	1.2. Methodology
3	<b>2. OVERVIEW OF THE INTENDED NATIONALLY DETERMINED CONTRIBUTIONS</b>
3	2.1. Coverage of Mitigation
3	2.1.1. Sectors
4	2.1.2. Type of contribution
6	2.1.3. Mitigation Measures
7	2.2. Coverage of Adaptation
9	<b>3. TARGET-BASED MITIGATION IN AGRICULTURE AND LULUCF</b>
9	3.1. Agriculture
11	3.2. LULUCF
15	<b>4. ACTION-BASED MITIGATION IN AGRICULTURE AND LULUCF</b>
15	4.1. Agriculture
16	4.2. LULUCF
19	<b>5. VULNERABILITIES AND NATIONAL CIRCUMSTANCES</b>
19	5.1. Food security and nutrition vulnerabilities
20	5.2. Importance of the agriculture sectors
20	5.3. Biophysical vulnerabilities
21	5.4. Economic and social vulnerabilities
25	<b>6. ADAPTATION POLICIES AND OTHER MEASURES</b>
26	6.1. Long-term goals and vision
26	6.2. Adaptation planning and policies
27	6.3. Disaster risk management
29	6.3.1. <i>DRM in agriculture</i>
31	6.4. Loss and damage
31	6.5. Water management
32	6.6. The Agriculture Sectors
33	6.6.1. Crops
33	6.6.2. Livestock
33	6.6.3. Genetic resources
34	6.6.4. Fisheries and aquaculture
36	6.6.5. Forestry
37	6.6.6. Land use planning and land management
37	6.6.7. Diversification and income
38	6.6.8. Research and capacity building

39	<b>7. SYNERGIES AND CO-BENEFITS</b>
39	7.1. Synergies between adaptation and mitigation
41	7.2. Energy production and use
42	7.3. Co-benefits with other environmental, economic and social goals
45	<b>8. PLANNING AND IMPLEMENTATION OF THE INDCS</b>
45	8.1. Stakeholder engagement
45	8.2. Policies and Institutions
46	8.3. Financial resources
48	8.4. Gaps, barriers and needs
51	<b>REFERENCES</b>
53	<b>ANNEX</b>
53	<b>A. Methodology</b>
53	<i>A.1 Approach</i>
53	<i>Data collection and organization</i>
54	<i>A.2 Country Classification</i>
56	<b>B. Climate-Smart Agriculture (CSA) in the INDCs</b>
60	<b>C. Related INDC assessments</b>

# ACRONYMS

AI	Annex I
BAU	Business as usual
CCAFS	CGIAR Research Program on Climate Change, Agriculture and Food Security
CDKN	Climate and Development Knowledge Network
CDM	Clean Development Mechanism
CGIAR	Consultative Group on International Agricultural Research
COP	Conference of the Parties to the UNFCCC
CSA	Climate-smart agriculture
CZME	Coastal zone and marine ecosystems
DRM	Disaster risk management
DRR	Disaster risk reduction
EU ETS	European Union Emissions Trading System
EWS	Early warning system
FAO	Food and Agriculture Organization of the United Nations
GCF	Green Climate Fund
GDP	Gross domestic product
GHG	Greenhouse gas
GPS	Global Positioning System
INDC	Intended nationally determined contribution
IPCC	Intergovernmental Panel on Climate Change
IPPU	Industrial processes and product uses
JRC	Joint Research Center (the European Commission's science and knowledge service)
LAC	Latin America & Caribbean
LDC	Least-developed country
LEDs	Low-Emission Development Strategies and Plans
LLDC	Landlocked developing country
LULUCF	Land use, land-use change and forestry
M&E	Monitoring and evaluation
MRV	Measurement, reporting and verification
NAI	Non-Annex I
NAMA	National Appropriate Mitigation Actions
NAP	National Adaptation Plan
NAPA	National Adaptation Programmes of Action

REDD	Reducing Emissions from Deforestation and Forest Degradation; "REDD+" goes beyond deforestation and forest degradation, and includes the role of conservation, sustainable management of forests and enhancement of forest carbon stocks.
R&D	Research and development
SFM	Sustainable forest management
SIDS	Small-island developing states
SSA	Sub-Saharan Africa
UN/DESA	United Nations Department of Economic and Social Affairs
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNISDR	United Nations International Strategy for Disaster Reduction
VCS	Verified Carbon Standard
WRI	World Resource Institute



# EXECUTIVE SUMMARY

The Intended Nationally Determined Contributions (INDCs) served as the basis for negotiations at COP21 and helped produce the Paris Agreement on climate change. The INDCs will guide country-level climate action for the coming years.<sup>1</sup> INDCs include not only targets, but also concrete strategies for addressing the causes of climate change and responding to its effects. As at 31 March 2016, 188 countries<sup>2</sup> had submitted their INDCs to the UNFCCC.

FAO has analyzed the INDCs and found that the agriculture sectors (crops, livestock, fisheries and aquaculture, as well as forestry) feature prominently in meeting national mitigation and adaptation goals. This is a clear signal: the agriculture sectors are central to the response to climate change.

The INDCs were not prepared according to a standard format. While many Parties followed non-binding guidance, the INDCs are heterogeneous in length, coverage and level of detail. All 188 countries refer to mitigation commitments in their INDCs, while 70 percent include an adaptation section. Some specify detailed measures in specific sectors, while others only point to existing plans for further reference. This heterogeneity calls for caution in comparing country priorities and actions beyond broad patterns.

## Overview: the agriculture sectors in the INDCs

The agriculture sectors feature prominently in the INDCs. Ninety-four percent of all countries include the agriculture sectors in their mitigation and/or adaptation contributions. Developing countries – particularly the least-developed countries (LDCs) – put a strong emphasis on these sectors. Many of these countries highlight the role of agriculture, forestry and fisheries in economic development, particularly for employment, exports and rural development. Many also point to the vulnerabilities of these sectors to climate change.

## Mitigation

Agriculture<sup>3</sup> and land use, land-use change and forestry (LULUCF) are among the most referenced sectors in countries' mitigation contributions (targets and/or actions). LULUCF is referenced in 77 percent of all countries' INDCs, and as such is second only

1 Following the Paris Agreement, countries' INDCs will become Nationally Determined Contributions (NDCs).

2 161 INDCs were submitted to the UNFCCC, corresponding to 188 countries (the European Union INDC corresponds to 28 countries). Libya, Nicaragua, North Korea, State of Palestine, Syria, Timor-Leste and Uzbekistan have not yet submitted their INDCs. Panama submitted its NDC on 19 April 2016, which is not included in this analysis.

3 In the context of mitigation, 'Agriculture' – in accordance with IPCC terminology – includes emissions from enteric fermentation, manure management, rice cultivation, prescribed burning of savannas and grassland, and from soils (i.e. agricultural emissions). Emissions related to forest and other land use are covered under LULUCF



to the energy sector. Agriculture is mentioned in 73 percent of the countries' mitigation contributions. When considered together, 86 percent of countries refer to agriculture and/or LULUCF.

**The mitigation potential of agriculture and LULUCF is prominently acknowledged in all regions and at all levels of socio-economic development.** On average 80 percent of countries in all regions point to agriculture and/or LULUCF as a means of mitigating climate change. These are equally well represented in the INDCs of the most and least developed countries, with around 95 percent of both groups pointing to agriculture and/or LULUCF.

**Developing countries put a strong emphasis on the agriculture sectors in their mitigation contributions.** About 92 percent of countries in Sub-Saharan Africa (SSA) refer to these sectors under their mitigation contributions. The corresponding figure in Eastern, South-Eastern and Southern Asia is around 90 percent. Among the Latin American and Caribbean (LAC) countries, 84 percent refer to the agriculture sectors in their mitigation section. In Northern Africa and Western Asia, the figure is a more modest 70 percent. Meanwhile, in Oceania and the economies in transition in Europe and Central Asia, the agriculture sectors feature in only 50 percent of the countries' mitigation contributions. In the case of developed countries, this figure is almost 95 percent.

About 82 percent of Sub-Saharan African countries refer to mitigation in **agriculture** (crops and livestock). In most other regions this figure ranges from 61 to 67 percent, with the exception of Oceania where only 21 percent of countries do so. For **LULUCF**, the figure in Eastern and South-Eastern Asia is 85 percent. LULUCF is similarly prominent in the INDCs of countries in Sub-Saharan Africa. LULUCF is also included in the mitigation contributions of many countries in Southern Asia (78 percent) and Latin America and the Caribbean (77 percent).

**Countries rarely include quantified sector-specific targets for agriculture and LULUCF.** Most countries consider mitigation in agriculture and LULUCF as part of an economy-wide GHG target.

**Many countries include specific actions (policies and measures) in agriculture and LULUCF.** Actions put forward by countries in agriculture focus on cropland management, livestock management and grazing land management. For LULUCF, the actions mentioned by countries can be grouped under forest management and restoration, afforestation/reforestation and reducing deforestation.

## Adaptation

**Adaptation is a key concern for developing countries (including LDCs).** About 95 percent of these countries include an adaptation section. This ranges from 100 percent in Sub-Saharan Africa and Eastern and South-Eastern Asia, to 79 percent in Oceania. None of the INDCs submitted by developed countries include an adaptation section.

**The agriculture sectors are the foremost priority for adaptation.** Among the 130 countries that include an adaptation section, 95 percent refer to crops and livestock, while 83 percent refer to forests and 46 percent refer to fisheries and aquaculture. Across all

regions, most countries that include an adaption section refer to the agriculture sectors. The emphasis on the agriculture sectors is particularly pronounced in Sub-Saharan Africa, where all countries point to these sectors in relation to adaptation. All of the countries in Latin America and the Caribbean, Southern Asia and Oceania that include an adaptation section in their INDC (94 percent, 89 percent and 79 percent respectively) refer to the agriculture sectors in this context.

**Countries highlight the vulnerability of the agriculture sectors to climate change.**

Of the countries that discuss climate-induced risks at the sector level, almost 90 percent mention the agriculture sectors and 60 percent mention freshwater resources. Thirty-nine countries list climate change as a major threat to food security.

**Most LDCs highlight extreme events as their central adaptation challenge, whereas developed countries emphasize temperature rise.** Seventy percent of all countries discuss vulnerability, though this varies significantly in accordance with the level of socio-economic development: One hundred percent of LDCs and 90 percent of other developing countries address vulnerability, whereas 44 percent of countries in transition and seven percent of developed countries do so. Among the 131 countries that highlight vulnerabilities, the majority point to extreme events (i.e. droughts, floods) as a foremost threat to the environment and socio-economic development, while almost half of the countries refer to changes in weather patterns. However, there are significant disparities when results are disaggregated by development status: more than 80 percent of the LDCs mention droughts and floods among their immediate threats, whereas developed countries identify the rise in temperature as the major hazard affecting the livelihoods of their populations.

**Countries reflect on the importance of disaster risk reduction (DRR) in the agriculture sectors.** Thirty percent of the countries that include adaptation measures refer to disaster risk management (DRM) in the agriculture sectors. This is specified most often by LDCs (37 percent) and economies in transition (33 percent). Almost half of the countries in Eastern and South-Eastern Asia refer to the agriculture sectors in the context of DRM, while 35 percent of countries in Sub-Saharan Africa do so. The most common measures include understanding disaster risks by assessing national circumstances and strengthening disaster resilience. By contrast, disaster risk governance is rarely addressed at the sectoral level.

### **Synergies and co-benefits**

**The agriculture sectors are most often referred to in the INDCs as providing adaptation-mitigation synergies, as well as socio-economic and environmental co-benefits.** Around one third of all countries acknowledge (and in some cases prioritize actions based upon) the potential synergies between mitigation and adaptation. Almost 30 percent of countries mention social, economic and environmental co-benefits, particularly rural development and health, poverty reduction and job creation, and conservation of ecosystems and biodiversity. With regard to gender equality, the agriculture sectors are highlighted – more

so than any other sector – as providing diverse opportunities for empowering women as well as reducing their vulnerability to climate change.

**The agriculture sectors also play a role in meeting countries' commitments for mitigation in the energy sector.** Ninety-eight percent of all countries refer to energy as a sector for mitigating climate change. Many countries intend to substitute fossil fuels with cleaner energy sources and renewable energy. This has important implications for the agriculture sectors, as evidenced in the INDCs. Forty percent of all countries explicitly refer to bioenergy production when discussing mitigation measures in the agriculture sectors (e.g. crop production for biofuels), while about 11 percent of countries plan measures that reduce energy use in the agriculture sectors (e.g. solar irrigation schemes). Eleven percent of all countries explicitly point to fuelwood harvesting as a driver of deforestation and forest degradation.

**Climate-smart agriculture (CSA) is highlighted as contributing to both adaptation and mitigation.** Thirty-one countries (including 40 percent of LDCs) specifically refer to CSA in their INDCs. About one-third of these countries – all in Sub-Saharan Africa – highlight CSA as an approach to pursue both adaptation and mitigation goals. Approximately 19 percent of these countries refer to CSA only in relation to mitigation, and about 50 percent do so in relation to adaptation.

### Implementation

**Many countries highlight specific policies that relate to the preparation and/or implementation of their INDC.** About 80 percent of all countries refer to policies and frameworks that were used to prepare their INDC, while 72 percent point to existing or planned policies that will support INDC implementation. This is particularly common among LDCs; 87 percent mention at least one policy or plan that was used as a basis for formulating their INDC, while 68 percent point to at least one policy or plan that will support INDC implementation.

**All of the LDCs and more than 90 percent of the other developing countries indicate their need for financial support.** Regarding possible funding sources across various sectors, about 15 percent of all countries mention the Green Climate Fund (GCF). Some countries note the need for international assistance to strengthen their institutional framework and human capacity to deal with the complexity involved in accessing climate finance. Some countries call for immediate increased contributions to the GCF and stress that international sources should include reliable, additional official development assistance, and not redirected/labeled flows.

**Many countries also indicate their technical and capacity building needs in relation to the agriculture sectors.** Countries frequently refer to the need for technical support to develop forest inventories and national planning systems, or approaches to reduce dependence on inefficient bioenergy technologies. With regards to capacity building, countries refer to the need for best practices on sustainable forest management and climate-smart agriculture, and highlight the need for support in implementing afforestation and



reforestation activities. Countries also request training on how to assess (or improve established methods for) GHG emissions and removals.

FIGURE 1.

**Countries that refer to mitigation in Agriculture, LULUCF, or both.**

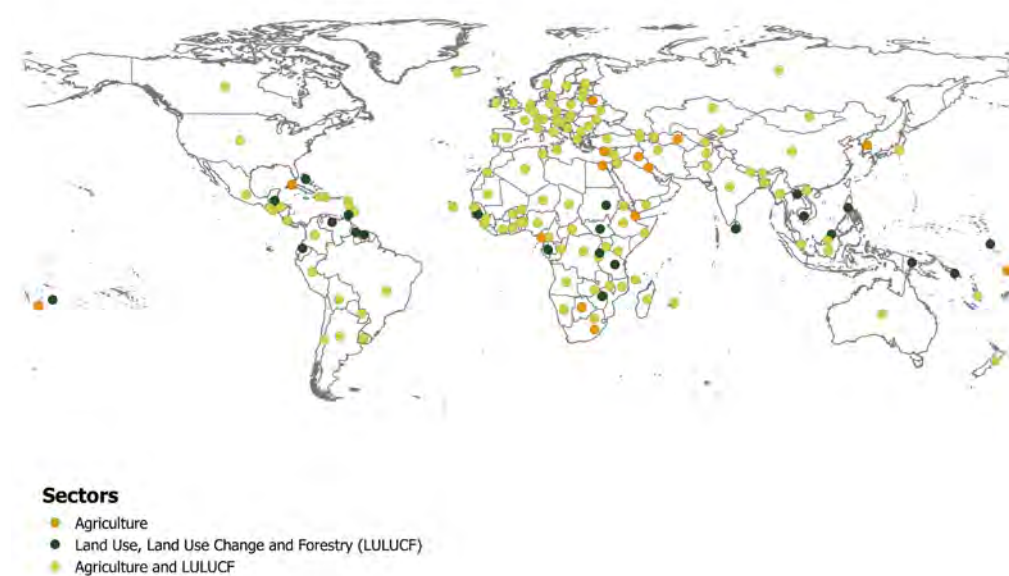
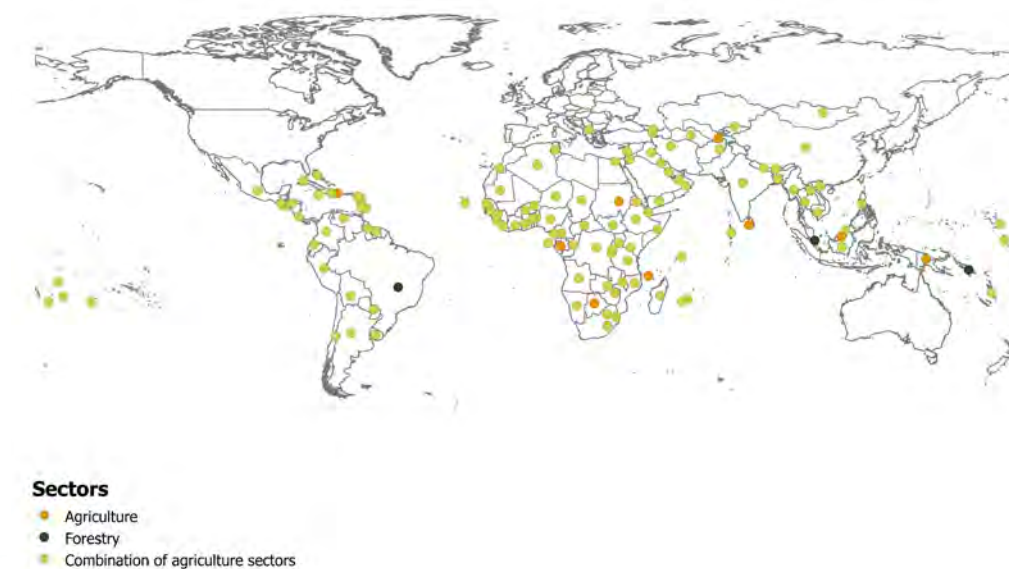


FIGURE 2.

**Countries that refer to adaptation in the agriculture sectors.**





# INTRODUCTION AND METHODOLOGY

The **Paris Agreement**<sup>4</sup>, endorsed by all Parties to the United Nations Framework Convention on Climate Change (UNFCCC) during COP21, includes important language on food security. The preamble refers to “safeguarding food security and ending hunger, and the particular vulnerabilities of food production systems to the adverse impacts of climate change”. Meanwhile, Article 2.1 mentions the importance of “increasing the ability to adapt to the adverse impacts of climate change and foster climate resilience and low greenhouse gas emissions development, in a manner that does not threaten food production”.

The **Intended Nationally Determined Contributions** (INDCs)<sup>5</sup> served as the basis for negotiations at COP21 and are credited with having helped produce the Paris Agreement on climate change. As of 31 March 2016, 161 INDCs had been submitted to the UNFCCC, corresponding to 188 countries and 189 Parties, respectively.<sup>6</sup> The INDCs mark countries’ climate change strategies until 2030 and beyond. They include measures to address the causes of climate change (mitigation options) and respond to its effects (adaptation options).

The **agriculture sectors** (crops, livestock, forestry, fisheries and aquaculture) are significant contributors to global greenhouse gas (GHG) emissions. At the same time, they are and will be greatly affected by climate change. Concerted mitigation and adaptation actions are therefore vital to protect and enhance global food security and nutrition. The agriculture sectors thus will play an important role in accomplishing the targets and commitments expressed in the INDCs.

## 1.1. PURPOSE AND STRUCTURE

This report aims to provide an overview of how the agriculture sectors have been considered in the INDCs, taking into account the interdependencies characterizing these sectors. It provides a basis for the identification of priorities for international support for climate action in the agriculture sectors. The report aims to complement existing reports (see Annex C).

The outline of this report follows a structure similar to that of the UNFCCC synthesis report (2015).

4 Paris Agreement, FCCC/CP/2015/L.9/Rev.1.UNFCCC Secretariat. Available at: <http://unfccc.int/resource/docs/2015/cop21/eng/l09r01.pdf>

5 The INDCs are available at: <http://www4.unfccc.int/submissions/indc/Submission%20Pages/submissions.aspx>

6 Latvia submitted the INDC on behalf of the European Union, which counts for 29 Parties (28 member states and the European Union). The following seven Parties have not provided (I)NDCs yet: Libya, Nicaragua, North Korea, State of Palestine, Syria, Timor-Leste, Uzbekistan. Panama submitted its nationally determined contributions (NDC) on 19 April 2016, and it is not included in this analysis.



## 1.2. METHODOLOGY

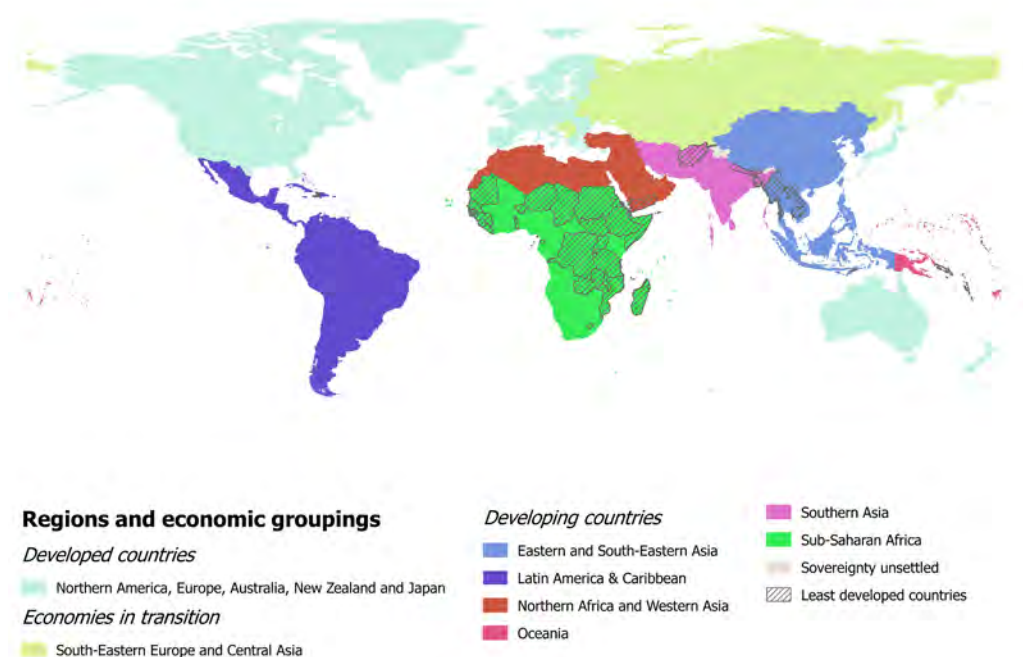
Each INDC was studied in full text to ensure a comprehensive assessment of the coverage of the agriculture sectors in this report. Original text was extracted into a database, which facilitates the replication and re-examination of the screening process. The data was cross-checked using a keyword search in English, French and Spanish.

Instead of denoting the percentage of INDCs that mention the issue, percentages, unless stated otherwise, refer to the number of countries that submitted an INDC (188 countries). While the UNFCCC (2015) use qualifiers (few, some, several, many, most) to denote the percentage range a respective indicator falls into, this assessment reports the actual percentages. However due to uncertainties associated with methodological aspects, gaps in information and the measured data, figures might vary by  $\pm 2$  percentage points.

Countries were aggregated according to their status of development<sup>7</sup> (least-developed countries, developing countries, economies in transition and developed countries). As the focus of the analysis is on developing countries, they were also considered by region<sup>8</sup> (see Figure 3).

FIGURE 3.

### Country classification



Further detail on the methodology and related challenges is presented in Annex A.

<sup>7</sup> The classification according to economic conditions follows the grouping by UN/DESA (United Nations, 2016).

<sup>8</sup> The regional classification follows the Statistics Division of the United Nations Secretariat, see <http://unstats.un.org/unsd/methods/m49/m49.htm>



# OVERVIEW OF THE INTENDED NATIONALLY DETERMINED CONTRIBUTIONS

All Parties' INDCs include contributions related to climate change mitigation. These contributions differ in type and coverage of sectors and greenhouse gases. 130 countries provide additional information on existing and intended adaptation measures in their INDC.

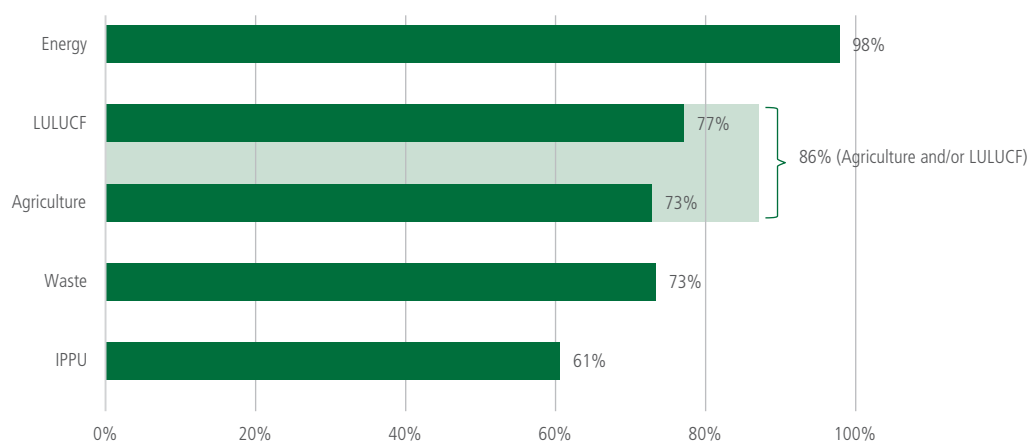
## 2.1. COVERAGE OF MITIGATION

### 2.1.1. Sectors

All but three countries include energy under their **climate change mitigation contributions**<sup>9</sup> (targets and/or actions). Mitigation in relation to Land Use, Land-Use Change and Forestry (LULUCF) is referenced in 77 percent of all countries' INDCs. Meanwhile, agriculture is included in 73 percent of countries' mitigation contributions. When considering agriculture and LULUCF together, 86 percent of countries refer to these sectors. As illustrated in Figure 4, these sectors are second only to the energy sector. Waste and Industrial processes and product uses (IPPU) sectors are referenced by 73 and 61 percent of countries respectively.

FIGURE 4.

**Percentage of countries addressing mitigation, by targeted sector**



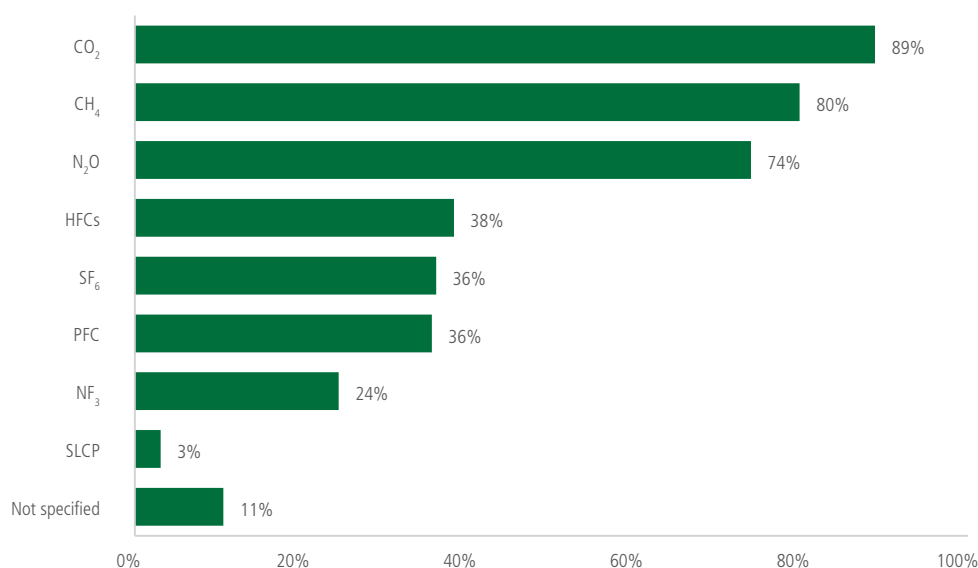
<sup>9</sup> When not explicitly stated otherwise, in the discussion of contributions to climate change mitigation, numbers refer to countries (188 including countries of the EU-28) or Parties (all countries including EU-28 which as an economic integration organization represents an own Party to the convention).



Almost 89 percent of countries explicitly mention that their INDC covers carbon dioxide emissions (CO<sub>2</sub>), while 80 percent refer to methane (CH<sub>4</sub>) and 74 percent to nitrous oxide (N<sub>2</sub>O). Between 35-40 percent of all countries cover hydrofluorocarbon (HFC), sulfur hexafluorides (SF<sub>6</sub>) and perfluorocarbon (PFC). Only 24 percent of countries cover all seven GHGs included in the Kyoto Protocol, including nitrogen trifluoride (NF<sub>3</sub>). Twenty countries do not specify their coverage of GHGs. Assuming that those 20 countries would consider at least CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O (which therefore represent the maximum percentage of countries accounting for those three greenhouse gases), it would result in a coverage of 100 percent, 94 percent and 88 percent respectively.

FIGURE 5.

**Percentage of countries addressing mitigation, by targeted GHG**



### 2.1.2. Type of contribution

About 80 percent of the INDCs contain **target-based** contributions (i.e. **GHG** and/or **non-GHG** outcomes). 20 percent include **action-based** contributions (e.g. policies, programmes and projects), either exclusively or in combination with targets. The targets (GHG target, or non-GHG target) and coverage of gases and sectors have significant implications for how the agriculture sectors are considered.

## BOX 1.

**TYPES OF GHG-TARGETS**

Types of mitigation outcome (UNFCCC, 2015 and Levin *et al.*, 2015)

***Reduction relative to business as usual:*** This relative target is used for reducing emissions below the 'business as usual' (BAU) level or compared to a scenario for the economy-wide mitigation targets. It is also called a Baseline scenario target.

***Absolute emission target:*** This target is expressed as an emission reduction below the level in a specified base year, or not linked to a base year but to an overall maximum absolute limit on emissions (e.g. carbon neutrality by a future date). This includes Base year emissions target and Fixed-level target.

***Intensity target:*** Intensity target refers to reductions in GHG emissions per unit of gross domestic product (GDP) or per capita relative to a base year or absolute level of per capita emissions by 2025 or 2030. It is also called a Base year intensity target.

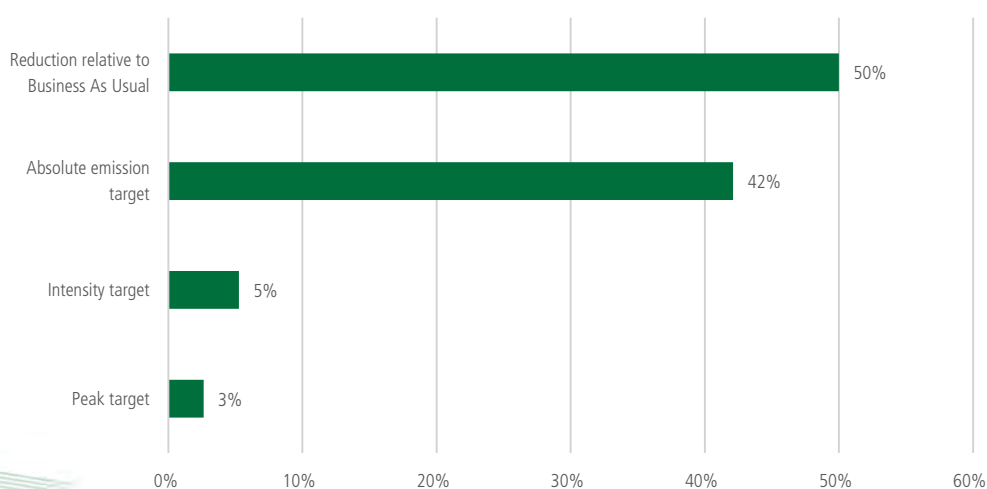
***Peak target:*** This target specifies the year or time frame in which the respective country's emissions are expected to peak. It is called also a trajectory target.

**GHG-target**

One hundred and fifty-two countries include GHG-targets. Fifty percent of these countries communicate their GHG reduction target relative to a business-as-usual (or baseline) scenario. Five of these are economies in transition, and the remainder are either LDCs or other developing countries. All of them are Non-Annex-I (NAI) Parties to the Convention.

FIGURE 6.

**Percentage of countries addressing mitigation, by GHG-target** (Note: only 80 percent of countries include a GHG-target in their INDC)



Absolute emission targets, including those relative to a base year, are used by 42 percent of the 152 countries that include a GHG-target. This type of target is most often used by industrialized economies, and in particular by all Annex-I (AI) Parties. About 95 percent of all developed countries and two-thirds of the economies in transition include such a target. Countries that include a base year target commonly refer to the years 1990, 2005 and 2010.

Four countries (Armenia, Bhutan, Costa Rica and Ethiopia) include economy-wide absolute level targets. Armenia, Bhutan and Costa Rica intend to achieve or maintain carbon neutrality. Meanwhile, Liberia states its intention to achieve carbon neutrality as a long-term contribution (by 2050), while Benin – which commits to action-based measures – sets a sectoral GHG-target of enhancing carbon sequestration by 1.4-5.7 percent. By sequestering/offsetting carbon, LULUCF plays a key role in achieving zero net carbon emissions in these cases.

Eight countries state intensity targets, i.e. the reduction of GHG emissions per unit of GDP (or per capita in the case of Israel). Half of these countries are emerging economies in Asia (China, Malaysia, Singapore and India).

#### **Non-GHG targets**

32 countries include non-GHG targets, most of which are combined with GHG-outcomes (20). Almost 80 percent aim to increase the share of renewable energy in electricity generation. One-third of these 32 countries set non-GHG targets in the forest sector.

#### **Action-based**

Twenty-four countries include only action-based contributions in terms of specific policies, programmes or projects, while nine further countries mention a combination of target- and action-based contributions. Actions are frequently related to economic diversification and cleaner energy. Countries from the Middle East most often used this type of target.

### **2.1.3. Mitigation Measures**

Many countries outline policies and other measures that are relevant to setting and/or achieving their targets. The most detailed information across all sectors is provided by developing countries, including LDCs.

Many countries highlight policies and programmes/projects that are already in place. These **existing measures** are usually not integrated into the baseline scenario, but are rather included as ways to achieve mitigation targets or as additional mitigation efforts.<sup>10</sup>

Forty-four countries refer to Nationally Appropriate Mitigation Actions (NAMAs) as a basis and/or means of supporting implementation of the INDC (20 and 80 percent, respectively).

<sup>10</sup> The extent to which INDCs explicitly refer to existing policies and programmes/projects also influences the length of the documents. While some countries only cite the respective frameworks, others incorporate parts of them in their INDCs.



## 2.2. COVERAGE OF ADAPTATION

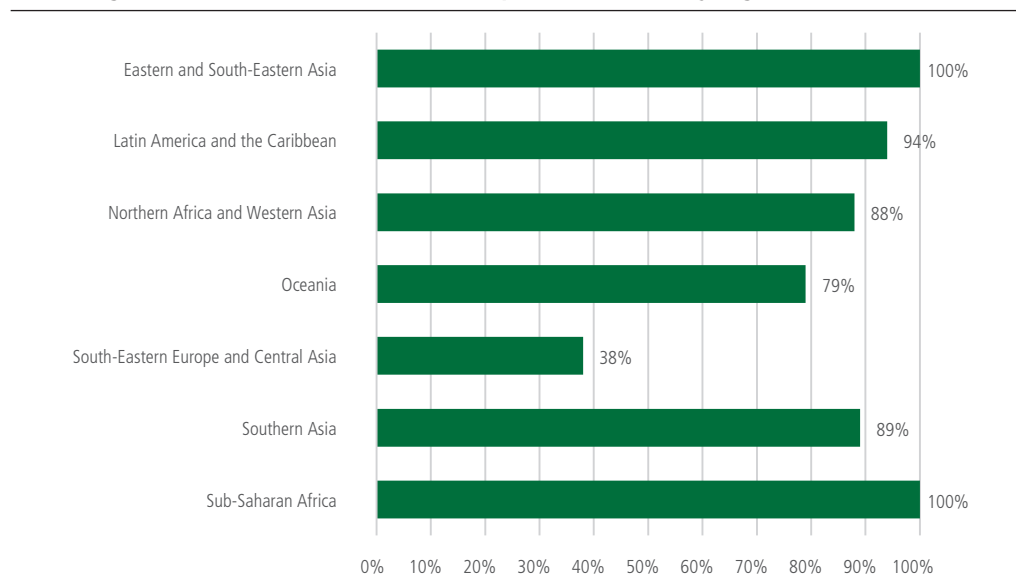
Decision 1/COP20, para 12. ‘Invites all Parties to consider communicating their undertakings in adaptation planning or consider including an adaptation component in their intended nationally determined contributions’.

This analysis identifies 130 countries that include an adaptation section in their INDCs. Among these 130 countries, 95 percent are LDCs and other developing countries (34 and 61 percent respectively). The remaining 5 percent are economies in transition. No developed countries include an adaptation section in their INDCs.

As outlined in Figure 7, all countries from Sub-Saharan Africa and Eastern and South-Eastern Asia include an adaptation section. The corresponding figure among LAC countries is 94 percent. Adaptation also features prominently in the INDCs submitted by countries in Southern Asia (89 percent), Northern Africa and Western Asia (88 percent) and Oceania (79 percent).

FIGURE 7.

### Percentage of countries that include an adaptation section, by region



Among the countries that included an adaptation section, about 40 percent (most of which are in Sub-Saharan Africa) stress that the implementation of adaptation measures is their foremost priority.



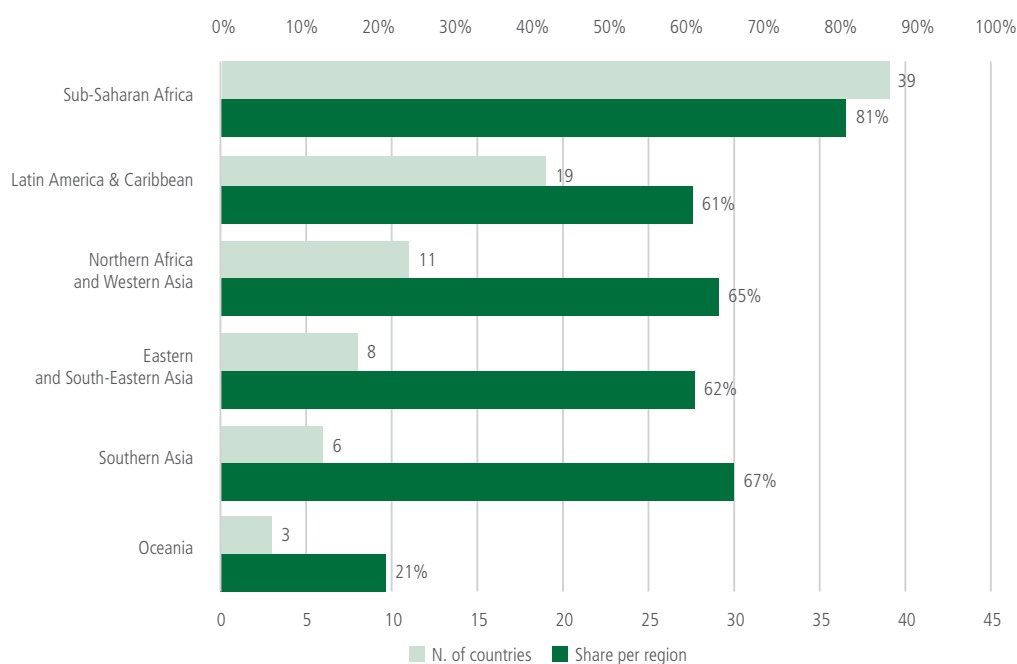
# TARGET-BASED MITIGATION IN AGRICULTURE AND LULUCF

## 3.1. AGRICULTURE

About 73 percent of all countries refer to agriculture in their mitigation contributions.<sup>11</sup> All Annex-I countries and 62 percent of Non-Annex I countries refer to mitigation targets and/or actions in agriculture. The countries that refer to agriculture collectively account for almost 95 percent of global agricultural emissions. Figure 8 provides an overview of the extent to which developing countries (including LDCs) refer to agriculture in relation to mitigation.

FIGURE 8.

**Share of INDCs in developing countries (including LDCs) referring to mitigation in agriculture (crops, livestock), by region**



As outlined in Figure 9, most countries that refer to mitigation in agriculture do so within their broad economy-wide target (115 countries). Others do so as a sectoral target

<sup>11</sup> In line with IPCC guidelines (IPCC,1997), **agriculture** subsumes emissions – predominantly CH<sub>4</sub>, N<sub>2</sub>O – related to **livestock** (i.e. enteric fermentation, manure management) and the cultivation of **crops** (agricultural soils, rice cultivation, burning of agricultural residues and savannas).

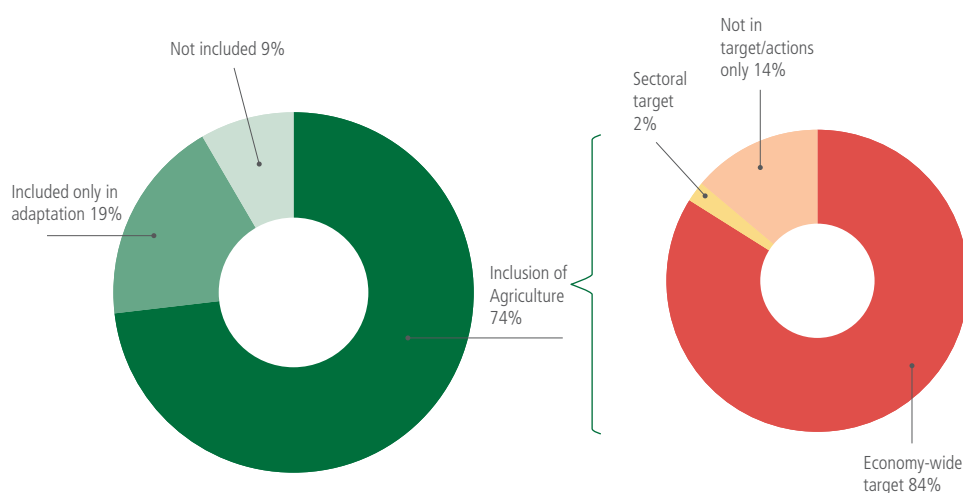


(Uruguay and Mali); as a target conditional on financial and technical support (Bangladesh and Vanuatu); or in terms of actions only (17 countries).

The way agriculture is included in the INDCs varies. The majority of the countries do not specify the measures intended to achieve their broader target, and at most point to inventory subsectors (e.g. enteric fermentation, manure management or managed soil) or activity categories (e.g. livestock or cropland-based management). Given that most countries do not elaborate their measures beyond a short description, this leaves room for interpretation regarding the inclusion and assignment of agriculture to targets/actions. For example, Antigua and Barbuda includes agriculture in its sector coverage, but does not specify whether the contribution is linked to mitigation, adaptation (which the country includes in its conditional targets) or both. Meanwhile, agriculture was included as a sector for mitigation in Rwanda's first submission, but was no longer considered in its revised submission.

FIGURE 9.

**Percentage of countries addressing mitigation in agriculture, by type of contribution**



Only a select few countries quantify the potential reduction of GHG emissions from agriculture, either by setting an explicit target for agricultural emissions or emissions from a subsector. For example, Uruguay explicitly states intensity targets for each gas ( $\text{CH}_4$ ,  $\text{N}_2\text{O}$ ) (conditional and unconditional) in the livestock sector, as well as for rice cultivation and dairy production. Malawi intends to reduce emissions from synthetic fertilizers and, as a conditional target, implement climate-smart agriculture. Other countries state more general objectives for agriculture. For instance, Bangladesh seeks to raise productivity of agricultural land and lower emissions of  $\text{CH}_4$ , while Japan aims to reduce  $\text{CH}_4$  emissions from paddy rice fields and reduce  $\text{N}_2\text{O}$  emissions from fertilizers. Burundi includes a non-GHG target that aims to achieve “a gradual replacement of 100 percent of mineral fertilizers with organic fertilizers by 2030”.

Regarding reasons for including or excluding agriculture, countries often refer to data uncertainties or the small role of agriculture in total national emissions (see Box 2 for selected examples).



## BOX 2.

## COMMENTS GIVEN BY COUNTRIES ON THE INCLUSION OR EXCLUSION OF THE AGRICULTURE SECTOR

COUNTRIES	AGRICULTURE CONSIDERED?	COMMENTS
<b>Albania</b>	No	"Greenhouse gas emissions and removals from agriculture, forestry and other land uses are currently not included in the accounting. Emissions and removals from these sectors can be included in the INDC at a later stage when technical conditions allow for that." (p.3)
<b>Angola</b>	Yes: Sectoral GHG-target and actions (unconditional)	Note stated in broader target, but as sectoral target: "The objective is to stabilize GHG emissions from these sources. Besides, the country is willing to develop the production of ethanol as an alternative to fossil fuels." (p.9)
<b>Bangladesh</b>	Yes: actions (cond.)	Agriculture was not included in the quantified contributions as a robust data-set is not as readily available for this sector: "Increase mechanization in agriculture leading to a reduction in numbers of draft cattle (and therefore lower methane emissions); increase the share of organic manure in the used fertilizer mix; Scale up rice cultivation using alternate wetting and drying irrigation" (p.7)
<b>Gabon</b>	No	Agriculture is excluded due to limited data availability.
<b>Guyana</b>	No	"It is acknowledged that agriculture is a source of methane and nitrous oxide emissions, and should be part of mitigation. However, for us, (and for SIDS, LDC's and the African Group), agriculture is regarded as food production, food security, and rural livelihoods, and it is under threat from the adverse effects of climate change such as floods and droughts. With this in mind, and in consideration of the fact that we have little emissions to reduce under mitigation, we will treat agriculture as an adaptation issue in this INDC, leaving the possibility that in future cycles we can review our position." (p.1)
<b>Montenegro</b>	Yes	"GHG emissions and removals from AFOLU <sup>12</sup> are currently not included in the accounting, but may be included in the INDC at a later stage, due to significant data uncertainty." (p.3)
<b>Seychelles</b>	Yes	"The emissions from agriculture were deemed to be so insignificant that the SNC mentions that it might not be necessary to calculate emissions from agriculture in the future." (p.9)

## 3.2. LULUCF

Countries frequently acknowledged the importance of LULUCF in responding to climate change. About 77 percent of all countries consider LULUCF within their mitigation contributions. In Eastern and South-Eastern Asia, the figure is 85 percent. LULUCF is similarly prominent in the INDCs submitted by countries in Sub-Saharan Africa. LULUCF is also included in the mitigation contributions of many countries in Southern Asia (78 percent) and Latin America and the Caribbean (77 percent). The corresponding

<sup>12</sup> AFOLU stands for Agriculture, Forestry and Other Land Use.

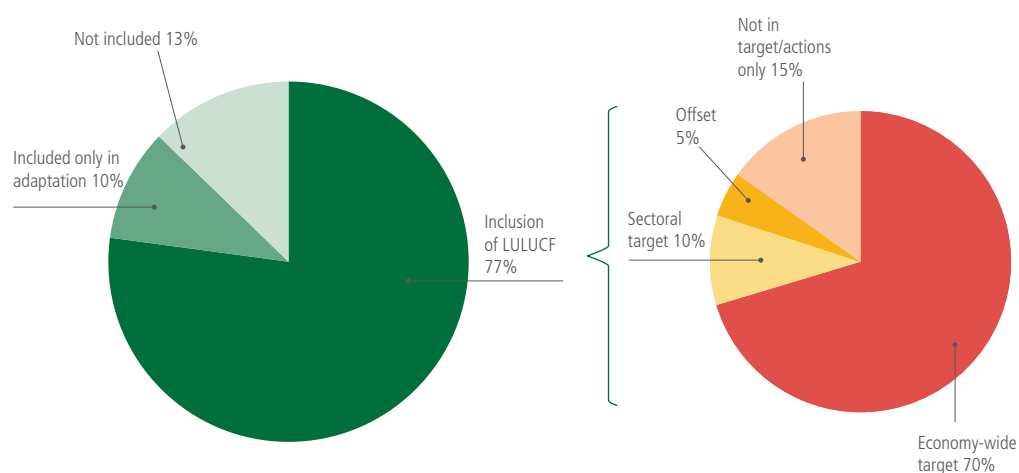
figures are more modest in Northern Africa and Western Asia (44 percent) and Oceania (36 percent).

Among countries that do not include LULUCF, the reasons for excluding the sector include data uncertainties and issues of data availability, as well as the lack of a defined accounting methodology. Other countries mentioned that they do not yet have relevant policies in place.

Countries communicated diverse contributions and frequently presented a mix of targets and actions. Among countries that included the LULUCF sector, 70 percent treat this sector as part of their economy-wide target (see Figure 10). Fifteen percent consider mitigation efforts in LULUCF outside their targets or within their action-based contributions. Ten percent of the submissions set a sectoral target for this sector and only 5 percent of countries mention intentions to offset LULUCF contributions into their broader target.<sup>13</sup>

FIGURE 10.

**Percentage of countries addressing mitigation in LULUCF, by type of contribution**



The most frequently-used approach is a baseline scenario to account for emissions and removals from this sector (50 percent of INDCs with GHG-targets). Gross-net and net-net methods were chosen by 27 percent and 20 percent of countries respectively. Not more than 35 percent of submissions present their land use accounting in a comprehensive manner. Principles, methods and/or assumptions are stated by 95 percent of developed countries, 40 percent of LDCs and around 30 percent of other developing countries. Only three of the INDCs submitted by economies in transition include a comprehensive accounting method for LULUCF. Between 35-46 percent of all INDCs in LAC, SSA and Eastern/South-Eastern Asia presented a comprehensive land accounting. Only about

<sup>13</sup> Not all countries explicitly state their intentions to offset their net land use emissions, but mention the importance of forest removals for achieving their broad targets.

5 percent of all countries include the effect of non-anthropogenic disturbances in their assumptions.

Among the countries that refer to LULUCF in their mitigation efforts (i.e. within or outside targets), 85 percent mention activities related to “forestry”, “forest land” or “land use change”. Less prominent are grasslands or rangelands (11 percent), wetlands (9 percent), croplands (9 percent) and peatlands (e.g. Azerbaijan).

Some countries (less than 5 percent of total submissions) do not consider LULUCF in their (broader or sectoral) targets, but do propose the implementation of different policies and other measures to increase their mitigation potential.<sup>14</sup>

Less than 5 percent of submissions acknowledge the impact of natural disturbances on emissions and removals by the land sector.<sup>15</sup> Furthermore, roughly 3 percent of countries consider additional accounts for harvested wood products in their methods.

<sup>14</sup> The following INDCs fall under this category: Bangladesh, Cameroon, Guinea, Kiribati, Papua New Guinea, Tonga, Vanuatu and Zimbabwe. They were classified in our analysis as considering LULUCF but without being part of their economy-wide or sectoral target. Other INDCs consider LULUCF but their commitments do not state any target, thus they are action-based and are not considered in this chapter.

<sup>15</sup> The countries explicitly stating that they will account for natural disturbances were: Australia, Canada, New Zealand, Philippines, Republic of Moldova and USA.



# ACTION-BASED MITIGATION IN AGRICULTURE AND LULUCF

## 4.1. AGRICULTURE

More than one third of the countries that include agriculture in their mitigation efforts do not provide further information regarding subsectors or activities. Seventy-seven countries propose mitigation measures in agriculture – either under a target, or as standalone action-based contributions – while 57 countries explicitly mention livestock. The level of detail varies, ranging from countries that only note the sector or respective inventory subcategories (e.g. managed soil, enteric fermentation) to comprehensive descriptions of intended policies and programmes/projects in this sector (e.g. Malawi, Bangladesh, Burkina Faso).

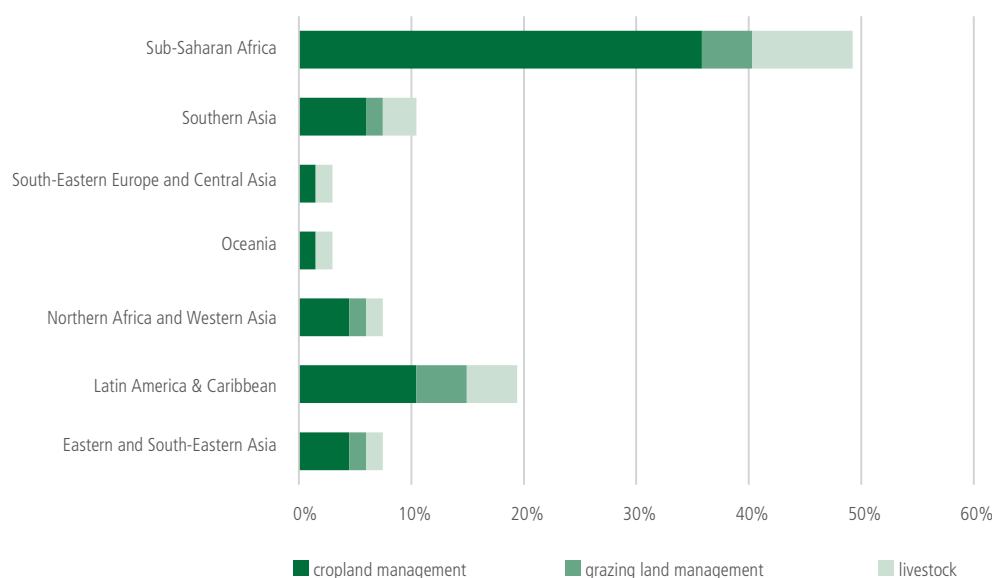
Among the mitigation actions highlighted by developing countries (including LDCs) and economies in transition, cropland management features prominently (40 countries). In particular, countries mentioned “nutrient management” (18); “plant management” (8); “tillage/residue management” (5). Other related activities include rice management (12) and water management (8). Concerning livestock, some countries explicitly specified grazing land management (9); feed management (10); breeding management (5); and manure management (9). Other frequently addressed strategies include integrated systems such as agroforestry (21) and climate-smart agriculture (16) (see Figure 11 for a regional breakdown). Given that both concepts offer considerable potential for mitigation-adaptation synergies, they are discussed separately in Section 7.1.

Six countries refer to NAMAs in agriculture either as a basis for the formulation of the INDC (Gambia) or the implementation of the INDC (Chile, Costa Rica, Equatorial Guinea, Malawi, Sierra Leone).





FIGURE 11.

**Percentage of countries that refer to mitigation measures in agriculture, by type of activity and region**

Only five countries specifically address mitigation actions in fisheries and aquaculture. These focus on feed management, reducing energy use (accounted for in the energy sector) and improving technology equipment. These measures are often part of broader strategies to develop the fisheries and aquaculture sectors. For example, Congo targets self-sufficiency in production, as sea and river fishing and aquaculture cover only 60 percent of their existing consumption needs. The country intends to increase catch and production by a factor of six by 2035, with a proportional impact on diesel consumption. Meanwhile, Cameroon seeks to develop the production of feed supplements for livestock and fish. Chad aims to develop sustainable fishery systems as part of its mitigation strategies.

#### 4.2. LULUCF

Among the 145 countries that mention LULUCF, 22 include action-based contributions only. All 22 of these countries refer to forests in this context, and five specifically refer to REDD+ as an important policy instrument.

Many of the other 131 countries include targets and specific policies or other measures to reduce emissions in this sector. As the number of action-based contributions is relatively small, the findings presented below do not distinguish the policies and programmes/projects by type of contribution.

Out of the 145 countries that mention LULUCF, 21 countries point to forests and land use in the broad sense without naming specific inventory subcategories. Among those that include information on the type of land, almost 95 percent refer to forests, while significantly less refer to grasslands and rangelands (<40 percent), croplands (<40 percent) and wetlands and/or peatlands (<15 percent).

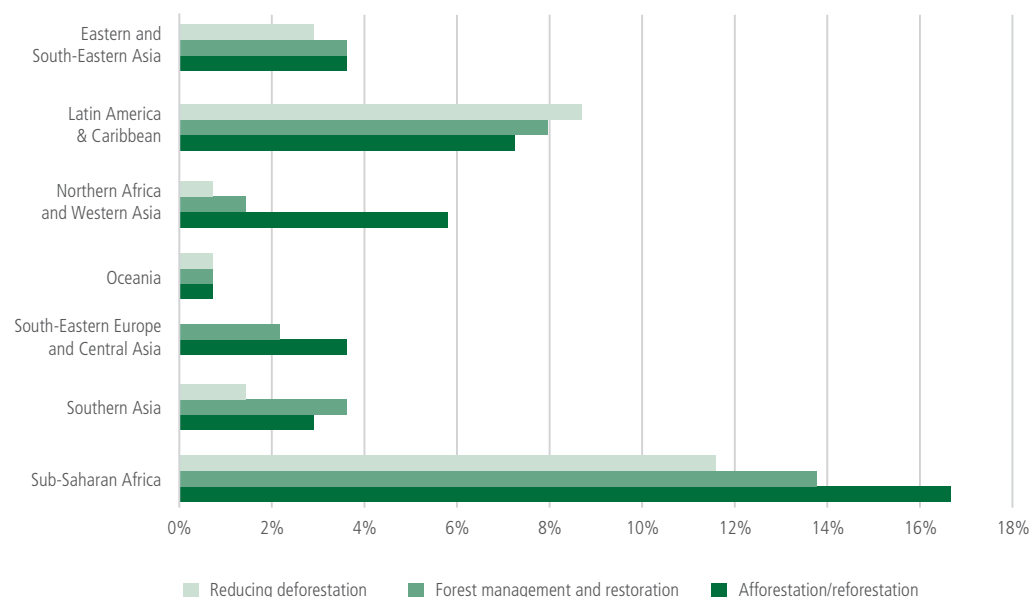
The most common types of actions mentioned by developing countries (including LDCs) and economies in transition in this context are forest management and forest

restoration (33 percent), afforestation/reforestation (41 percent), and reducing deforestation (26 percent).

Figure 12 provides an overview of the mitigation measures in LULUCF most frequently addressed in the INDCs submitted by developing countries (including LDCs) and economies in transition.

FIGURE 12.

**Percentage of countries that refer to mitigation measures in LULUCF, by type of activity and region**



Around 40 percent of the INDCs that mention LULUCF highlight existing or planned policies to reduce emissions in this sector. REDD+ is mentioned 45 times (including its intended use as a market mechanism), while only three countries (Burkina Faso, Honduras, Tunisia) refer to the development and implementation of NAMAs for this sector.



# VULNERABILITIES AND NATIONAL CIRCUMSTANCES

131 countries<sup>16</sup> include information about the existing and anticipated impacts of climate change, as well as their specific vulnerabilities. Another six countries highlight their level of vulnerability without explicitly identifying its causes. Among these 137 countries, 130 also include adaptation measures. Seven countries state information on climate change impacts and vulnerabilities without referring to explicit adaptation goals or actions.<sup>17</sup>

Although 70 percent of all countries refer to vulnerability, this share varies significantly with the level of socio-economic development. All of the LDCs and 87 percent of developing countries address vulnerability. By contrast, only 44 percent of countries in transition and 7 percent of developed countries mention this issue.

Seven countries used existing vulnerability assessments to prepare their INDCs, or point to on-going actions in this regard. Sixteen countries intend to undertake vulnerability assessments. These are all developing countries, two-thirds of which are Small Island Development States (SIDS) or Landlocked Developing Countries (LLDCs).

## 5.1. FOOD SECURITY AND NUTRITION VULNERABILITIES

The impacts of climate change on the agro-ecosystem affect agricultural productivity and food security. In this regard, 39 countries include food insecurity and malnutrition among the major risks they face, several of which acknowledge the direct link between agriculture and food security. Seven countries (six of which are SIDS located mainly in the Pacific region) mention food security as a key concern even though domestic food production is limited. The dependence of these countries on food imports not only aggravates their vulnerability to climate change, but also increases the importance of the agriculture sectors in food-exporting countries. Among countries that specify their vulnerabilities, the proportion that refer to food security in this context ranges from 50 percent in Southern Asia and Oceania to 14 percent in South-Eastern Europe and Central Asia (see Figure 13 for a regional breakdown).

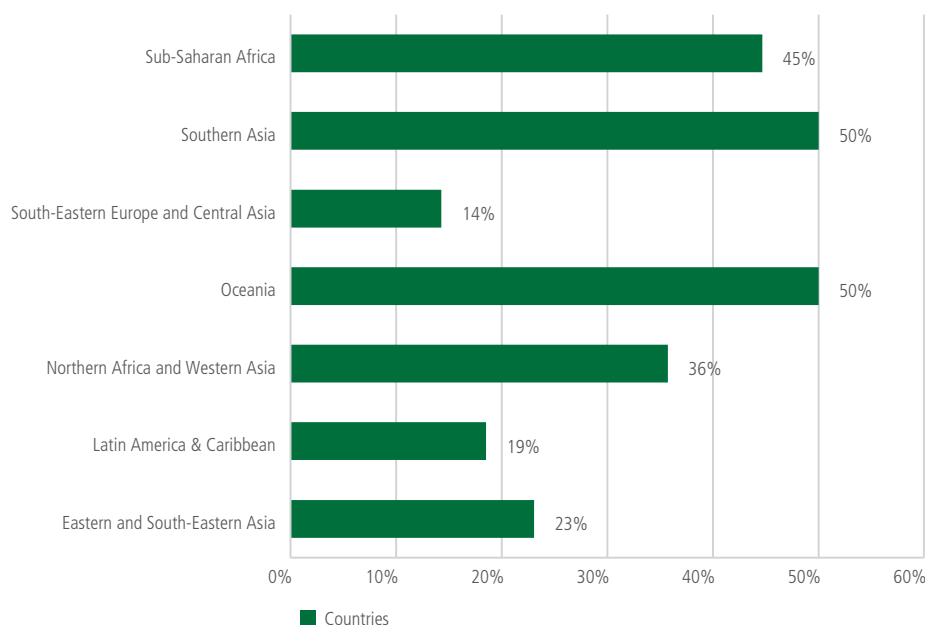
<sup>16</sup> When referring to vulnerabilities and adaptation, the number of 'countries' is equivalent to the number of INDCs.

<sup>17</sup> Regarding developed countries, Andorra, Monaco and Switzerland also state information on vulnerabilities and national circumstances.



FIGURE 13.

**Percentage of countries (among those that specify vulnerabilities) referring to food security, by region**



## 5.2. IMPORTANCE OF THE AGRICULTURE SECTORS

Thirty-four countries highlight the importance of the agriculture sectors<sup>18</sup> for the economy, employment and exports, and in particular for rural and indigenous populations. Burkina Faso, Malawi, Mali, and Niger place a particular emphasis on the role of the agriculture sectors for the work force, as it employs up to 85 percent of the people in these countries. Argentina, Rwanda, Uruguay and New Zealand<sup>19</sup> refer to agricultural exports as an important driver of the economy. Eight countries refer to their reliance on agricultural imports for food security, six of which are SIDS. Nine countries (mainly LDCs) highlight the essential role of energy from biomass in particular for the rural population.

Economic dependence on the agriculture sectors and natural resources is also at the core of many countries' vulnerability concerns. Two-thirds of countries point to these sectors when discussing climate-related risks – more than any other sector. When focusing exclusively on economic vulnerabilities, almost 90 percent of countries refer to agriculture sectors.

## 5.3. BIOPHYSICAL VULNERABILITIES

The 131 countries that cover elements of vulnerabilities in their INDCs refer to diverse types of climate-related hazards. The vast majority (98 countries) point to extreme events (e.g. droughts and/or floods) as a significant threat to their environment and economic development. Thirty-seven of these countries are in Sub-Saharan Africa, equivalent to 78

<sup>18</sup> Regarding the discussion of adaptation strategies, the categorization is consistent with the FAO definition of agriculture sectors (i.e. crops, livestock, fisheries and aquaculture, forestry).

<sup>19</sup> New Zealand mentioned its role in global food security under mitigation.



percent of the countries in this region.<sup>20</sup> Thirty-four of these countries refer to droughts and 31 to floods. In Oceania, 9 out of 12 countries point to droughts, while 7 out of 8 Southern Asian countries point to floods as being among the most significant hazards they face.

Changes in the precipitation pattern (i.e. the timing, duration and intensity of rainfall) are also perceived as a major threat. Almost 60 percent of SSA countries refer to this hazard, as do more than half of the countries in LAC and East and South-East Asia. Changes in temperature patterns are a concern for the majority of the countries in LAC, and are also highlighted by the three developed countries that reflect on vulnerabilities. Meanwhile, two-thirds of the countries in Oceania highlight their vulnerability to sea-level rise, as do half of the countries in North Africa and West Asia. Other hazards are also specific to the geographical situation including ice melting and corresponding hydrological risks (nine countries from Latin America, Asia, and Europe); and coral bleaching (nine countries, seven of which are SIDS). More than one-third of the 131 countries refer to storms (e.g. hurricanes, tornados, El Nino).

Countries also outline how abiotic and biotic hazards affect ecosystems, especially: soil and coastal erosion (32 countries, mainly from LAC, Oceania and SSA); biodiversity and ecosystems (20 countries, nine of which are located in SSA); and pests and diseases (17 countries, half of which are in SSA).

#### 5.4. ECONOMIC AND SOCIAL VULNERABILITIES

Most countries outline challenges that increase their vulnerability to climate change, or decrease their capacity to respond to it. These challenges are usually discussed in the description of national circumstances and adaptation needs. A few countries mention them when justifying the scope of their mitigation commitments (i.e. under ‘Fairness and Ambition’).

Demographic aspects are highlighted throughout the INDCs. Population growth is mentioned in about 25 percent of countries, either as a potential obstacle to the reduction of national GHG-emissions or as a threat to food security.

For many countries, vulnerability is linked to the geographic concentration of their populations. Two factors are mentioned particularly often: (1) high population density along coastlines that are vulnerable to climate-related hazards; and (2) the migration of people from rural to urban areas, fueling social tensions over scarce factors (e.g. limited employment opportunities) and the degradation of natural resources (e.g. land, biomass for energy).

Forty countries address poverty in relation to vulnerabilities. This corresponds to half of the countries in South Asia, 40 percent in LAC, and around one third of countries in SSA. Several countries address poverty reduction under their adaptation goals and/or refer

<sup>20</sup> Percentage shares refer to the total number of countries in a region that mention vulnerabilities.

to specific policies in this regard (see section 6.1). Many countries also highlight social inequalities as an additional obstacle to sustainable development.

Limited human capital (e.g. low levels of education and high illiteracy rates) is mentioned in more than 20 countries. Several countries also mention this challenge in their long-term vision of national development. Some countries mention education as part of their gaps and barriers regarding implementation of their contributions.

Health issues are also mentioned by several countries. Twenty-eight countries refer to infectious, vector-borne or air-borne diseases such as HIV/Aids, Malaria and Ebola. Seventeen of these countries are in SSA, and another three are in Northern Africa. Some countries draw a direct link between climate change and the increased incidence of vector-/air-borne diseases.

Twenty-five countries – more than two-thirds of which are in SSA and Northern Africa – outline social and political conflicts and crises as important sources of vulnerability. Nineteen countries refer to migration issues and the displacement of people from other regions. In particular, countries from Oceania and Northern Africa highlight that these factors contribute to land degradation, deforestation and water scarcity. Some countries explicitly state that climate change causes or exacerbates conflicts over natural resources, especially land and water, and that migration has been experienced as a direct result of climate change.

Climate-related hazards and other biophysical impacts of climate change also lead to profound economic losses and damages. Forty-two percent of all countries that submitted INDCs refer to this issue. Most of them quantify the past and/or expected economic impacts of climate change (see Box 3). More than 90 percent of the countries in Eastern and South-Eastern Asia refer to loss and damage, as do two-thirds of the countries in Southern Asia and LAC. The share of countries that do so from Oceania and SSA is 57 and 51 percent, respectively.

Eighty-five countries specify economic sectors that are particularly vulnerable to climate change. Almost 90 percent of them (73 countries) mention the agriculture sectors in this context. This is particularly common in Southern Europe and Central Asia (71 percent of the countries that specify vulnerabilities in this region), as well as Oceania (67 percent) and Sub-Saharan Africa (66 percent). Switzerland and Andorra also highlight this sector. Many of these countries are SIDS (18) or Landlocked Developing Countries (19). Meanwhile, the water sector is mentioned by 51 of these 85 countries. One-third of these countries refer to infrastructure (including coastal zones), while 15 percent refer to energy and tourism in this context.

## BOX 3.

**THE ECONOMIC IMPACTS OF CLIMATE CHANGE AND CLIMATE-RELATED HAZARDS  
ON THE AGRICULTURE SECTORS (EXAMPLES FROM INDCs)**

<b>Iran</b>	"Due to the changing trends of climate change and hydrological parameters, agricultural production and economy has faced significant damages amounting to 3.7 billion USD (based on fixed prices) annually from 2015 to 2030 compared to 2010." (p.8)
<b>Nepal</b>	"The 2013 study on 'Economic Impact Assessment of Climate Change in Key Sectors '(agriculture, hydropower and water-induced disasters) has estimated direct cost of current climate variability and extreme events equivalent to 1.5 to 2 percent of current GDP/year (approximately USD 270-360 million/year in 2013 prices) and much higher in extreme years" (p.2)
<b>Nigeria</b>	Under a business-as-usual scenario, agricultural productivity could decline between 10 to 25 percent by 2080, and by as much as 50 percent in rain-fed agriculture. GDP will be reduced by about 4.5 percent by 2050, the share of agriculture in GDP is projected to decrease from 40 to 15 percent, which will render food imports necessary (increase in rice net-imports by 40 percent)
<b>Turkmenistan</b>	The projected increase in temperature and decrease in rainfall first of all would adversely affect all available water resources and agriculture is the main consumer of water in Turkmenistan. Assuming failure of timely adaptation measures, less received volume of production could reach 20 percent by 2030, and the loss of value of crop production only for the 15-year period (2016-2030 years) will amount to 20.5 billion USD. (p.5)
<b>Uganda</b>	"In the absence of adaptation actions, the cost of the impacts of climate variability and change in Uganda would range between 270 and 332 billion USD over the 40 year period 2010-2050, for the agriculture, water, infrastructure, and energy sectors. Annual costs could be in the range of 3.2 billion \$5.6 billion USD within a decade in these four sectors alone." (p.4)
<b>Yemen</b>	"Considerable losses in grain production and husbandry have already been experienced in 2008/2009; when aggregate production was lower by 24 percent compared to 2007. This dramatic fall in food production was largely due to increasingly prolonged drought conditions, when most of water sources in valleys producing grain dried up. These changes in temperature and rainfall patterns are likely to worsen existing water scarcity conditions, loss of land productivity and desertification processes as well as frequency and intensity of climate induced drought and flood related disaster risks, which have been increasing over the past decade in all parts of the country including the latest Chapala tropical cyclone of November 2015".

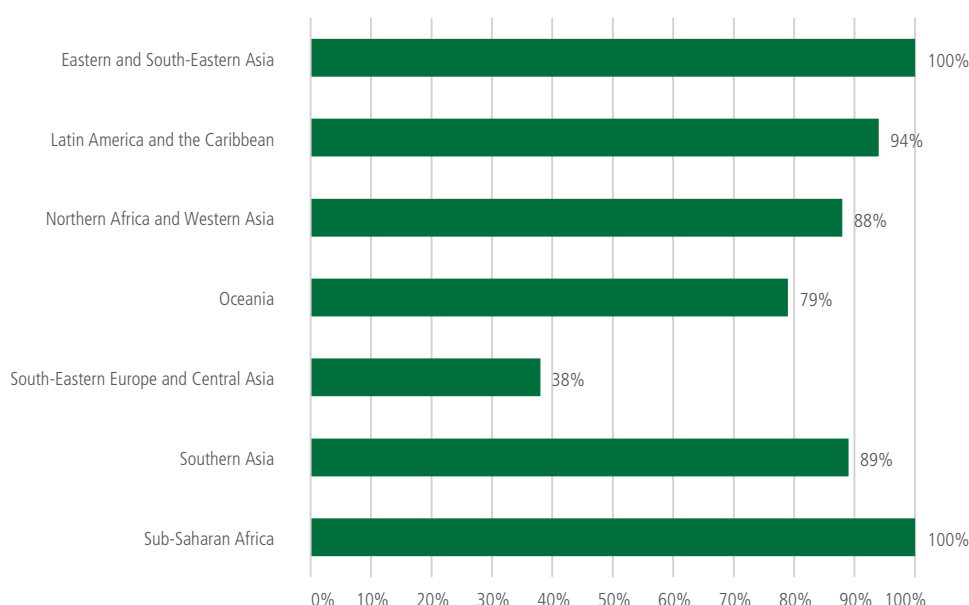


# ADAPTATION POLICIES AND OTHER MEASURES

Of the 130 countries that include an adaptation section, 127 countries<sup>21</sup> refer to the agriculture sectors: 124 countries to crops and livestock, 108 countries to forestry (including related measures for land use planning and management), and 60 countries to fisheries and aquaculture.<sup>22</sup> The following analysis only takes into account the 130 countries that include an adaptation section in their INDCs.

FIGURE 14.

**Percentage of countries that include an adaptation section, by region**



Around 95 percent of these countries are from developing countries (61 percent) and LDCs (34 percent) and the rest are economies in transition. All Parties from Sub-Saharan Africa and Eastern and South-Eastern Asia include an adaptation section. The corresponding figure among LAC countries is 94 percent. Adaptation also features prominently in the INDCs submitted by countries in Southern Asia (89 percent), Northern Africa & Western Asia (88 percent) and Oceania (79 percent). Only 38 percent

<sup>21</sup> When referring to vulnerabilities and adaptation, the number of 'countries' is equivalent to the number of INDCs.

<sup>22</sup> In addition to the 130 countries that include a specific adaptation section, Belize, Israel, New Zealand and Micronesia refer to other documents that discuss their adaptation strategies while Belarus outlines the timeline for the development of appropriate adaptation measures. Azerbaijan, Pakistan and Serbia include general considerations on adaptation. Micronesia and Tuvalu acknowledge their adaptation needs, but do not see the INDC as the right vehicle to address them.



of countries from economies in transition in Southeast Europe and Central Asia include an adaptation section. None of the INDCs submitted by developed countries include this information.

Among the countries that included an adaptation section, roughly 40 percent (most of which are in Sub-Saharan Africa) stress that the implementation of adaptation measures is their foremost priority. Some countries note that the INDC process is an opportunity to raise awareness of the national adaptation programme to attract technical, financial and capacity-building support for its implementation.

### 6.1. LONG-TERM GOALS AND VISION

Most countries reflect on their development goals and vision when discussing adaptation needs. Many of these aspirational or qualitative goals aim to reduce vulnerabilities or increase overall resilience to climate change. Specific objectives include institutional mainstreaming of climate change; reducing loss and damage; and increasing the welfare of the population. Many countries, especially LDCs, link adaptation to the eradication of poverty and their aim to become a middle-income country. A few countries explicitly refer to the Millennium Development Goals (seven countries) and/or Sustainable Development Goals (13 countries).

Countries also include sector-specific considerations. The water sector is a priority for many countries. Meanwhile, almost one-third of Parties reflect on the development of the agriculture sectors. They often do so by highlighting their significance for food security and economic wellbeing, or by outlining their vision for the development of these sectors. About 20 percent of the countries specifically refer to food security among the objectives that drive their adaptation strategies.

### 6.2. ADAPTATION PLANNING AND POLICIES

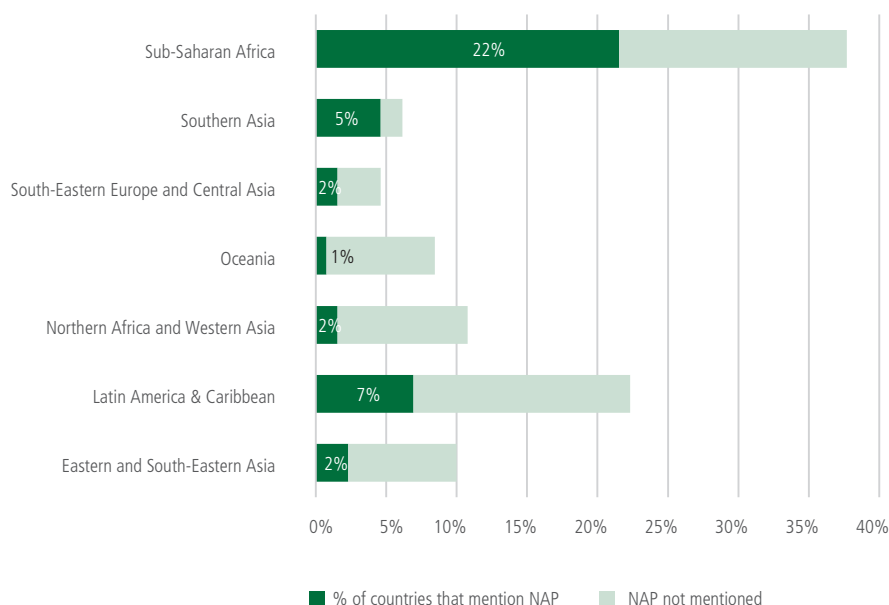
Countries refer to a variety of policy frameworks for responding to the effects of climate change, including National Adaptation Programmes of Action (NAPAs) and National Adaptation Plans (NAPs).

Forty-four countries, almost 88 percent of the LDCs,<sup>23</sup> mention NAPAs when describing past or present adaptation efforts, or as a measure for implementing their INDCs. Several countries refer to specific projects from NAPAs as being part of their intended contributions.

Thirty countries highlight that they are designing or finalizing a NAP. Another 21 countries intend to start the NAP process in the near future. Afghanistan, Botswana, Costa Rica, Lesotho, Sudan, Uganda and Uruguay explicitly refer to agriculture as a priority sector for their NAPs. The majority of these 51 countries are from Sub-Saharan Africa (55 percent), followed by Latin America and the Caribbean (18 percent), and Southern Asia (12 percent). Southern Asia and to a lesser extent SSA exhibit a high share of countries that mention NAPs (75 percent and 57 percent, respectively).

<sup>23</sup> Excluding two island states (Cabo Verde, Samoa) that have since graduated from the LDC group.

FIGURE 15.

**Percentage of countries that refer to NAPs, by region**

About one third of the other countries refer to their national adaptation-oriented action plans, particularly in Latin America and the Caribbean (8 out of 20 countries).

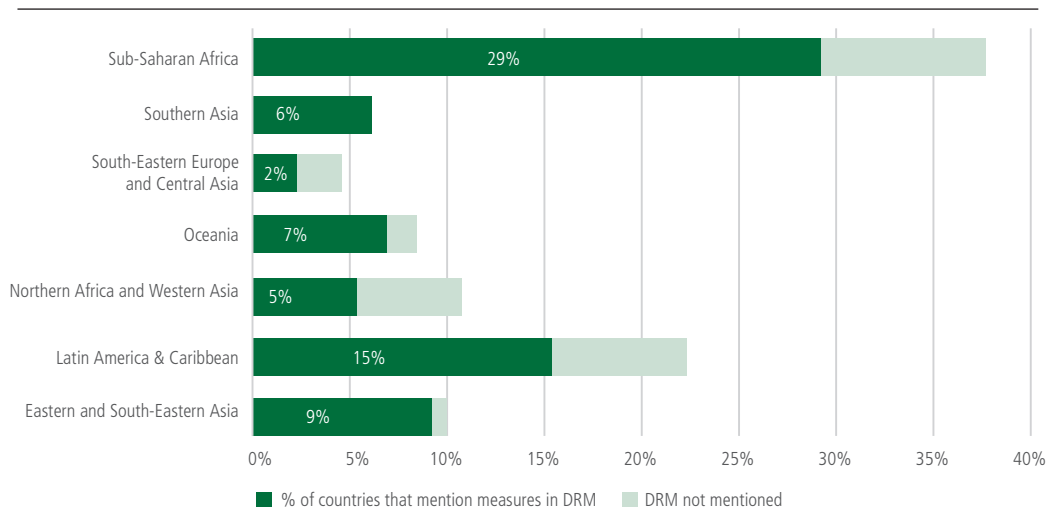
Many countries also refer to the information contained in past National Communications and/or Biennial Update Reports under their adaptation section.

A variety of non-climate specific policies are also mentioned. Examples include national development strategies, as well as sectoral and/or regional strategies, policies and plans. Several countries refer to frameworks or programmes in the agriculture sectors.

### 6.3. DISASTER RISK MANAGEMENT

Almost 75 percent of countries reflect on Disaster Risk Management (DRM). As illustrated in Figure 16, DRM is an adaptation priority in all regions, particularly in Southern Asia (100 percent), Eastern and South-Eastern Asia (92 percent), and Oceania (82 percent). Countries in these regions place a particular emphasis on Disaster Risk Reduction (DRR) in this context. 10 countries note national plans and strategies on DRM or DRR.

FIGURE 16.

**Percentage of countries that refer to DRM, by region**

About 60 percent included specific policies and actions related to DRM in their INDCs<sup>24</sup> that largely fall under the following categories in line with the Sendai Framework for Disaster Risk Reduction (UNISDR 2015):

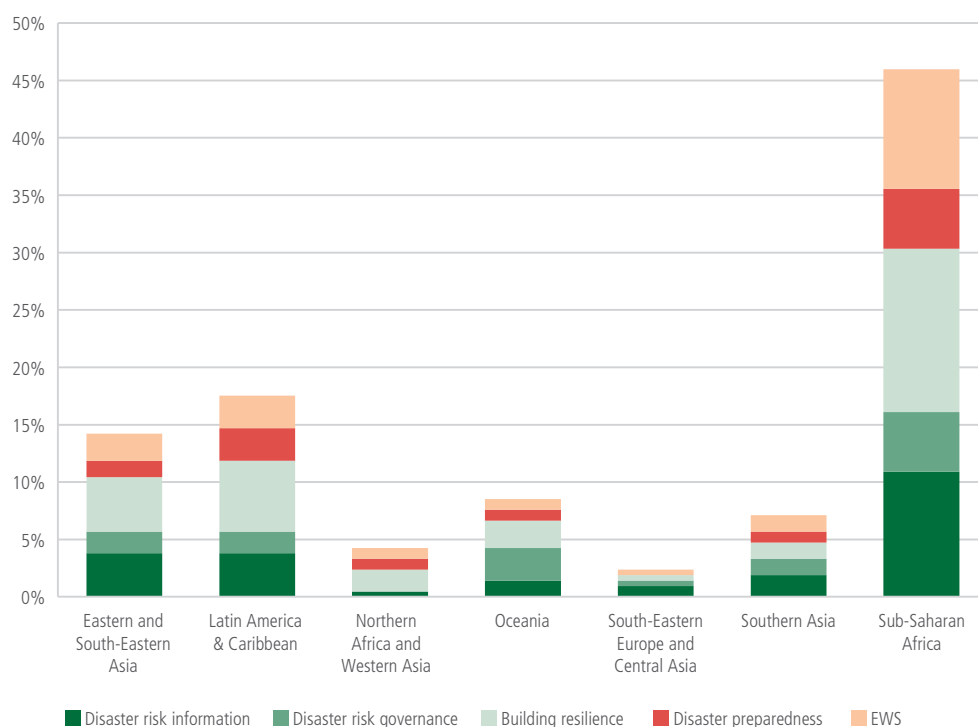
1. Understanding disaster risk (e.g. collection, analysis, management and use of data, capacity building at all stakeholder levels, hazard mapping, food security and vulnerability assessments).
2. Strengthening disaster risk governance to manage disaster risk (e.g. development and implementation of DRR strategies and plans; mainstreaming DRR; raising public awareness).
3. Investing in disaster risk reduction for resilience (e.g. structural and non-structural measures in DRR, insurance mechanisms).
4. Enhancing disaster preparedness for effective response and to “Build Back Better” in recovery, rehabilitation and reconstruction (e.g. contingency plans, early warning systems (EWS), forecasting, hazard-monitoring).

As Figure 17 shows, enhancing disaster preparedness including EWS and investing in disaster resilience are the foremost priority actions, followed by enhancement of disaster risk information (25 percent) and disaster risk governance (16 percent).

<sup>24</sup> This number refers to measures associated with managing disaster risks and strengthening resilience to climate-related hazards (in particular floods, droughts, storms). It represents a lower boundary as many parties use DRM as a cross-sectoral category whereas sector-specific actions are often not included. Several countries also mention their vulnerability to extreme events without reflecting specifically on DRM but the enhancement of overall resilience to climate change. Note that measures referring to agriculture sectors were filtered out and assessed separately.

FIGURE 17.

**Percentage of DRM measures by region and categorical breakdown** (Note: EWS are presented separately)

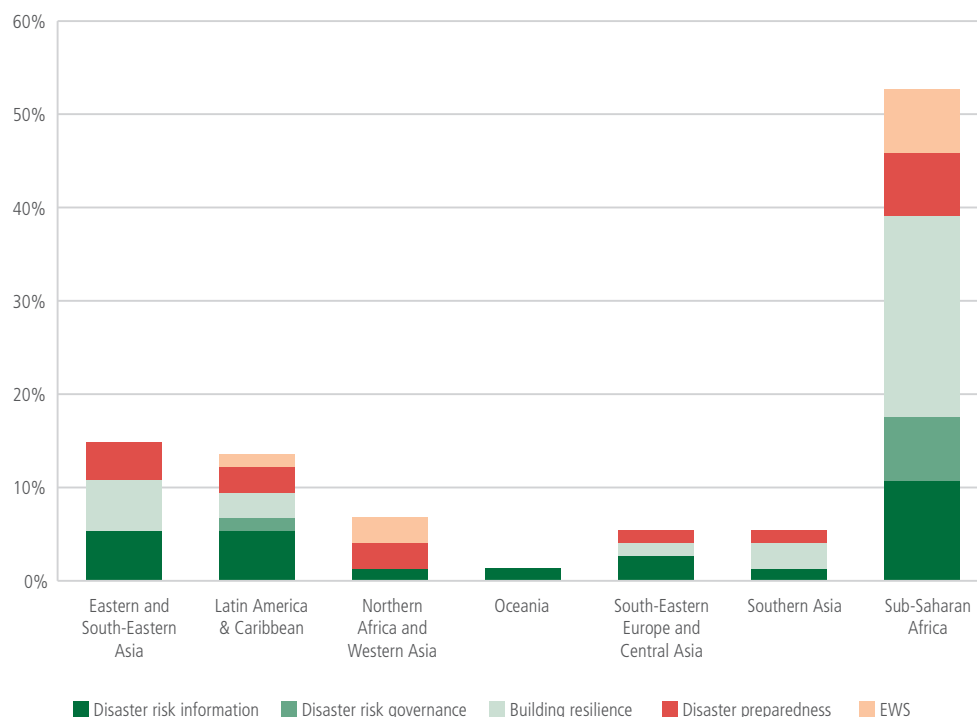


### DRM in agriculture

Around 30 percent of the countries that include adaptation measures mention DRM in the agriculture sectors: 37 percent of the LDCs, 33 percent of economies in transition, and 28 percent of the developing countries. Almost half of the countries in Eastern and South-Eastern Asia refer to the agriculture sectors in the context of DRM. The corresponding figures in SSA and South-Eastern Europe and Central Asia are 35 percent and 33 percent respectively. Less than 30 percent of the countries in LAC and Southern Asia refer to DRM when discussing adaptation measures in the agriculture sectors, while around 20 percent of the countries in Northern Africa and Western Asia and in Oceania mention specific measures in this regard. As Figure 18 shows, the most common measures include understanding disaster risks by assessing national circumstances and strengthening disaster resilience. By contrast, disaster risk governance is rarely addressed at the sectoral level. Figure 18 (below) provides an overview of selected measures for DRM in the agriculture sectors, as communicated by the countries in their INDCs.

FIGURE 18.

**Percentage share of DRM measures in the agriculture sectors by region and categorical breakdown** (Note: EWS are presented separately)



## BOX 4.

**SELECTED DRM MEASURES IN THE AGRICULTURE SECTORS, AS COMMUNICATED IN THE INDCs (EXAMPLES FROM INDCs)**

<b>Disaster risk governance (general)</b>	<ul style="list-style-type: none"> <li>Costa Rica is finalizing its National Disaster Risk Management Policy 2016-2030 with the following pillars Risk Reduction, Disaster Response and Readiness, and Disaster Recovery, with climate change adaptation as a cross-cutting issue (Costa Rica).</li> <li>Brunei Darussalam's National Disaster Management Centre (NDMC) has developed a Strategic National Action Plan for Disaster Risk Reduction, along with the private sector, non-governmental organisations, local bodies and other national agencies, to ensure a safer and disaster resilient country and community (Brunei).</li> </ul>
<b>Disaster risk information</b>	<ul style="list-style-type: none"> <li>Forest fire risk assessment and management (Bhutan, forestry).</li> <li>Assessment and management of risk and damage from windstorms on agricultural crops and human settlements (Bhutan, agriculture).</li> </ul>
<b>DRR for resilience</b>	<ul style="list-style-type: none"> <li>Strengthen forest disaster prevention and forest resource protection and reduce deforestation-related emissions; enhance grassland disaster prevention and farmland protection and to improve carbon storage of soil; and strengthen the construction of forestry infrastructure (China).</li> <li>Developing and rehabilitating the flood protection dykes for agricultural/urban development (Cambodia).</li> </ul>
<b>Disaster preparedness and response</b>	<ul style="list-style-type: none"> <li>Development of new early warning systems and new hydro-meteorological insurances, within the disaster risk reduction framework for the agriculture sector (Uruguay).</li> <li>Developing an early warning system for agricultural pests and climatic conditions (Lebanon).</li> </ul>



#### 6.4. LOSS AND DAMAGE

Many countries reflect on loss and damage when addressing their national circumstances and vulnerabilities. Several countries also refer to loss and damage in the context of their adaptation strategies. Forty-two countries mention the importance of quantifying losses and damages. Twenty countries propose insurance mechanisms for dealing with environmental hazards. Eleven of these 20 countries (mostly from Sub-Saharan Africa) highlight the need for insurance systems in the agriculture sectors (especially crops, livestock and fisheries). Moreover, five INDCs (China, Jamaica, Nauru, Niue, Sri Lanka) point to the need to establish an international mechanism on loss and damage.

##### BOX 5.

##### LOSS AND DAMAGE (EXAMPLES FROM THE INDCs)

<b>Costa Rica</b>	Hydrological events have created direct economic losses of around USD 1.13 billion between 2005 and 2011. The most impacted sectors have been road infrastructure, power distribution networks, agriculture and housing. These losses are – without proper adaptation measures – projected to increase to more than USD 7 billion by 2030 and could reach almost USD 30 billion by 2050. They will in particular affect vulnerable groups such as women, children and people in extreme poverty.
<b>Côte d'Ivoire</b>	Economic losses from coastal erosion range from USD 4.0 to 6.75 million for land loss in case of flooding between 0.5 and 2 meters. Estimated losses in agriculture: at least 10 percent of the annual rice production (USD 85.6 million based on the costs of imported rice), 10 percent of annual cocoa production (about USD 202 million based on the value of cocoa exports), destruction of major oil and coconut palm fields in the Abidjan region (losses not yet quantified).
<b>Dominica</b>	The share of the agricultural production in total GDP has been continuously declining since Hurricane Hugo, especially crops, and within this subsector the banana industry, have been severely affected by droughts, causing the sectoral output to drop by 20 percent between the late 1980s and 1990s. Agricultural access roads have been severely damaged or destroyed by Tropical Storm Erika in August 2015, which resulted in estimated losses to the agriculture sector of about USD 31 million, jeopardizing food security. "With the rapid decline in the major cash crop (bananas), many farmers began moving into the fishing sector [...]. The damage caused by Hurricane Lenny in 1999 on the Roseau Fisheries Complex brought about a significant increase in tuna landings in the following season, however, the lack of storage facilities resulted in wastage and loss of revenue to fishermen. Climate change impacts on Dominica's vibrant diving and whale-watching industry are yet to be determined."

#### 6.5. WATER MANAGEMENT

One hundred and fifteen countries mention the water sector in the context of adaptation. All countries in Southern Asia and 93 percent of the countries in the LAC region refer to the water sector, as do 88 percent of the countries in Sub-Saharan Africa. Water is also a key adaptation concern among countries in Oceania (82 percent), and Eastern and

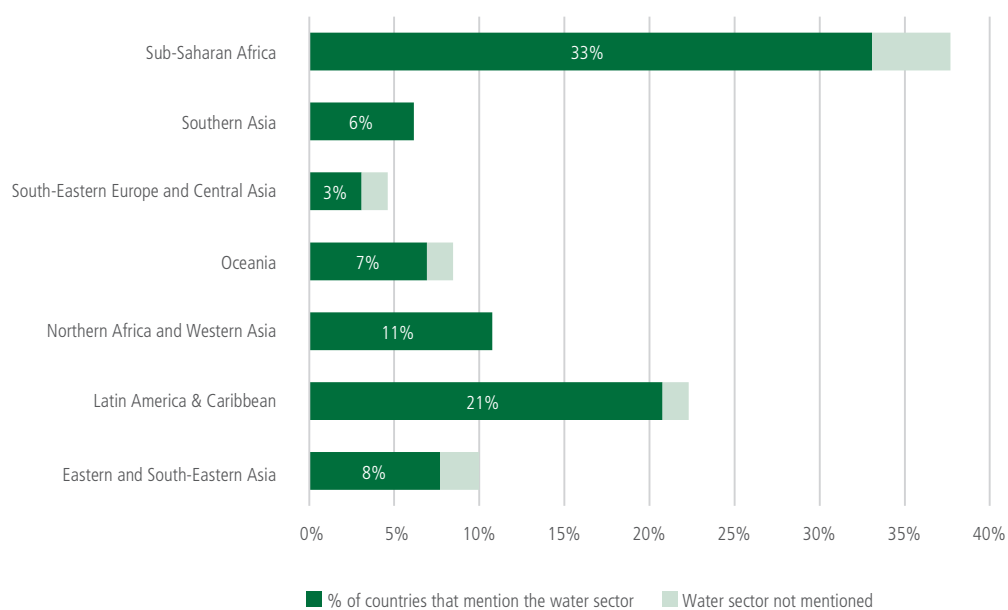
<sup>25</sup> Measured in constant prices of 2011.

South-Eastern Asia (77 percent). Two thirds of the countries in South-Eastern Europe and Central Asia refer to freshwater resources.

Ninety-one countries specify measures for managing water scarcity and protecting water quality. The most frequently mentioned actions relate to infrastructure (e.g. pipelines, new storage and distribution technologies), water demand management and groundwater monitoring. Regarding the protection of water quality, structural and non-structural measures for preventing salinization or improving desalinization are included. Water management is closely linked to the agriculture sectors. Examples include irrigation and drainage systems, watershed management, rainwater harvesting, wastewater recycling and reuse and integrated water resource management. As concerns policy strategies, many countries aim to develop new or improve existing frameworks and mainstream climate change into sectoral plans.

FIGURE 19.

#### Percentage of countries that mention the water sector, by region



## 6.6. THE AGRICULTURE SECTORS

About 98 percent of the countries that include an adaptation section refer to the agriculture sectors in this context. The agriculture sectors are therefore the foremost priority for adapting to climate change.<sup>26</sup> As also shown in Section 5, the agriculture sectors are particularly vital for least-developed and developing countries. Crop cultivation, livestock, fisheries and forestry constitute the primary source of income for a high share of their population; ensure and strengthen food security; and have important ancillary benefits for the environment, such as the prevention of soil erosion and the protection of water sources.

<sup>26</sup> Sri Lanka (which is included in this list) did not specify sectors but only targets of adaptation, one of which was food security.

### 6.6.1. Crops

One hundred and twenty-four countries refer to crops and/or livestock in the context of climate change adaptation, with a regional coverage of at least 85 percent. All countries in Southern Europe & Central Asia, Southern Asia and Sub-Saharan Africa include this sector.

One hundred and eleven countries include specific measures, with roughly 30 percent pointing to food security in this regard. The most common activities relate to water, plant and soil management (see Box 6). Eight countries include post-harvest measures related to the storage of food products.

Only a few countries state quantified measures. For example, Burkina Faso specifies the amount of land on which organic fertilizer will be applied. Niger sets specific targets for the amount of land on which multiuse species will be cultivated.

Regarding policies, several countries intend to develop or update existing sectoral plans or ensure institutional mainstreaming of climate change.

### 6.6.2. Livestock

Forty-four countries elaborate on adaptation measures in the livestock sector. Countries in Sub-Saharan Africa often point to pasture management in this regard. While some countries do not detail specific activities, others cover a wide spectrum of strategies, ranging from rehabilitation of degraded rangeland to improved management of transhumance and agro-pastoralism, and fire control. Livestock management is also often addressed with respect to animal health (e.g. pests and disease monitoring), breeding (e.g. biological diversity of livestock and improved species) and feed management (e.g. supplements, improved fodder crops).

### 6.6.3. Genetic resources

Thirty-three countries refer to the use of plant genetic resources. They often refer to the traditional knowledge of breeding, R&D in crop varieties and the adoption of climate-resilient crops from other regions as targeted measures to be adopted over the next 15 years. Thirteen countries also refer to improving genetic resources in livestock. References to plant genetic resources are most common in Southern Asia and Eastern and South-Eastern Asia, followed by Africa.

Almost one third of these countries refer to stress-tolerant crops, in particular drought and flood-resistant varieties, as well as short-cycle seeds and crops adapted to salt water. Some countries also mention crops that are resistant to pests and diseases. India points to genotypes with enhanced CO<sub>2</sub> fixation. Measures refer not only to the utilization of varieties, but also to the development, conservation and creation of grain banks.

## BOX 6.

**MEASURES FOR ADAPTATION IN THE AGRICULTURE SECTORS (EXAMPLES FROM THE INDCs)<sup>27</sup>**

<b>Agronomic Practices</b>	<ul style="list-style-type: none"> <li>• Improving rotation cultivation (Cameroon).</li> <li>• Reinforce cloud-seeding operations to compensate for the rainfall deficit in agriculture (Chad).</li> <li>• Changing cropping patterns, changing sowing dates and good management practices (Egypt).</li> <li>• Drainage and conservation agriculture (Burundi).</li> <li>• Appropriate farm mechanization (Gambia).</li> <li>• Mainstreaming agroecology techniques using spatial plant stacking; soil conservation and land husbandry (Rwanda).</li> </ul>
<b>Water management</b>	<ul style="list-style-type: none"> <li>• Wastewater irrigation (Rwanda).</li> <li>• Develop district irrigation master plans (Rwanda).</li> <li>• Increased irrigation with water saving technologies including snow, and rain water harvesting (Mongolia).</li> <li>• Maintenance of old wells for water harvesting purposes and establishment of new wells in the rural area; Implementation of supplemental irrigation, improving water use efficiency and the augmentation of drip irrigation in irrigated areas and utilization of saline water in the irrigation of crops tolerant to salinity; Establishment of desalinization units or sea water and use for agriculture (Jordan).</li> </ul>
<b>Livestock management</b>	<ul style="list-style-type: none"> <li>• Better management of pastoralism, especially transnational pastoralism, so as to limit degradation of grazing and soil and reduce the risks of usage conflicts (Guinea).</li> <li>• Introduction of rapid growth fodder plant for animal feeding (Guinea-Bissau).</li> <li>• Facilitate the genetic diversity of different animals (Burundi).</li> <li>• Animal health and disease outbreak monitoring and control (Laos).</li> <li>• Transition to semi-intensive systems of livestock management (Bolivia).</li> </ul>
<b>Policies and Plans</b>	<ul style="list-style-type: none"> <li>• NAPs: in the process of design: Afghanistan, Cambodia, Liberia, Nepal, Uganda, Uruguay; intended: Gambia, Yemen.</li> <li>• Sectoral plans and projects: e.g. Climate Smart Agriculture Program 2015-2025 (Uganda).</li> </ul>

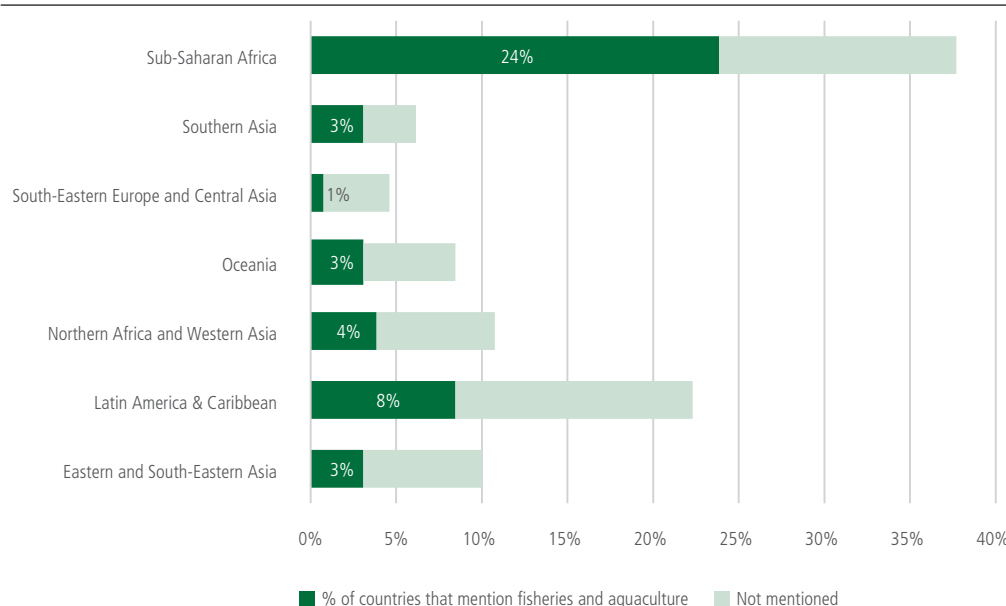
**6.6.4. Fisheries and aquaculture**

Sixty countries mention fisheries and aquaculture as a targeted sector for adaptation measures, most of which were specified further. One-third refer to the development of the fisheries sector by improving the legal and institutional framework (e.g. through facilitating access to funding), diversifying livelihoods and creating new opportunities for fishery products. Twenty countries mention fisheries and aquaculture management, including through development of sectoral plans. Resilience building and disaster risk management, including infrastructure measures, are also mentioned by 40 percent of these countries.<sup>28</sup> Furthermore, five countries (Ghana, Kenya, Liberia, Madagascar and Mauritius) reflect on climate-smart techniques in the fisheries sector. Almost 60 percent of the INDCs that refer to fisheries and aquaculture also mention activities in coastal zones and marine ecosystems (CZME).

<sup>27</sup> The discussion of adaptation measures for agriculture largely follows FAO (2016), p. 35 ff.

<sup>28</sup> The discussion of adaptation measures for fisheries and aquaculture follows Vadacchino et al. (2011), p. 19 ff.

FIGURE 20.

**Percentage of countries that mention fisheries and aquaculture, by region**

## BOX 7.

**SELECTED STRATEGIES FOR ADAPTATION IN FISHERIES AND AQUACULTURE  
(EXAMPLES FROM THE INDCs)**

	FISHERIES AND AQUACULTURE
<b>Sectoral development</b>	<ul style="list-style-type: none"> <li>Diversify income generating activities in rural areas by promoting artisanal fishing activities (providing training, equipment, micro-credit) in coastal areas; promote blue economy; and improve quality of fishery products through eco-labelling (Cabo Verde).</li> <li>Diversification of the fisheries sector to sustainable use of available marine resources.</li> <li>Facilitation and increase access to financing to develop mariculture (Maldives).</li> <li>Strengthen regulatory framework for protection of beach, dunes and vegetation.</li> <li>Blue Economy and Seychelles Strategic Plan 2015 (Seychelles).</li> </ul>
<b>Fisheries and aquaculture management</b>	<ul style="list-style-type: none"> <li>Development of agro-ecological fish-farming techniques; Development of techniques to conserve and process fish-farming products (Guinea).</li> <li>Management of coastal and fisheries resources through promotion of non-destructive fishing techniques to maintain resilience of marine ecosystems (Sierra Leone).</li> </ul>
<b>Resilience building, DRM and infrastructural measures</b>	<ul style="list-style-type: none"> <li>Increase the resilience of fisheries, guaranteeing the adequate levels of food security and nutrition (Mozambique).</li> <li>Strengthen fisherman insurance mechanism to ensure minimum monthly income from fishing activities for lost fishing due extreme events (Liberia).</li> <li>Improve port infrastructure for artisanal and industrial fisheries (Seychelles).</li> <li>By 2030, 100 percent of piers and boat storm shelters are constructed, and 100 percent of offshore fishing boats and ships have sufficient communication equipment (Vietnam).</li> </ul>



### 6.6.5. Forestry

Adaptation to climate change is also a priority in the forest sector. Ninety out of 108 countries mention specific forestry activities among their adaptation efforts. Most of these countries are in Sub-Saharan Africa (40 percent) and Latin America and the Caribbean (23 percent).

Parties often refer to sustainable management practices to improve the health of forests and other natural areas, and in so doing enhance carbon sinks, biodiversity and access to non-timber forest products.

The use of regulatory instruments is the major adaptation strategy in the forest sector. This includes designing and/or implementing laws, plans to reduce deforestation (including REDD+) or the creation of protected areas. Thirty-four countries plan to use regulatory instruments to support adaptation in the forest sector. This approach is particularly common among countries in Latin American and the Caribbean, as well as in Northern Africa & Western Asia. Meanwhile, sustainable forest management is mentioned in 28 countries, particularly from countries in Southern Asia and Oceania.

The second most common approach is the restoration of forests and/or degraded lands. This strategy is especially prominent among countries in Southern Europe & Central Asia, Oceania and Northern Africa and Western Asia.

Integrated approaches (e.g. agroforestry, landscape approaches) are mentioned in nearly one-third of the countries that describe adaptation measures. They are equally prominent in Sub-Saharan Africa, LAC and Oceania.

Afforestation/reforestation plans and projects are mentioned by 26 countries as strategies for adapting to climate change. On average, one-third of the countries in each region refer to these measures, with several of them highlighting mitigation synergies.

## BOX 8.

## SELECTED STRATEGIES FOR ADAPTATION IN THE FORESTRY SECTOR

<b>Regulatory instruments</b>	<ul style="list-style-type: none"> <li>• Generating legal instruments for the conservation and sustainable use of forests, e.g. regulate the exploitation of forest species and SFM (Venezuela)</li> <li>• Forest Code (Brazil)</li> </ul>
<b>Forest management</b>	<ul style="list-style-type: none"> <li>• Implementation of control systems, monitoring and tracking for the appropriate use of areas of forest life; actions of inspection and control for the proper management of forests; actions for the proper management of protected areas and forest areas with conservation priority (Bolivia)</li> <li>• Forest areas are planned to be managed in a variety of modalities and regimes including community forests, leasehold forests, collaborative forests and protected areas following a landscape approach to resource conservation and management (Nepal).</li> </ul>
<b>Afforestation/reforestation and forest restoration</b>	<ul style="list-style-type: none"> <li>• Establishment of plantation forests to meet the needs of population in fuel wood for heating, cooking etc. (Moldova);</li> <li>• promote afforestation/reforestation of designated areas through enhanced germplasm and technical practices in planting and post-planting processes (plant timing) (Rwanda)</li> <li>• Promoting reforestation and rehabilitation of cleared and degraded forests with climate change resilient, and ecologically and socially appropriate tree species (Tonga)</li> </ul>
<b>Integrated Approaches</b>	<ul style="list-style-type: none"> <li>• Strengthening practices in integrated and sustainable management of forests and the integrated and sustainable timber and non-timber harvesting (Bolivia)</li> <li>• Integrated landscape restoration focusing on forest zones, establish biological corridors by adopting agro-forestry systems and low-carbon agricultural practices (El Salvador).</li> </ul>

Fifteen countries refer to other terrestrial ecosystems and freshwater resources.

#### 6.6.6. Land use planning and land management

Twenty-four countries mention activities related to land use planning and management. These measures are particularly common in the INDCs of countries in Northern Africa & Western Asia (57 percent) and to a lesser extent in Southern Europe and Central Asia (33 percent). Land use planning is mentioned in selected countries in five of the six regions. Seven countries note their aim to create or improve existent land use plans.

Restoration of degraded lands and reduction of soil erosion is acknowledged primarily in the SSA and LAC regions (9 out of 11 in total). Eight countries support the use of land management practices that reduce vulnerabilities to droughts, floods, sea level rise and sand dune movements.

#### 6.6.7. Diversification and income

Around 25 percent of the INDCs that include an adaptation section refer to strategies to improve agricultural livelihoods by promoting local knowledge transfer, diversifying agricultural production, and/or developing new market opportunities (see Box 9). This is especially the case for crops, livestock and fisheries, whereas only a few countries address livelihood strategies in forestry. Angola for instance refers to its value chain approach to charcoal production. Several other countries address livelihood aspects as co-benefits of strengthening resilience in forestry.

### 6.6.8. Research and capacity building

Around one-third of the countries point to research and capacity building in the agriculture sectors as part of their adaptation sections. Countries frequently refer to the development of adapted varieties in crops and livestock, fish and forest species, as well as research on agro-ecology. A few countries also intend to integrate specific agronomic concepts (e.g. organic farming, conservation agriculture) into formal curricula for primary, secondary and/or tertiary education (see Box 9).

#### BOX 9.

#### SELECTED MEASURES ON LIVELIHOOD STRATEGIES, RESEARCH AND CAPACITY BUILDING IN THE AGRICULTURE SECTORS

<b>Diversification and income</b>	<ul style="list-style-type: none"> <li>• Expand local markets by constructing market infrastructure; developing decentralized agriculture processing centers; develop niche export crops under organic and fair-trade branding (Rwanda).</li> <li>• Increase the contribution of agriculture to economic development, food security and exports; Reduce poverty and improve food and nutrition security through sustainable use of natural resources, improved access to markets (Swaziland).</li> <li>• Improve value addition, access to markets, including micro-finance (Uganda).</li> <li>• Developing frameworks for sustainable intensification and commercialization of agriculture at different scales across agro ecologies (Zimbabwe).</li> </ul>
<b>Research</b>	<ul style="list-style-type: none"> <li>• Design and implementation of a national biodiversity research programme, research and development of natural biocides, promoting the establishment of regional research centers and a national outreach programme; and development of sustainable systems based on agroecology (Honduras).</li> <li>• Model development of the soilless and hydroponic agriculture for medicinal and herbal plants and vegetables for water saving (Jordan).</li> <li>• Research in conserving and exploiting genetic heritage to adapt cereal crops to climate change, developing innovative systems for arable crops (Tunisia).</li> </ul>
<b>Capacity Building</b>	<ul style="list-style-type: none"> <li>• Capacity building in adapting irrigated crops in the central regions (Tunisia).</li> <li>• Capacity building in adapting mixed farming-livestock production to climate change in vulnerable regions (Tunisia).</li> <li>• Education: young persons in local primary and secondary schools are taught organic agriculture, environmental art and creative land use (Saint Vincent and the Grenadines).</li> </ul>

# SYNERGIES AND CO-BENEFITS

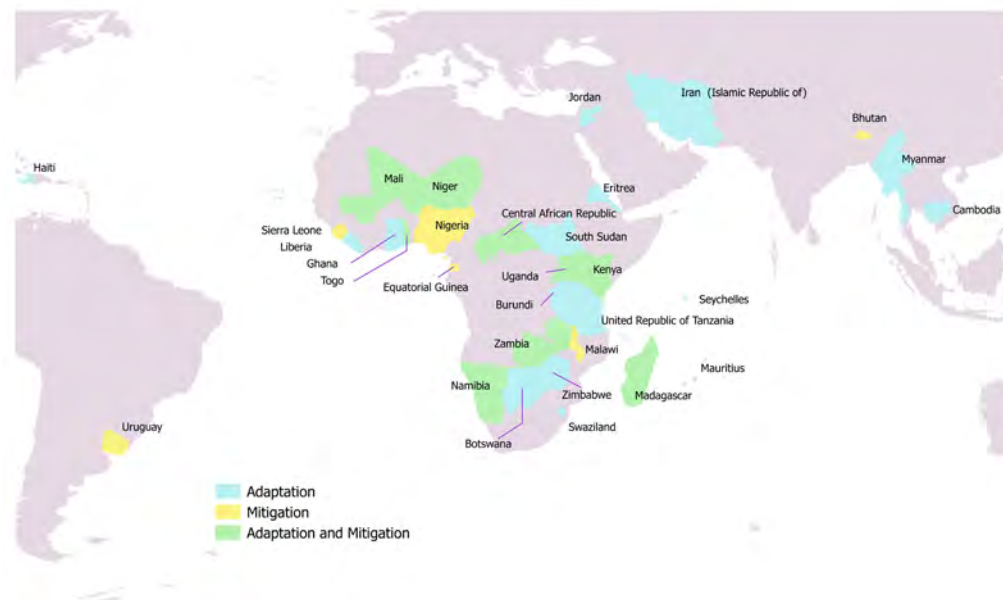
## 7.1. SYNERGIES BETWEEN ADAPTATION AND MITIGATION

One hundred and nine countries refer to the agriculture sectors both with regards to mitigation and adaptation. This is indicative of the potential to leverage mitigation-adaptation synergies in these sectors. These rich opportunities are sometimes explicitly acknowledged. Around one-third of all countries endorse or even prioritize actions based on the potential synergies between mitigation and adaptation. Several countries refer to concepts that capitalize on mitigation-adaptation synergies, such as climate-smart agriculture. Other countries implicitly draw on these synergies by planning measures that entail positive spillovers between mitigation and adaptation (e.g. reducing deforestation). Thirty-one countries specifically make reference to the concept of Climate-Smart Agriculture (CSA),<sup>29</sup> 77 percent (equivalent to 24 countries) of which are in Sub-Saharan Africa (see Figure 21). The remaining countries are located in Eastern, South-Eastern and Southern Asia (four countries), LAC (two countries) and Western Asia (Jordan). Around 40 percent of all LDCs refer to CSA.

<sup>29</sup> Note that this number also includes slight variations of this term. Specifically, Equatorial Guinea, Haiti and Jordan refer to “climate-intelligent” practices in agriculture. Countries that only refer to practices that could be considered under CSA (like Honduras’ Quesungual agroforestry system), but do not mention the term explicitly are not included in this list. Furthermore, INDCs were only assigned to CSA when the description entailing this term actually points to the intended use of the concept. Côte d’Ivoire, for example, refers to a publication whose title contains the term CSA when describing its vulnerabilities, but does not reflect on this concept either under mitigation nor under adaptation (see Annex B).



FIGURE 21.

**References to CSA in the INDCs**

Fifteen countries mention CSA under adaptation. Meanwhile, 10 countries (all in Sub-Saharan Africa) highlight CSA as an approach to pursue both adaptation and mitigation goals, while another six countries refer to CSA under mitigation only (see Annex B).

Many other practices and actions promoted in the INDCs have important adaptation/mitigation co-benefits. For instance, agroforestry is highlighted as both a measure for mitigation (by 21 countries) and adaptation (by 25 countries). Twenty-five INDCs refer to agroforestry under adaptation. One-third of these countries include this concept under both mitigation and adaptation. Meanwhile, afforestation is commonly addressed under mitigation (40 countries), whereas 24 countries also include it as an adaptation measure. In several cases synergies are not explicitly noted.

Further activities under crops and livestock, especially with regard to cropland and nutrient management, and forests (e.g. land restoration, forest management, and protection and preservation of other terrestrial ecosystems) offer opportunities to achieve simultaneous climate change mitigation and adaptation benefits.



## BOX 10.

## SELECTED SYNERGIES BETWEEN MITIGATION AND ADAPTATION

<b>Agriculture (crops, livestock)</b>	Improving pasture management would increase the carbon sink of CO <sub>2</sub> eq to 29 million t/yr which is equal to one-third of emission reduction in the energy sector; Reducing bare fallow to 30 percent in rain-fed crop land, increasing variety of crops, zero-tillage and crop rotation would consequently increase a carbon sink; Increasing protected areas up to 25-30 percent of the total territory will help maintain natural ecosystems and preserve water resources with a certain synergy effects for emission reduction; Increasing forest area up to 9 percent by 2030 and reducing forest fire affected areas by 30 percent would conserve ecosystems and increase carbon sink (Mongolia).
<b>Fisheries</b>	Restoration of mangrove forests help sequestering carbon, can prevent coastal erosion (Myanmar) and attracts and provides habitat for fish and other marine resources (Senegal).
<b>Forestry</b>	Protection of wetlands and watersheds as carbon sinks also reduces risks of flooding and storm surge by enhancing water retention (Antigua and Barbuda). Adaptation action [in the forest sector] will have mitigation co-benefits that will increase climate change resilience, enhance carbon sinks, assist with protection of water resources and, more generally, the health of the people (Bahrain). Actions to preserve the forest provide flood management benefits (adaptation) and where this is coupled with reforestation or afforestation to expand the forests reserves area, there could be enhanced mitigation benefits too (Brunei Darussalam).

While countries widely acknowledge the potential adaptation-mitigation synergies in the agriculture sectors, in some countries' INDCs agriculture sector measures were included in adaptation or mitigation objectives without respective references in the other sections.

## 7.2. ENERGY PRODUCTION AND USE

One hundred and eighty-four out of 188 countries mention energy as a sector for mitigating climate change, many of which refer to renewable energy. Approximately 40 percent of these countries explicitly mention bioenergy. One third of all countries refer to biomass as a source of renewable energy when discussing mitigation measures. Three SIDS (Belize, Fiji and Samoa) mention bioenergy production as a mitigation activity related to the energy sector, without referring to any other measures in agriculture or LULUCF. Different biomass resources are mentioned, ranging from agricultural/forestry residues (e.g. rice husk) and dedicated bioenergy plantation (e.g. sugar cane, coconut) to harvested wood products (e.g. wood chips).

Twenty-one countries plan measures that reduce energy use in the agriculture sectors (e.g. solar irrigation schemes).

Fourteen percent of all countries explicitly reflect on fuelwood as a driver of deforestation and forest degradation. Almost all of these countries are from LDCs (almost 75 percent) and developing countries (21 percent). Thirty countries note their intentions to promote more efficient cook stoves as a means of mitigating climate change (see Box 11). Other countries highlight co-benefits between agriculture and energy, which further amplifies the linkages between these sectors.

## BOX 11.

## SELECTED EXAMPLES OF BIOENERGY PRODUCTION AS COMMUNICATED IN THE INDCs

<b>Belize</b>	Promote and facilitate Clean Production systems in the processing of Agriculture and Forestry outputs to co-produce bio-fuels and/or electricity. Promote the adoption of appropriate processing technologies to convert biomass from waste, forestry, agriculture and microbial production into food, feed, fibre, chemicals and energy (electricity, heat and bio-fuels)
<b>Republic of Congo</b>	To increase the share of renewable energy to be used for the extraction of mining products to 90 percent in 2025 and 95 percent in 2035 (use of biomass plantations in savannah in addition to hydropower). Sugar cane or palm oil could also be extended to the production of ethanol or digester for agricultural and rural fuels.
<b>Côte d'Ivoire</b>	Reforestation with fast-growing species for energy generation purposes (Reboisement avec des essences à croissance rapide à vocation bois énergie).
<b>Cuba</b>	Construction of 19 bio-electricity plants on-site at sugar mills that produce 755 MW from sugar cane and forest biomass (19 bioeléctricas anexas a los centrales azucareros con 755 MW a partir de la biomasa cañera y forestal).
<b>Bosnia Herzegovina</b>	Energy generation from wood chips and wood waste.
<b>Fiji</b>	Large-scale biomass production is also an important option that is part of the mix from the Fiji Sugar Corporation (FSC) and timber producers. In addition, small scale biomass is a distinct possibility.
<b>Guyana</b>	Independent power producers and suppliers will be encouraged to construct energy farms and sell energy to the national grid. The Agencies will work closely with small farmers to encourage the use of small bio-digesters to reduce waste and produce biogas.
<b>Laos</b>	Determine and develop policies related to the most effective use of lands for plantation of crops for fuel and industrial uses, carry out participatory land use planning and local land use zoning, and monitor and enforce the implementation of the policy.
<b>Samoa</b>	12MW of various projects aimed at utilizing biomass, biogas or alternative bioenergy source for electricity generation to be implemented by IPPs (see Energy Sector Plan 2012-2016): biofuel from coconuts and other energy crops.

## 7.3. CO-BENEFITS WITH OTHER ENVIRONMENTAL, ECONOMIC AND SOCIAL GOALS

Almost 30 percent of all countries mention social, economic and environmental co-benefits (especially rural development and health, poverty reduction and job creation, and conservation of ecosystems and biodiversity). Particularly with regard to gender equality, agriculture is highlighted as a sector – more than any other – that can provide diverse opportunities for empowering women and reducing their vulnerability to climate change.

## BOX 12.

**GENDER IN THE INDCs**

More than 40 percent of the submissions mention gender-related issues, though to a varying extent: Seven countries inform about the status of women in the national context (e.g. literacy rate, gender equality, inclusion in development) without further including the topic in their contributions.

Twelve countries point out the special vulnerability of women to climate change. Thirty-six countries mention gender in the adaptation section, most often associated with adaptation goals, capacity building, or mainstreaming in policies and plans. Four countries intend to strengthen the resilience of women to disasters, through safety nets and other support systems, or by implementing gender sensitive DRM initiatives. With respect to agriculture, seven countries mention gender concerns, either in stating explicit measures in adaptation (e.g. Côte d'Ivoire: strengthening capacities especially of women farmers in the context of intensified and sustainable modes of production); or in pointing to the co-benefits for women that arise from mitigation and adaptation actions (e.g. Zambia: rural poverty reduction particularly among women). Four countries mention gender in connection with the benefits of renewable energy and increased efficiency (better cook stoves, etc.). More than half of the countries that refer to this topic promote an active role for women during the implementation process of their INDC and in future policy design. However, only three countries explicitly mention the engagement of women or their representatives (such as ministries for gender promotion/equality and women's organizations) in the stakeholder process (Burkina Faso, Liberia, Mauritius).

Multiple co-benefits are acknowledged in the context of mitigation activities in agriculture and LULUCF. Twenty-six countries mention co-benefits related to agriculture, 16 of which are in SSA. One-third of these 26 INDCs are from countries in LAC, Northern Africa and Western Asia, and Southern Asia. Meanwhile, 29 countries identify co-benefits related to LULUCF with a majority from LDCs (15) and other developing countries (13).

In many cases, only broad concepts are listed as co-benefits. For instance, regarding agriculture mitigation activities, rural development is mentioned by four developing countries and six LDCs. Many countries explicitly refer to food security under agricultural measures (e.g. Burkina Faso, Cameroon, Ethiopia and India). Poverty reduction and job creation are referred to by five countries in SSA.

## BOX 13.

**SELECTED EXAMPLES FOR MEASURES ALONG THE FOOD SUPPLY CHAINS AS COMMUNICATED IN THE INDCs.**

<b>Cameroon</b>	Develop the production of animal feed supplements and fish and other products (silage, etc.); develop an efficient mechanization of agriculture and improve processing and packaging infrastructure to extend the value chain; improve the livelihood of rural producers and their connection to markets, improved access to materials, equipment and appropriate financing.
<b>Congo</b>	To develop 50 percent of savannas under agricultural private-cooperative partnerships for the production of food crops (cassava, peanuts, sweet potato, potato, banana, plantain, yam, rice, meat, oil palm, corn, ...) but also export crops or livestock feed (soya, pellets).
<b>Côte d'Ivoire</b>	Elaboration of the concept "Agriculture zero deforestation" and valorisation of related products; develop basic infrastructure for improving transport logistics of agricultural products, livestock and aquaculture; Promotion and intensification of production and use of highly productive seeds and particularly resistant to climatic factors and disease (excluding GMOs and hybrids); Strengthening partnerships and collaborations on soil analysis to improve their productivity and improve the implementation of agricultural innovations; Development of efficient agricultural mechanization and improvement of packing facilities, harvesting and conservation; Promotion of agriculture and livestock association.
<b>Morocco</b>	Modernize the agriculture sector to make it more competitive and integrated in the global market to create wealth over the entire value chain.
<b>Nepal</b>	Nepal with its Agriculture Development Strategy will gradually move towards commercial agriculture considering climate change vulnerabilities.
<b>Viet Nam</b>	R&D solutions to reduce GHG emissions in farming, livestock, fisheries and animal feed and food processing.

# PLANNING AND IMPLEMENTATION OF THE INDCs

## 8.1. STAKEHOLDER ENGAGEMENT

Countries highlighted the importance of incorporating the views, observations and approval of all relevant stakeholders in order to identify realistic and effective mitigation targets that comply with the development goals of the countries and are socially feasible. Nevertheless, only a few INDCs actually name key stakeholders explicitly.

Eighty-one countries (90 percent of which are from developing countries, including LDCs) provide insights into the national consultation processes, which involved, inter alia, different ministries, academic and research institutions, civil organizations, provincial and regional governments, the private sector and international development partners. In many cases the stocktaking of possible measures has been supported by national or international research groups and then discussed in a broader stakeholder process.

Most countries do not include detailed information about the exact stakeholders involved. Public agencies representing agriculture sectors were explicitly mentioned in eight out of the 81 INDCs that comment on national consultation processes.<sup>30</sup>

## 8.2. POLICIES AND INSTITUTIONS

Approximately 80 percent of all countries refer to policies and frameworks that were used in the preparation of their INDC, while more than 72 percent also present existing or planned policies to support the implementation of their intended contributions. LDCs most often included this type of information; 87 percent mention at least one policy or plan as a basis for formulating their INDCs, while 68 percent point to at least one policy or plan as a means of supporting implementation.

Specific frameworks mentioned include national sector policies and development plans, and UNFCCC-related documents, such as National Communications, Biennial Update Reports, Nationally Appropriate Mitigation Actions (NAMAs) and National Adaptation Programmes of Action (NAPAs).

Most countries recognize the importance of incorporating climate change in their national policy agenda. Some examples include: comprehensive national legally binding climate change legislation; taxes or penalties on CO<sub>2</sub> emissions; national climate change

<sup>30</sup> This figure also includes New Zealand which did not specify the stakeholder engagement within the INDC, but provided a link to a Cabinet paper that outlines the extensive consultation process. In this document, agriculture stakeholders (e.g. relevant ministries, indigenous population) were featured very prominently.





strategies; GHG inventories; emissions trading schemes; and specific sectoral policies (e.g. agriculture, energy, forest management, transport), among others.

Countries emphasized the importance of strengthening national institutional arrangements, particularly through multi-sectoral cooperation and inter-ministerial coordination. Additionally, several countries presented their efforts to involve private sector, civil society and other non-governmental actors.

Most countries also emphasized the importance of monitoring and evaluating (M&E) the impact of the proposed strategies. Some countries elaborated on their intentions to establish adaptation and vulnerability indicators to measure progress. Others included detailed measures for monitoring, reporting and reacting to the performance of their adaptation and mitigation strategies. There are also some cases where countries introduced M&E measures for specific regions or sectors only, and intend to scale them up to the national level.

Although most countries included some description of the policy frameworks and institutional arrangements under which their INDCs would take place, many identified the need to strengthen these processes and institutions.

Several countries emphasized the inclusion of all levels of government and the need to strengthen inter-ministerial coordination for climate action. Additionally, some countries expressed the relevance of national, subnational and regional cooperation among governments and non-state actors, including through south-south cooperation.

### 8.3. FINANCIAL RESOURCES

Throughout the INDCs, countries highlighted (in different levels of detail) the support needed to implement their contributions. Almost 30 percent of the countries included estimates of their financial needs. Table 1 exhibits the share of countries that specify or intend to seek international financial support.

TABLE 1.

**Countries indicating need for financial support for the implementation of their INDCs**

	TOTAL PARTIES	% OF PARTIES HIGHLIGHTING NEED FOR FINANCIAL SUPPORT
<b>Least developed countries</b>	47	100%
<b>Developing countries</b>	84	92%
<b>Countries in transition</b>	16	55%

Thirty-five countries mention domestic efforts to address these financial needs. Such efforts include: the adoption of market instruments; the use of public-private partnerships; expansion of budgetary support for climate action; environmentally responsible procurement; reformation of fiscal regimes; and enhancement of green credit mechanisms.

Few countries provided specific figures on the degree of support required. Figures and the level of detail provided varied. For the most part, information related to exchange rates and projected inflation was not included. Some countries described funding needs for

specific projects at local level, or for a particular economic sector. Others provided general figures without a breakdown of the items they would be covering.

These estimates range from USD 50 million (Nauru) to USD 2.5 trillion (India). Distinguishing between mitigation and adaptation, the financial resources needed for the reduction of emissions vary between USD 50 million (Nauru) and USD 834 billion (India, for low carbon development). Projected adaptation costs range from USD 25 million (Dominica) to USD 213.7 billion (India, for the agriculture sectors and energy). Most countries based their calculations on previous policy documents, in particular NAPAs and NCs, so that in many cases the time period of commitments for mitigation and adaptation does not coincide. Similarly, it is often unclear which of the projects included in the cost estimates are already ongoing and have secured funding, and which ones are conditional upon future support.

Table 2 provides an overview of the funding needs of selected countries in Sub-Saharan Africa. It is important to note that quantitative comparisons need to be treated with caution due to data inconsistencies. For the sake of comparison, the numbers stated in the INDCs were reconciled so as to present annual financial needs of the countries. Even for this small sample, figures vary to a great extent. On average, annual financial needs for adaptation amount to 70 percent of the needs for mitigation. Four countries (Burkina Faso, Eritrea, Senegal and Togo) delineate higher needs per year for adaptation than for mitigation, by as much as 400 percent in the case of Eritrea. In comparison to other countries, Sub-Saharan Africa shows the highest average cost share of agriculture and LULUCF in mitigation, as well as the highest share of the agriculture sectors in total financial needs for adaptation.

Less than 10 percent of developing countries include concrete information regarding funding for unconditional commitments. In some cases, these figures were the result of allocating a portion of the domestic budget. In other cases, they represent international funds that countries had already secured, hence they were counted as unconditional resources.

TABLE 2.

**Financial needs per year of selected countries in Sub-Saharan Africa (in current Mio. USD)**  
(Source: Parties' INDCs)

Party/ Region	TOTAL NEEDS		MITIGATION AGRICULTURE		MITIGATION LULUCF		ADAPTATION AGR	
	Mitigation	Adaptation	Allocated	Needed	Allocated	Needed	Allocated	Needed
Sub-Saharan Africa	5,030	3,573	51	1,332	24	1,092	720	1,883
Angola	1,470	100		770*		250		10
Burkina Faso	188	581		65	22	65		142
CAR	220	144	25		2	4		31
Congo	1,254	908		353		630		81
Eritrea	46	203					107	138
Mauritania	820	627						126
Senegal	333	650	26	120	<0.01	5	32	10
Seychelles	28	27						3
Somalia				<0.01		2		1
Togo	100	140				45*		21
Uganda	570	193		24				12
Zimbabwe						91*	582	1,309

\*: number represents the needs for both conditional and unconditional measures

Some countries identified specific international funds that are already financing parts of their respective INDCs and/or those that they will target in the future. Regarding possible funding sources across various sectors, about 15 percent of all countries mention the Green Climate Fund (GCF). Other funds noted are the Global Environment Facility and the Adaptation Fund; the Least Developed Countries Fund and the Special Climate Change Fund, as well as other bilateral and multilateral sources of funding, including United Nations programmes and organizations, foreign direct investments and soft loans. In addition to the funds, Parties noted that certain measures could be implemented as market mechanisms. More than one-third of the countries indicate that they plan to use (or consider using) market-based instruments, either at national and/or regional level or to make use of international mechanisms. Examples include the Clean Development Mechanism (CDM), European Union Emissions Trading System (EU ETS), ecosystem service payments, and Verified Carbon Standard (VCS), among others. Some countries explicitly state that they will not use market mechanisms.

#### 8.4. GAPS, BARRIERS AND NEEDS

Around 60 percent of the countries express the need for general support related to technology transfer and capacity building. Technology transfer most often relates to renewable energy, energy optimization, mitigation and adaptation technologies, data collection and implementation of national R&D initiatives, among others. With regard to capacity building, countries prioritize technical capacities, followed by capacity development in engaging stakeholders, and formulating strategies and policies. More

specific needs revolve around monitoring and evaluation, stakeholder involvement, policymaking, and awareness raising. However, less than 20 percent of countries provide information on the specific areas where they would like to receive assistance from international entities. Most countries include only general references to their technology transfer and capacity building needs.

Regarding the agriculture sectors, technical needs frequently relate to the development of forest inventories and national planning systems, or approaches to reduce dependence on inefficient bioenergy technologies. Some countries also mention the current lack of technologies associated with Measurement, reporting and verification (MRV) like geographic information systems and remote sensing.

Needs associated with capacity building were also identified, especially with regard to best practices for implementing sustainable forest management, including the use of technologies like GPS and cartography, and climate-smart agriculture. Countries also highlight the need for support in implementing afforestation and reforestation activities. Furthermore, countries request training on how to assess (or improve established methods for) GHG emissions and removals. Additionally, some countries mention the need to develop policies and/or establish institutions (e.g. through the implementation of initiatives such as REDD+).





# REFERENCES

- Grassi, G., & Dentener, F. (2015). Quantifying the contribution of the Land Use sector to the Paris Climate Agreement. The LULUCF sector within the Intended Nationally Determined Contributions. JRC. doi:<http://dx.doi.org/10.2788/096422>
- Höhne, N., Ellermann, C., & Fekete, H. 2014. Process guidance for Intended Nationally Determined Contributions (INDCs). International Partnership on Mitigation and MRV. <http://mitigationpartnership.net/international-partnership-mitigation-and-mrv-2014-process-guidance-intended-nationally-determined--0>
- Holdaway, E., Dodwell, C., Sura, K., & Picot, H. 2015. A Guide to INDCs. Ricardo-AEA/CDKN. [http://mitigationpartnership.net/sites/default/files/u2055/cdkn-ricardo-aea-guide-to-indcs\\_final\\_web.pdf](http://mitigationpartnership.net/sites/default/files/u2055/cdkn-ricardo-aea-guide-to-indcs_final_web.pdf)
- Holmes, K., & Ramage, A. 2015. The Land Sector and Country Commitments to global Climate Action: A Rainforest Alliance Assessment of Intended Nationally Determined Contributions (INDCs). Rainforest Alliance. [http://www.rainforest-alliance.org/sites/default/files/publication/pdf/INDC-Assessment\\_12-4-5\\_Final.pdf](http://www.rainforest-alliance.org/sites/default/files/publication/pdf/INDC-Assessment_12-4-5_Final.pdf)
- Holmes, K., & Ramage, A. 2015. The Land Sector and Country Commitments to Global Climate Action: A Rainforest Alliance Assessment of Intended Nationally Determined Contributions (INDCs). New York, N.Y.: Rainforest Alliance.
- Levin, K., Rich, D., Bonduki, Y., Comstock, M., Tirpak, D., McGray, H., Waskow, D. (2015). Designing and Preparing Intended Nationally Determined Contributions (INDCs). WRI/UNDP. [http://mitigationpartnership.net/sites/default/files/indcs\\_may27\\_v2.pdf](http://mitigationpartnership.net/sites/default/files/indcs_may27_v2.pdf)
- Petersen, K., & Braña Varela, J. 2015. INDC Analysis: An Overview of the Forest Sector. [http://d2ouvy59p0dg6k.cloudfront.net/downloads/r2\\_wwf\\_indc\\_brief.pdf](http://d2ouvy59p0dg6k.cloudfront.net/downloads/r2_wwf_indc_brief.pdf)
- Richards, M., Bruun, T., Campbell, B., Gregersen, L., Huyer, S., Kuntze, V., Vasileiou, I. 2015. How countries plan to address agricultural adaptation and mitigation. An analysis of Intended Nationally Determined Contributions. CCAFS: CGIAR. <https://cgspace.cgiar.org/rest/bitstreams/63683/retrieve>
- South Centre. May 2015. Policy Brief on Intended Nationally Determined Contributions (INDCs). Climate Policy Brief, 17. [http://www.southcentre.int/wp-content/uploads/2015/05/CPB17\\_Intended-Nationally-Determined-Contributions\\_EN.pdf](http://www.southcentre.int/wp-content/uploads/2015/05/CPB17_Intended-Nationally-Determined-Contributions_EN.pdf)
- UNFCCC. 2015. Synthesis report on the aggregate effect of the intended nationally determined contributions. <http://unfccc.int/resource/docs/2015/cop21/eng/07.pdf>
- Wienges, S., Zachow, I., von Lüpke, H., Neubert, A., Harthan, R., & Siemons, A. 2015. How to advance Intended Nationally Determined Contributions. International Partnership on Mitigation and MRV. [http://mitigationpartnership.net/sites/default/files/2015-how\\_to\\_advance\\_indcs.pdf](http://mitigationpartnership.net/sites/default/files/2015-how_to_advance_indcs.pdf)



**Convention on Biological Diversity CBD.** 2008 . The potential impacts of biofuels on biodiversity - matters arising from SBSTTA recommendation XII/7; Note by the Executive Secretary; UNEP/CBD/COP/9/26

**Zelege, A., Phung, T., Tulyasuwan, N., & O'Sullivan.** 2016. Role of Agriculture, Forestry, and Other Land Use Mitigation in INDCs and National Policy in Asia. *LEDS Global Partnership - Agriculture, Forestry and Land Use (AFOLU) working Group*. <http://ledsgp.org/wp-content/uploads/2016/01/Role-of-AFOLU-mitigation-in-INDCs-and-nat-policy-in-Asia-review-draft-Nov-24-2015.pdf>.

# ANNEX

## A. METHODOLOGY

### A.1 Approach

This annex provides a brief overview of the challenges, approach and assumptions underlying the screening and analysis of the INDCs.

#### Data collection and organization

The systematic investigation of the INDCs entails a set of methodological challenges owing to the aggregate volume of the documents (totaling almost 2 000 pages) and the heterogeneity and depth of content.

The methodology underlying the findings in this report aimed to consider these aspects as much as possible prior to the data gathering. In order to ensure a systematic screening, a data structure was developed, containing the information blocks outlined by UNFCCC and refined/extended by categories of special interest for FAO. Subsequently, each INDC was screened for the respective criteria. Due to the heterogeneity of the documents, each document was studied in full detail in order to ensure the proper coverage of the agriculture sectors. This meant reading through all documents and extracting the original text fragments, which facilitates the replication and re-examination of the screening process. Subsequently, data were cross-checked by keyword search reflecting the range of terms used in the INDCs.

In order to evaluate the significance of agriculture relative to other sectors in a coherent framework, the data collection was not restricted to crops, livestock, fisheries and forestry only. The coverage of the full INDCs also gives a benchmark for comparison with other INDC analyses at a more aggregated level (such as UNFCCC 2015).

For retrieving the quantitative results, the original text phrases were classified according to pre-defined categories (see Smith et al. 2014 for mitigation measures in agriculture and LULUCF, as well as FAO 2016, Vadacchino et al. 2011 for adaptation measures in the agriculture sectors). For the purpose of this report, INDCs were aggregated according to the classification presented in Annex B.

The following rules underlie this report:

- (a). The analysis is entirely based on information communicated by Parties in their INDCs as at 31 March 2016. Revised submissions were considered until that date. Nationally determined contributions (NDCs) are not included in this analysis, as NDCs present countries' commitments on climate action under the Paris Agreement against which they will have to report progress in the years to come.

Thus, they imply a higher degree of commitment than INDCs. Panama, which submitted its NDC on 19 April 2016 is not included in this analysis.

- (b). As at 31 March 2016, 161 INDCs were submitted to the UNFCCC, corresponding to 188 countries and 189 Parties, respectively.<sup>31</sup> Countries mostly provided the documents in English, Spanish, French; INDCs formulated in other languages such as Russian, Arabic and Chinese were accompanied by official translations. When possible, official translations from the Parties are used in the screening analysis. The INDCs of two countries (Iraq and Kuwait) are covered only in broad categories (sectors for mitigation and/or adaptation) based on the WRI compilation, as no official translation is available up to date.
- (c). Agriculture and LULUCF are assessed based on the overall information provided by the INDCs irrespective of the conditionality of the contributions.
- (d). The report does not include in its analysis any other policy or target not communicated by Parties as part of their INDCs, nor does it consider any information provided in other documents (such as sectoral plans or other documents related to the convention) mentioned in the INDCs regarding planning, formulation and/or implementation of the contributions.
- (e). Mitigation contributions in agriculture and LULUCF are assessed along IPCC guidelines on GHG inventories.
- (f). Mitigation activities follow the categorization outlined in AR4, WG III.
- (g). Bioenergy is discussed separately from mitigation contributions as the overall impact on GHG emissions depends on various factors. This means that countries that refer to bioenergy only are not accounted for in the sector coverage.
- (h). Since no clear guidelines were provided for the communication of adaptation measures, adaptation strategies (i.e. policies and other measures) are analysed based on the categorization of agriculture sectors from FAO (i.e. crops, livestock, fisheries and aquaculture, forestry).

## A.2 Country Classification

Under UNFCCC, the 197 Parties have different commitments based on their status of economic development. For this reason, a hybrid version was chosen for the presentation of the findings in this report reflecting both economic conditions and regions. It is aligned with the classification by UN/DESA (WESP 2016) which subsumes countries in the following three mutually exclusive groups (the number of countries included in the respective grouping is shown in round brackets):

**Developing countries (including LDCs)**<sup>32</sup>, which can be grouped in the following six regions (139 countries in total, 132 of which submitted INDCs):

1. Eastern and South Eastern Asia (15)

<sup>31</sup> Latvia submitted the INDC on behalf of the European Union which counts for 29 Parties (28 member states and the European Union). The following eight Parties have not provided (I)NDCs yet: Libya, Nicaragua, North Korea, San Marino, State of Palestine, Syria, Timor-Leste, Uzbekistan.

<sup>32</sup> Square brackets refer to respective FAO subregions.

†These countries are subsumed under Western Asia according to the UN standard country classification M49 from 2013.

2. Latin America and Caribbean [Central America, South America, Caribbean] (33)
3. Northern Africa and Western Asia (21)
4. Southern Asia (9)
5. Sub-Saharan Africa [Middle, Western, Southern, Eastern Africa, including Sudan] (49)
6. Oceania (14)

Within this group, all countries represent Non-Annex-I (NAI) Parties to the Convention. The 48 LDCs are given special consideration under the Convention due to their vulnerability and low adaptive capacity to climate change.

**Countries with economies in transition** from South-Eastern Europe and the Commonwealth of Independent States, including Georgia : Albania, Bosnia and Herzegovina, Montenegro, Serbia, Macedonia; Armenia†, Azerbaijan†, Belarus, Georgia†, Kazakhstan, Kyrgyzstan, Republic of Moldova, Russian Federation, Tajikistan, Turkmenistan, Ukraine, Uzbekistan (17 countries in total, 16 of which submitted INDCs).

All but three countries are in Europe and Central Asia according to the UN standard country classification M49. † Except for Belarus, the Russian Federation, and Ukraine all economies in transition are NAI Parties.

**Developed countries** from Europe (EU-28 plus Andorra, Iceland, Liechtenstein, Norway, Monaco, San Marino, Switzerland)), Northern America (Canada, US), Australia, Japan, New Zealand (40 countries and 41 Parties in total, all of which submitted INDCs)



## B. CLIMATE-SMART AGRICULTURE (CSA) IN THE INDCs

COUNTRIES THAT REFER TO CSA IN THE INDCs			
	Country	Section	Original text from the INDC
1	<b>Bhutan</b>	Mitigation	<p>Promote climate smart livestock farming practices to contribute towards poverty alleviation and self sufficiency through:</p> <ul style="list-style-type: none"> <li>• Organic livestock farming and eco-friendly farm designs;</li> <li>• Improvement of livestock breeds, including conservation of native genetic gene pool/ diversity;</li> <li>• Expansion of biogas production with stall feeding;</li> <li>• Agro-forestry or agro-silvo pastoral systems for fodder production.</li> </ul> <p>Promote climate smart agriculture to contribute towards achieving food and nutrition security through:</p> <ul style="list-style-type: none"> <li>• Organic farming and conservation agriculture;</li> <li>• Development and promotion of sustainable agricultural practices;</li> <li>• Integration of sustainable soil and land management technologies and approaches.</li> </ul>
2	<b>Botswana</b>	Adaptation	Climate Smart Agriculture which include techniques such as low to zero tillage, multi-cropping to increase mulching which reduce evapotranspiration and soil erosion.
3	<b>Burundi</b>	Adaptation	Promotion of climate-smart agriculture (agrometeorology); Integration of smart agriculture into the National Agricultural Investment Programme (NAIP).
4	<b>Cambodia</b>	Adaptation	Promoting climate resilient agriculture in coastal areas through building sea dykes and scaling-up of climate-smart farming systems.
5	<b>Central African Republic</b>	Mitigation and adaptation	The inclusion of climate-sensitive agroecological approaches (smart agriculture) in the PNIASAN with a view to increasing productivity and yield may make it possible to keep each farmer on the same original parcel of land for five years, which will make it possible to minimise or complete avoid increases in area and thus capitalise the deforestation (28 percent) avoided over the four years following the start-up of the project.
6	<b>Equatorial Guinea*</b>	Mitigation	Convertir a Guinea Ecuatorial en un país de referencia en concepto de agricultura climáticamente inteligente para las zonas tropicales con los objetivos de garantizar la seguridad alimentaria, diversificar la economía nacional, limitar las emisiones de metano y óxido nitroso, así como favorecer la captación de carbono.
7	<b>Eritrea</b>	Adaptation	Eritrea has been undertaking vigorous efforts to enhance Climate Smart Agriculture.

\* = Countries with similar terms in original language

\*\* = Countries that state "climate-smart" in combination with other terms (techniques, fishery systems, etc.)

COUNTRIES THAT REFER TO CSA IN THE INDCs			
	Country	Section	Original text from the INDC
8	<b>Ghana**</b>	Adaptation	Agriculture resilience building in climate vulnerable landscapes: [...] Scale up penetration of climate smart technologies to increase livestock and fisheries productivity by 10 percent.
9	<b>Haiti*</b>	Adaptation	Développer la bio-économie, l'agriculture climato-intelligente et biologique.
10	<b>Iran**</b>	Adaptation	Modern and eco-friendly and climate smart agricultural technology and practices for scattered local communities in 2/3 of the country's area.
11	<b>Jordan*</b>	Adaptation	Raising awareness and declarations on Climate Intelligent Agriculture and promoting utilization of renewable energy and uses in agricultural and food production sector for cooling and heating purposes, for example in poultry production, nurseries, green houses, olive mill, etc.
12	<b>Kenya</b>	Mitigation and adaptation	Climate smart agriculture (CSA) in line with the National CSA Framework.
13	<b>Liberia**</b>	Adaptation	(F) Develop and implement climate smart fishery systems to enhance the adaptive capacity and resilience of fisher communities.
14	<b>Madagascar</b>	Mitigation and adaptation	(M) Large scale implementation of conservation agriculture and climate-smart agriculture; smart use of marine resources.  (A) National Food Security assured through a large scale implementation of Resilient Agriculture Integrated Models (climate-smart agriculture) in major agricultural centres.  (F) Development and implementation of sustainable fishing management plans, strengthening of institutional capacity and adaptation of infrastructure (quay) to climate change (sea level rise).
15	<b>Malawi</b>	Mitigation	The mitigation measures suggested in the agricultural sector will unconditionally contribute 100 Gg CO <sub>2</sub> equivalent mainly from reduced synthetic fertilizer application, and around 400 Gg CO <sub>2</sub> equivalent per annum from implementing climate smart agriculture extensively by 2040, conditional upon support.
16	<b>Mali</b>	Mitigation and adaptation	(M) Le Programme pilote de développement d'une agriculture intelligente et résiliente aux changements climatiques.  (A) Développement d'une agriculture intelligente et résiliente aux changements climatiques, pour l'aménagement hydro-agricole de 92,000 ha dans le contexte d'une gestion durable des terres avec l'engagement de l'Etat à consacrer 15 percent du Budget national à l'agriculture.

\* = Countries with similar terms in original language

\*\* = Countries that state "climate-smart" in combination with other terms (techniques, fishery systems, etc.)

COUNTRIES THAT REFER TO CSA IN THE INDCs			
	Country	Section	Original text from the INDC
17	<b>Mauritius</b>	Mitigation and adaptation	(M) Climate smart agriculture including bio-farming. (A) Irrigation Techniques: Promote climate smart agriculture practices.
18	<b>Myanmar</b>	Adaptation	The agriculture sector is implementing climate smart agriculture approaches through implementation actions such as legume crops diversification, measures in the agro-forestry sector and systematic control of soil quality and irrigation water.
19	<b>Namibia</b>	Mitigation and adaptation	(M) Reducing chemical fertilizers by 20 percent through conservation and climate smart agricultural practices, use of organic manure and composts. (A) Promotion of climate smart agriculture and conservation agriculture.
20	<b>Niger</b>	Mitigation and adaptation	(M) Niger's strategy is based on the vision of climate-smart agriculture; The climate-smart agriculture support project of HC-13N, financed by the World Bank in the amount of US \$111 million beginning in 2016 and lasting five years in 20 departments. (A) The co-benefits in the AFOLU sector consist of the results of implementing and upscaling the climate-smart agriculture activities; the techniques of climate-smart agriculture are consistent with the objectives of the INDC (adaptation, mitigation and food security) by strengthening grassroots development.
21	<b>Nigeria</b>	Mitigation	Climate smart agriculture and reforestation.
22	<b>Seychelles</b>	Adaptation	The Ministry anticipates additional resources being committed to enhance human capacity development at the Seychelles Agricultural Agency, revitalising the extension services and also providing opportunities for young Seychellois to study climate-smart and ecosystem-based approaches to agriculture, put in place programmes for sustainable industrial and artisanal fisheries, sustainable mariculture, promote home gardening, improve port infrastructure for artisanal and industrial fisheries, reduce illegal, unreported and unregulated activities; and continue to support the insurance scheme for farmers and fishers.
23	<b>Sierra Leone</b>	Mitigation	Adoption and application of climate-smart and conservation agriculture through best agricultural practices that enhance soil fertility and improve crop yield.
24	<b>South Sudan</b>	Adaptation	South Sudan will thus embark on promoting sustainable, climate smart agriculture and livestock production and management.
25	<b>Swaziland</b>	Adaptation	Reduce vulnerability to the impacts of climate change by building adaptive capacity and resilience through water security, climate-smart agriculture.

\* = Countries with similar terms in original language

\*\* = Countries that state "climate-smart" in combination with other terms (techniques, fishery systems, etc.)

COUNTRIES THAT REFER TO CSA IN THE INDCs			
	Country	Section	Original text from the INDC
26	<b>Togo</b>	Mitigation and adaptation	(M/A) Commitment to the Climate-Smart Agriculture process in the framework of the implementation of the agricultural policy laid out by ECOWAS and NEPAD.
27	<b>Uganda</b>	Mitigation and adaptation	(M/A) Sustainable Land Management (SLM) and Climate Smart Agriculture (CSA) will be scaled up to increase resilience at the grassroots level; Climate Smart Agriculture techniques for cropping (Agricultural soils: 36 percent of national GHG emissions (13.5 Million tons of carbon dioxide equivalent per year (MtCO <sub>2</sub> eq/yr)) in 2000).
28	<b>United Republic of Tanzania</b>	Adaptation	Increasing yields through <i>inter alia</i> climate smart agriculture.
29	<b>Uruguay</b>	Mitigation	In particular, as a result of the 2010 Climate-Smart Agriculture Policy, Uruguay has made, and will continue to make, efforts to build a more efficient, resilient and low-carbon cattle farming sector, by introducing new technologies and incorporating successful experiences undertaken by other countries with similar characteristics.
30	<b>Zambia</b>	Mitigation and adaptation	(M) Conservation/ Smart agriculture. (A) To promote conservation/ smart agriculture activities leading to adaptation benefits and enhancing climate resilience, especially in rural areas, and generation of electricity from agriculture waste.
31	<b>Zimbabwe</b>	Adaptation	The agricultural sector also provides opportunities for climate change mitigation through initiatives such as Climate Smart Agriculture (CSA) and sustainable agro-forest-based adaptation and management practices. (A) Zimbabwe commits to promoting adapted crop and livestock development and climate smart agricultural practices through the following interventions: <ul style="list-style-type: none"> <li>• Strengthening capacities to generate new forms of empirical knowledge, technologies (including conservation agriculture) and agricultural support services that meet climate challenges;</li> <li>• Promoting the use of indigenous and scientific knowledge on drought tolerant crop types and varieties and indigenous livestock that are resilient to changes in temperatures and rainfall;</li> <li>• Developing frameworks for sustainable intensification and commercialization of agriculture at different scales across agro ecologies.</li> </ul>

\* = Countries with similar terms in original language

\*\* = Countries that state "climate-smart" in combination with other terms (techniques, fishery systems, etc.)

### C. RELATED INDC ASSESSMENTS

Several analyses have been conducted on INDCs ahead and in the aftermath of COP 21, differing in scope (global or regional), content (focusing on specific sectors or elements in the INDCs) and level of detail.<sup>33</sup>

The *UNFCCC Synthesis Report* (2015) is the most comprehensive assessment to date. It assesses the extent to which the INDCs contribute to the goal of keeping global warming to 2°C relative to pre-industrial levels and which role the sectors most responsible for anthropogenic GHG emissions – energy, agriculture, forest and land use, industries and waste – play in this regard. The report acknowledges that the INDCs account for land use, land use change and forestry (LULUCF) in different ways, which renders assessments of this sector quite difficult. The aggregate impact of adaptation commitments was not calculated due to methodological uncertainties. Instead, information on adaptation was synthesized by highlighting certain areas and trends.

Apart from the UNFCCC Synthesis Report, the land use sector was not analyzed in a comprehensive manner, as studies either centered on agriculture (CGIAR, LEDS) or LULUCF (JRC, WWF).

The *CGIAR Research Program on Climate Change, Agriculture and Food Security* (CCAFS) developed a series of documents to analyze the role of the agriculture sectors in the INDCs that had been submitted by mid-November 2015. As such, their assessments focused on 133 INDCs representing 160 countries. The CCAFS assessments were conducted using a keyword search to quantify mitigation and adaptation aspects.

Other assessments focus on certain regions or selected countries:

The Rainforest Alliance carried out an in-depth review of agriculture and LULUCF for 22 submissions, focusing in particular on forested countries in the tropics. The study includes countries in which the agriculture sectors are particularly important, as well as some developed and emerging economies that will likely influence trends in the land use sector. The review aims to provide relevant information on forestry, deforestation, climate smart agriculture and adaptation of vulnerable communities to climate change.

The *Joint Research Centre* (JRC) analyzed different mitigation perspectives in the LULUCF sector. The study compares expected net emissions in 2030 (from conditional and unconditional pledges) against countries' business-as-usual (BAU) and pre-INDC scenarios, as well as the share of LULUCF in these contributions. Due to a lack of historical data, the analysis is based on 46 INDCs representing 74 countries.

For example, the *Low Emissions Development Strategies Global Partnership* (LEDS) assessed the role of agriculture and LULUCF in the INDCs of seven Asian countries (Bangladesh, Cambodia, India, Indonesia, Lao People's Democratic Republic, Thailand, and Vietnam). The analysis compares the projected emissions reduction potential to the respective national emission profile for each INDC. The analysis focuses on existing (and potential) mitigation commitments, and has a strong focus on the corresponding financial needs.

<sup>33</sup> Note that the list of studies presented here does not constitute a complete or exhaustive presentation of existing analyses on INDCs.

















**Climate and Environment Division (NRC) Publications**

**Food and Agriculture Organization of the United Nations (FAO)**

[www.fao.org/climate-change](http://www.fao.org/climate-change)

[climate-change@fao.org](mailto:climate-change@fao.org)

ISBN 978-92-5-109244-6



9 789251 092446

15687E/1/05.16