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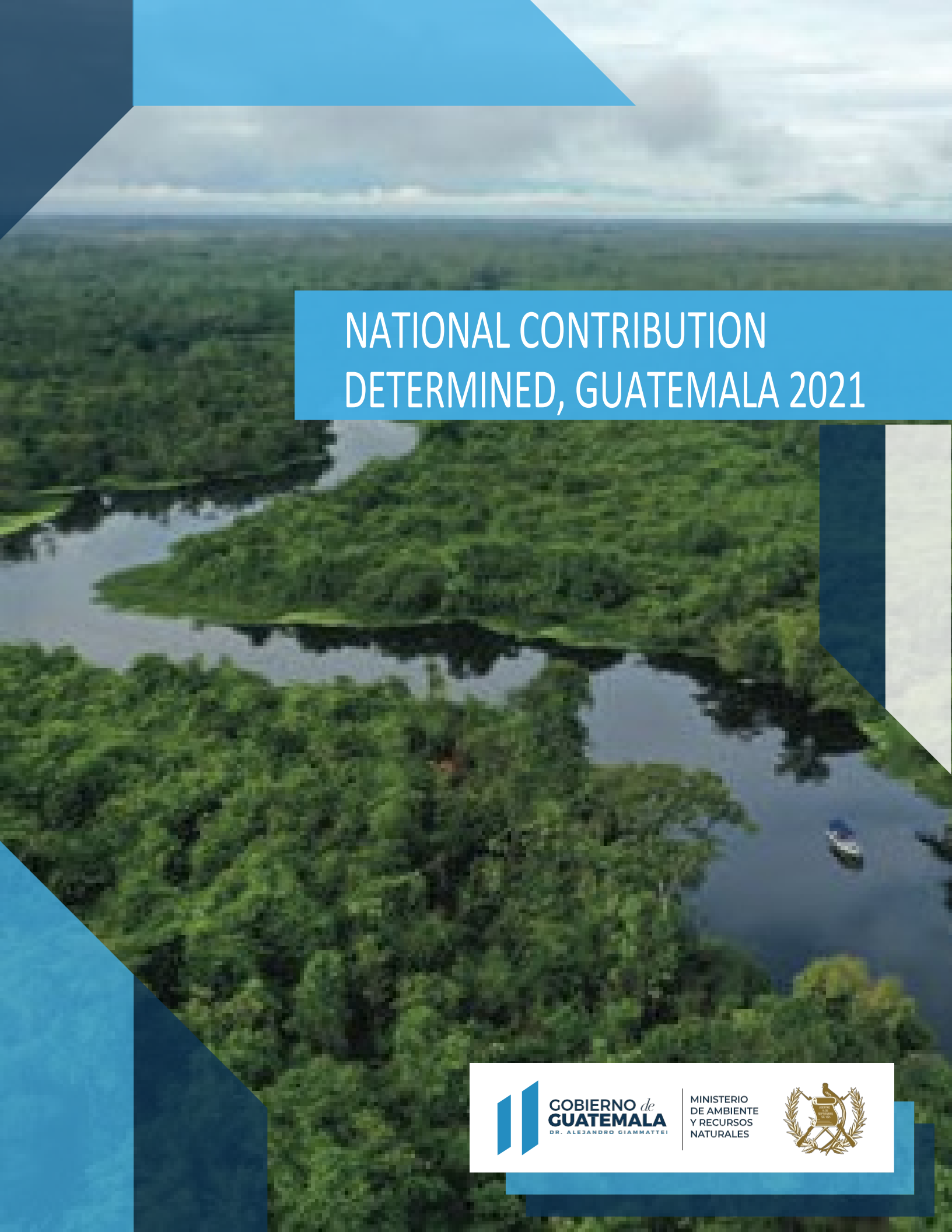

GOBIERNO de GUATEMALA
DR. ALEJANDRO GIAMMATTEI

MINISTERIO DE AMBIENTE Y RECURSOS NATURALES

NATIONAL CONTRIBUTION DETERMINED, GUATEMALA 2021

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Mario Roberto Rojas Espino
Minister of Environment and Natural Resources

MINISTRY OF ENVIRONMENT AND NATURAL RESOURCES
www.marn.gob.gt

PRESENTATION

The Government of Guatemala is pleased to submit Guatemala's **Nationally Determined Contribution (NDC) Update** 2021 to the United Nations Framework Convention on Climate Change (UNFCCC), in which it reaffirms the commitment made in the Paris Agreement.

Guatemala is a multi-ethnic, pluricultural, multilingual and megadiverse country, with a great wealth of natural resources and ecosystem services, essential for the global biological balance, which safeguards vast traditional and ancestral knowledge of indigenous peoples. The country has a Guatemalan System of Protected Areas (SIGAP) which represents 33% of the national territory. Being a country that contributes a very low percentage of global emissions, it is one of the most vulnerable to the effects of climate change worldwide, and has focused its efforts mainly on updating its Nationally Determined Contribution, referring to all those actions that contribute to strengthening resilience, improving adaptive capacity and contributing to the reduction of greenhouse gas emissions to reduce the adverse impacts of climate change.

Guatemala committed to promote low-emission sustainable development and minimise climate change-related threats in accordance with its common but differentiated responsibilities, working on the basis of national capacities to meet the commitments contained in the National Development Plan K'atun: our Guatemala 2032 and the National Development Priorities and Sustainable Development Goals (SDGs).

The National Council on Climate Change, established in Art. 8 of the "Framework Law to Regulate the Reduction of Vulnerability, Mandatory Adaptation to the Effects of Climate Change and the Mitigation of Greenhouse Gases", Decree 7-2013 of the Congress of the Republic, approved the NDC document, becoming an instrument of national priority in terms of compliance to make the necessary efforts in order to achieve the defined goals, nationally and internationally.

This Guatemala 2021 NDC Update ratifies the country's commitment to reduce greenhouse gas emissions through the implementation of climate change adaptation and mitigation actions, in addition to complying with the commitments assumed before the United Nations Framework Convention on Climate Change.

In the exercise of my duties, it is an honour to present to the United Nations Framework Convention on Climate Change, on behalf of the Government of Guatemala through the Ministry of Environment and Natural Resources, the **Guatemala 2021 NDC Update.**

Fredy Antonio Chiroy Barreno
Deputy Minister of Natural
Resources and Climate Change

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INTRODUCTION

Climate change is one of the main threats facing humanity today, and is related to global greenhouse gas emissions and country-specific vulnerability conditions.

The Ministry of Environment and Natural Resources, as the lead agency for environmental issues and Focal Point for the United Nations Framework Convention on Climate Change, proposes inclusive and reactivation strategies through the creation of sustainable models for development, which will allow the implementation of plans and strategies to address the adverse effects of climate change and focus efforts to increase adaptive capacity and vulnerability; and reduce GHG emissions, allowing the country to comply with national legal frameworks and international commitments.

In Guatemala, conscious of maintaining the commitment to the fight against climate change as a national priority, the process of updating the Guatemala 2021 NDC was carried out under the leadership of the Minister of Environment and Natural Resources, Mario Roberto Rojas Espino, and with the participation of governmental organisations, local governments, the private sector, academia, indigenous peoples, civil society and international cooperation, making it a participatory, inclusive and transparent process.

The Guatemala 2021 NDC Update document was prepared under methodological parameters in accordance with the updating of the Greenhouse Gas Inventories presented in the "First Biennial Update Report and the Third National Communication on Climate Change" with emissions information from 1990-2018, considering the 2006 guidelines of the Intergovernmental Panel on Climate Change and the Enhanced Transparency Framework of the Paris Agreement, allowing the definition of goals under quality guidelines and statistical projection of the mitigation sectors; resulting in targets with a higher degree of transparency in relation to the 2015 NDC.

The Guatemala NDC Update 2021, considers 34 targets for the Adaptation component in the sectors of: Agriculture and food security; Marine-coastal zones; Forest resources, ecosystems and protected areas; Integrated water resources management; Human health; and Infrastructure; and 10 targets for the Mitigation component in the sectors of: Land use, land use change and forestry; Energy; Agriculture; and Waste. The sectoral targets have institutional implementers and are supported and monitored by the Ministry of Environment and Natural Resources as the national focal point.

Based on the above, regulatory frameworks will play a fundamental role for efficient planning and monitoring, reporting and verification at all levels and sectors, which will enable the promotion of actions that contribute to low-carbon development, the reduction of vulnerability and the improvement of adaptation practices to improve the living conditions of the Guatemalan population.

The **CND Update** will allow the creation of synergies and strategic alliances between the public-private sector and all actors in society in order to implement responses and action plans, which involve allies in the fulfilment of national and international commitments.

Ciriaco Antonio Urrutia Lemus
Climate Change Director

MINISTRY OF ENVIRONMENT AND NATURAL RESOURCES
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INSTITUTIONAL PROGRESS

Guatemala, as a member country and active within the United Nations Framework Convention on Climate Change (UNFCCC), is aware of the commitments that must be made to combat the effects of climate change. In its role as Guatemala's focal point to the UNFCCC, the Ministry of Environment and Natural Resources (MARN) has made significant progress in institutionalising actions at the national level.

The country has made important contributions through the generation of a series of legal, technical and governance instruments strengthened at the national level. Examples of this are the National Policy on Climate Change (PNCC), Framework Law to regulate the reduction of Vulnerability, mandatory Adaptation to the effects of climate change and Mitigation of greenhouse gases, Decree 7-2013, the National Action Plan on Climate Change (PANCC), the National Strategy for Low Emissions Development (ENDBE), the Environmental Education Law, Decree 38-210 and the National Environmental Education Policy of Guatemala, duly aligned with the National Development Plan: K'atun Nuestra Guatemala 2032, with the Sustainable Development Goals and with the General Government Policy 2020-2024.

Under the leadership and coordination of the Ministry of Environment and Natural Resources, the process of updating the CND of Guatemala 2021 was carried out, mainly in the establishment o f the themes of Adaptation, Mitigation and Metrics; as well as inter-institutional strengthening, being carried out for the first time, as a national multisectoral participatory process.

Guatemala's Nationally Determined Contribution 2021 joins global efforts to contribute to the reduction of GHG emissions. In this sense, Guatemala committed to reduce with its own resources, 11.2%; and with the technical and financial support of the international community, up to 22.6% of its total GHG emissions projected to 2030, with respect to the base year 2016, the year in which the national GHG inventories were updated and reported in the Third National Communication on Climate Change.

Consequently, the CND Implementation Plan is currently being prepared, with the aim of identifying sources of financing and reaching consensus with the different sectors to achieve the new goals and the implementation of the different public policy instruments that contribute to increasing climate ambition.

Therefore, it is important to highlight the efforts that the Ministry of Environment and Natural Resources is making to achieve this goal, including the creation of databases, indicators and targets to consolidate the Monitoring, Evaluation and Reporting (MER) systems for the Adaptation sectors and the Monitoring, Reporting and Verification (MRV) for the Mitigation sectors. These efforts will strengthen the reinforced transparency framework embedded in the reports to be submitted to the UNFCCC, such as the Biennial Transparency Report (BTR), the National Adaptation Communication, the Finance Reports and the CND Implementation Progress Reports, among others.

Alejandro Eduardo Giammattei Falla
President of the Republic of Guatemala

Mario Roberto Rojas Espino
Minister of Environment and Natural Resources

Leading institutions in each sector during the NDC update process

Adaptation to climate change

Ministry of Environment and Natural Resources (Marine-Coastal Zones, Integrated Management of Water Resources); **Ministry of Agriculture, Livestock and Food** (Agriculture, Livestock and Food Security, Integrated Management of Water Resources); **National Institute of Forests**, **National Council of Protected Areas** (Forest Resources, Ecosystems and Protected Areas; Integrated Water Resources Management); **Ministry of Public Health and Social Assistance** (Human Health); **Ministry of Communications, Infrastructure and Housing, Secretariat of Planning and Programming of the Presidency** (Infrastructure); **Secretariat of Food and Nutritional Security** (Agriculture, Livestock and Food Security); Ministry of Agriculture, Livestock and Food Security (Agriculture, Livestock and Food Security); National Institute of Forestry, National Council of Protected Areas (Forest Resources, Ecosystems and Protected Areas; Integrated Management of Water Resources).

Climate change mitigation

Ministry of Environment and Natural Resources (Waste and Industrial Processes); **National Forest Institute, National Council of Protected Areas** (Land Use, Land Use Change and Forestry); **Ministry of Energy and Mines** (Energy); **Ministry of Agriculture, Livestock and Food** (Agriculture).

The development of the updated NDC was technically and financially supported by the United Nations Development Programme (UNDP), the German International Cooperation (GIZ), the Inter-American Development Bank (IDB) and the World Resources Institute (WRI).

This document was reproduced thanks to the financial contribution of the United Nations Environment Programme (UNEP) through the NDC-5 Project on Increasing the Ambition of Nationally Determined Contributions and Climate Finance in Central America and the Caribbean.

This document was prepared by the Ministry of Environment and Natural Resources, coordinated by the Vice-Ministry of Natural Resources and Climate Change through the Directorate of Climate Change, with the technical support of the Departments of: Adaptation and Vulnerability, Science and Metrics and Mitigation; where mainly technical staff participated, with the accompaniment of consultants provided by the Cooperation, through the CAEP Project. The NDC was presented to the National Council on Climate Change, who approved it at a meeting on 28 February 2022.

MARN 2022. NDC Update. Guatemala City.

ACRONYMS AND ABBREVIATIONS

EBA: Ecosystem-based Adaptation

AMM: Wholesale Market Association

Anacafé: National Coffee Association

ANAM: National Association of Municipalities of the Republic of Guatemala.

BAU: Business as usual (BAU) emissions baseline scenario

IDB: Inter-American Development Bank

BIOFIN: Biodiversity Finance Initiative

VIC: Ministry of Communications, Infrastructure and Housing

UNFCCC: United Nations Framework Convention on Climate Change, or simply Convention in some cases.

CNCC: National Council on Climate Change

CONADUR: National Council for Urban and Rural

Development **CONAP:** National Council for Protected Areas

CONRED: National Coordinator for Disaster Reduction

COP: Conference of the Parties

COREDUR: Regional Council for Urban and Rural Development

Decree 7-2013 of the Congress of the Republic: Framework Law to Regulate the Reduction of Vulnerability, Mandatory Adaptation to the Effects of Climate Change and the Mitigation of Greenhouse Gases (also known as framework law on climate change).

DIPESCA: Dirección de Normatividad de la Pesca y Acuicultura del MAGA.

EGEE: Empresa de Generación de Energía Eléctrica

ENDBE: National Low Emission Development Strategy

ERPA: Emission Reduction Purchase Agreement (ERPA)

ETCEE: Empresa de Transporte y Control de Energía Eléctrica

GCF: Green Climate Fund

ICG: Inter-Agency Coordination Group

GHG: Greenhouse gases

GERO-INDE: INDE's Rural Electrification and Works Management Department

GIMBUT: Inter-agency Forest and Land Use Monitoring Group

GIZ: German Society for International Cooperation **Iarna-URL:** Institute for Research and Projection on Natural Environment and Society **ICC:** Private Institute for Climate Change Research

HDI: Human Development Index

INAB: National Forest Institute

INDC: Intended Nationally Determined Contribution (INDC): Intended Nationally Determined Contribution (INDC).

Nationally Determined Contributions)

INE: Instituto Nacional de Estadística (National Statistics Institute)

INDE: National Institute of Electrification

INSIVUMEH: Instituto Nacional de Sismología, Vulcanología, Meteorología e Hidrología de Guatemala

IPCC: Intergovernmental Panel on Climate Change

RHI: Reef Health Index

MAGA: Ministry of Agriculture, Livestock and Food **MARN:**

Ministry of Environment and Natural Resources

MEM: Ministry of Energy and Mines

MER: Monitoring, Evaluation and Reporting

MICCG: Mesa Indígena de Cambio Climático de Guatemala (Guatemala's Indigenous Roundtable on Climate Change)

MINFIN: Ministry of Public Finance

MRV: Monitoring, Reporting and Verification

MSPAS: Ministry of Public Health and Social Assistance

MTA: Mesas Técnicas Agroclimáticas

NAMA: Nationally Appropriate Mitigation Action

NDC: Nationally Determined Contribution (NDC). Contribution)

SDGS: Sustainable Development Goals

ILO: International Labour Organisation **NCCAP:**

National Climate Change Action Plan **GDP:**

Gross Domestic Product

PINPEP: Forestry Incentive Programmes for Small Landholders of Forest or Agroforestry Vocation.

PNC: National Civil Police

UNDP: United Nations Development Programme

UNEP: United Nations Environment Programme

ERP: National Emissions Reduction and Removal Programme of Guatemala

PROBOSQUE: Programme of Incentives for the Establishment, Recovery, Restoration, Management, Production and Protection of Forests in Guatemala.

SAT: Superintendencia de Administración Tributaria

SEGEPLAN: Secretariat of Planning and Programming of the Presidency of the Republic of Guatemala

SESAN: Secretariat for Food and Nutritional Security **SGCCC:**

Guatemalan Climate Change Science System **SIGAP:**

Guatemalan System of Protected Areas

SNICC: National Climate Change Information System **SNIGT:** Sistema Nacional de Inventarios de Gases de Efecto Invernadero **USAC:** University of San Carlos de Guatemala

USD: US Dollars or US Dollars

LULUCF: Land use, land-use change and forestry

UVG: Universidad del Valle de Guatemala

3CNCC: Guatemala's Third National Communication on Climate Change

1IBA: First Biennial Update Report of Guatemala

EXECUTIVE SUMMARY

Guatemala, as a country highly vulnerable to the impacts of climate change, has directed its efforts to focus mainly on updating its Nationally Determined Contribution (NDC), referring to all those actions that contribute to strengthening resilience, improve adaptive capacity and contribute to reducing greenhouse gas emissions to address the adverse effects of climate change.

The country is ranked among the most vulnerable countries in the world by different organisations that analyse this factor. Guatemala's high-risk situation is due to its location and environmental factors, as well as socio-economic conditions. In this regard, an important indicator is the Human Development Index, for which Guatemala ranks 126th out of 189 countries (2019 data). Likewise, the different vulnerabilities to which the Guatemalan population is exposed and the increase in hazards as a result of climate change increase the risk of floods, landslides and droughts that directly limit people's living conditions and the country's development.

Changes in the main climatic variables have already been observed in the country. For example, an increase of 0.8 °C in the average temperature over the last 20 years has been detected. For its part, an average increase in annual precipitation of 122 mm was estimated, although it should be noted that this is distributed erratically, with an increase in the frequency and intensity of rainfall on some days, and longer periods without rain.

Unfortunately, changes in climate variability are expected to continue. Climate scenarios for the end of the century project temperature increases between 1°C and 4°C, and reductions in annual precipitation between 500 mm and 1100 mm, with relevant changes expected for the national territory.

It is estimated that around three quarters of the country's population lives in areas exposed to climate hazards (floods, droughts and landslides). As a consequence, a considerable increase in economic losses related to extreme hydrometeorological events has been observed: in the last decade (2010-2019) losses of USD 1320.1 million were reported, compared to USD 147.8 million reported in the 1940s. In the future, the economic impact is expected to be between 2.13% and 63.63%.
% of gross domestic product. Agriculture, livestock and food security; and infrastructure are the sectors most affected by the impacts of climate change, in addition to water resources and biodiversity.

In this sense, Guatemala is preparing to reduce its vulnerability and continue with global efforts to reduce greenhouse gas (GHG) emissions, which cause climate change. Firstly, and in contrast to 2015, the country has better information on its climate change situation, both in terms of adaptation and in relation to its progress in mitigation. It has also strengthened its institutional arrangements, the

regulatory framework, policies, methodologies validated by the United Nations Framework Convention on Climate Change (UNFCCC), and planning for addressing climate change. In this way, and in compliance with the requirements of the UNFCCC, Guatemala has ratified its commitment through the updating of its NDC.

In the updating process, the country's development goals and vision were harmonised, taking as a reference the National Development Plan K'atun: Our Guatemala 2032; the National Development Priorities, which corresponds to an exercise to harmonise the SDGs; the National Action Plan on Climate Change (PANCC) and the National Strategy for Low Greenhouse Gas Emissions Development (Estrategia Nacional de Desarrollo con Bajas Emisiones de Gases de Efecto Invernadero, or National Strategy for Low Greenhouse Gas Emissions). In addition, sectoral planning instruments linked to climate change were used.

The governance scheme for the NDC update included working and decision-making structures at three levels:

1. **Sectoral roundtables: these were** made up of representatives of institutions from each sector, including government, academia, among others, and served as the basis for discussion and technical validation of the proposed goals and measures[1].

2. **Coordinating committee and facilitating team:** led by the Directorate of Climate Change of the Ministry of Environment and Natural Resources (MARN) with the strategic accompaniment of other departments of the MARN, as well as the Secretariat of Planning and Programming of the Presidency (SEGEPLAN), the Ministry of Public Finance (MINFIN) and the external technical team that collaborated in the development of the updating process and in the preparation of this NDC document.

3. **Steering Committee:** with a strategic steering role and political backing for the process. This was led by the Vice-Ministry of Natural Resources and Climate Change of MARN and accompanied by the Undersecretary of Strategic Development Analysis of SEGEPLAN and the Vice-Minister of Revenues and Fiscal Evaluation of MINFIN.

The process of updating the NDC was planned in seven stages: 1) submission of proposals; 2) review by government technical teams and the NDC advisory committee; 3) sectoral validation; 4) drafting of the updated NDC; 5) national validation through a socialisation and feedback workshop; 6) approval by the National Climate Change Council (NCCC); and 7) submission to the UNFCCC.

The updated NDC has an adaptation component that includes six sectors, in line with those addressed in the NAPCC: 1) Marine and coastal zones, 2) Agriculture, livestock and food security, 3) Forest resources, ecosystems and protected areas, 4) Integrated water resources management, 5) Human health, and 6) Infrastructure.

[1] For the purposes of this NDC, we understand and use the term "measures" to refer to action strategies that are taken to achieve the country's intended mitigation and/or adaptation goals. These include the formulation, updating and/or implementation of policies and regulations.

For the first four, concrete adaptation targets were formulated based on national development planning and the NAPCC. These instruments were discussed and validated with the governing bodies of each sector, in addition to other relevant actors. In the case of the Human Health and Infrastructure sectors, only working routes were proposed to strengthen the capacities of the entities related to the issue, as well as to strengthen coordination between these entities and the MARN, since to date there is no information or history of sectoral linkages with the issue of climate change that would allow for the establishment of goals and responsible parties. These routes were constructed in a participatory manner with the input of representatives of the sectoral governing body and relevant actors identified in the process (Table 1).

For its part, the percentage mitigation target stipulated in the NDC formulated in 2015 is maintained, with a commitment to reduce 11.2% of projected emissions by 2030.[2] This target was maintained, given the national context: a) due to the updating of GHG inventories, which established a new baseline; b) the low contribution of GHG emissions from Guatemala; c) economic and social circumstances in the country resulting from the COVID-19 pandemic; and d) limited access to international funds for the fulfilment of climate change targets.

However, Guatemala is committed to meeting its international commitments, so measures were proposed for four of the emitting sectors: 1) Land use, land-use change and forestry (LULUCF); 2) Energy; 3) Agriculture; and 4) Waste. No measures from the Industrial Processes and Product Use sector were included in this NDC update, as no feasible measures to be implemented within the target timeframe were identified at this stage. However, in the Biennial Update Reports it is proposed to communicate on the implementation of voluntary emission reduction or mitigation actions in this sector.

It is important to emphasise that the measures to achieve this reduction target will be scaled up. To achieve this, the MARN and sectoral institutions will continue to work to establish other options of the National Low Greenhouse Gas Emissions Development Strategy that can be implemented in the period stipulated for this NDC, as well as to reach the target conditional on obtaining external support, which was set at 22.6% of projected emissions by 2030 (Table 1).

The NDC update has taken into account the cross-cutting issues of gender, indigenous peoples and local communities, and financing for NDC implementation. The inclusion of gender and indigenous peoples' considerations in the corresponding goals and measures was promoted, mainly in those of the adaptation component. To this end, institutional representatives of gender and the Mesa Indígena de Cambio Climático (Indigenous Roundtable on Climate Change) participated in reviewing and providing input to improve the proposals.

[2] This BAU scenario was updated with GHG inventory data from 1990 to 2018.

Table 1 Summary of targets and actions in the adaptation and mitigation components

Component	Sector	Target
ADAPTATION	Agriculture, livestock and food security	**AGS-1** Soil conservation **AGS-2** Reduction of chronic malnutrition **AGS-3** Climate Information Access System **AGS-4** Irrigation systems **AGS-5** Sustainable livestock husbandry practices **AGS-6** Project proposal addressing the issue of sustainable livestock husbandry
	Marine-coastal zones	**ZMC-1** Reforestation of mangrove ecosystems **MCZ-2** Shark fisheries management **ZMC-3.1** Technical studies of new protected areas in the marine-coastal zone **ZMC-3.2** Incorporation of protected areas into the SIGAP in the marine-coastal zone **ZMC-4** Reef health index
	Forest resources, ecosystems and protected areas	**REA-1** Forest cover **REA-2** Degradation by forest fires **REA-3.1** Forest restoration **REA-3.2** Agroforestry systems **REA-4** Ecosystem-based Adaptation
	Integrated management of water resources	**IWRM-1** Integrated water resources management programmes **GRH-2** Plans for the protection of the area and for the sustainable management of the area **GRH-3** Guide to measuring quality and flow rate **GRH-4** Riverside forests **GRH-5** National early warning system
	Human health	There are no defined goals, but a roadmap.
	Infrastructure	There are no defined goals, but a roadmap.

Component	Sector	Target	
MITIGATION	Land use, land-use change and forestry	**Target not conditional on international support:** By 2030, the 11.2 % of GHG emissions compared to the baseline scenario, leading to a reduction of 65 million tonnes of CO -eq$_2$	**LULUCF-1** Conservation, protection and sustainable management of forests **UTC-2** Reduction of forest degradation through fire prevention and control **UTC-3** Establishment of forest plantations **UTC-4** Restoration of degraded areas
	Energy Agriculture Waste	**Target conditional on international support:** 22.6 % of GHG emissions are reduced by 2030 compared to the baseline scenario, leading to a reduction of 56.6 million tonnes CO -eq$_2$	**ENE-1** Prioritise clean energy for power generation **ENE-2** Sustainable Mobility (electro-mobility and biofuels) **ENE-3** Change in the energy matrix **AGR-1** National strategy for sustainable low-emission cattle ranching **RES-1** Methane capture at the zone 3 landfill site and its use for electricity generation **RES-2** Clean Field Project

As a first follow-up task and to ensure the achievement of the proposed goals, a cost and financial gap analysis is being carried out. In addition, an implementation roadmap is planned. These inputs are expected to be developed during 2022.

In the case of the adaptation component of the updated NDC, sectoral validation was carried out through two rounds of workshops with relevant stakeholders identified in conjunction with the MARN and the governing body of each prioritised sector. In the case of the mitigation component, one round of workshops was held for three mitigation sectors: a) Land use, land use change and forestry (LULUCF); b) Agriculture; and c) Waste. The Energy sector defined its goals and measures directly from the Ministry of Energy and Mines (MEM), as the lead agency on the issue, with the support of MARN. In addition, a space for dialogue was opened and three working meetings were held with the private sector to see how the climate change adaptation and mitigation actions that are implemented and that can contribute to the goals of the NDC in the different sectors can be reported; it was agreed to continue the dialogue to establish voluntary agreements with stakeholders.

1. NATIONAL AND INTERNATIONAL CIRCUMSTANCES

1.1 Context on global commitments on climate action

Nationally Determined Contributions (NDCs) are the main instrument derived from the Paris Agreement. They express the commitments that each country makes to contribute to the achievement of the objectives of the United Nations Framework Convention on Climate Change (UNFCCC). These commitments include targets for reducing greenhouse gas (GHG) emissions and for enhancing adaptation to climate change (UNFCCC, n.d.). Obligations with respect to human rights, indigenous peoples, local communities, gender and women's empowerment, people in any situation of vulnerability, the right to development and intergenerational equity must also be respected, promoted and taken into consideration (UN, 2015).

Also noteworthy among the commitments is the principle set out in Article 3 of the UNFCCC (1992) text which states that:

> *Parties have the right to sustainable development and should promote it. Policies and measures to protect the climate system from human-induced change should be appropriate to the specific conditions of each Party and integrated into national development programmes, taking into account that economic growth is essential for the adoption of measures to address climate change.*

And the provisions of Article 4, which states that, in order to attend to commitments, Parties shall take into account their common but differentiated responsibilities and the specific nature of their national and regional development priorities, objectives and circumstances.

To provide a framework of guidelines to operationalise the NDCs, the Katowice Climate Package was adopted. This contains detailed guidance on how the NDCs should be presented in the

NDCs and how to follow up on efforts to enhance national adaptation capacities. It also promotes international cooperation and encourages parties to increase the ambition of their future climate action (UNFCCC, 2018).

1.2 Guatemala's situation in the context of climate change

The most recent GHG inventory (2018) prepared for the First Biennial Report and Third National Communication on Climate Change project showed that total emissions[3] were 63.55 million tonnes of CO_2-eq. This shows that Guatemala's contribution to global GHG emissions is very low, at only 0.08%[4] , although it is important to emphasise that the trend is increasing.

Despite its low contribution in emissions, Guatemala is highly vulnerable to climate change impacts. Analyses compiled for the Third National Communication on Climate Change in Guatemala (MARN et al., 2021) showed increases in mean temperature of 0.8 °C in the comparison period (2001-2019) with respect to the reference period (1973-1999). The most abrupt changes are observed during February, July, August and September. The annual rainfall regime has also shown an increase (122 mm). However, it is important to note that this is not evenly distributed, but concentrated in short periods of the year, causing the soils to be saturated. At the same time, the periods without rain have increased, resulting in the opposite effect, i.e. a greater number of droughts.

According to climate scenarios for Guatemala, these effects may become more pronounced in the coming decades. For example, the most conservative scenario indicates increases in the country's average temperature of 1 °C and reductions of 500 mm in annual precipitation by the end of the century. The most abrupt scenario foresees increases of up to 4°C and reductions of up to 1,100°C.
mm. In general, a generalised decrease in precipitation is expected at the national level, but with more intense rainfall in shorter periods and in specific areas (MARN et al., 2021).

These changes in climatic conditions have a number of consequences and impacts for the country. Around 75 % of the population is exposed to climate hazards such as floods, droughts and landslides. This also affects livelihoods and economic activities (MARN et al., 2021). For this reason, in 2014 the country ranked fourth in the exposure index of the Latin American region (Mapplecroft, 2014).

[3] Whenever reference is made to the country's total emissions, it refers to gross emissions.
[4] Calculated based on Climate Watch (n.d.) data.

Evidence of the increase in climate hazards is reflected in the economic losses due to extreme events such as droughts and cyclonic events, which are becoming increasingly frequent in the country. In the 1940s, losses were estimated at USD 147.8 million, compared to USD 1320.1 million reported for the period 2010-2019, i.e. their value increased by almost twelve [times5]. According to the assessment made by the Secretariat of Planning and Programming of the Presidency (SEGEPLAN), the damages, losses and additional costs caused by tropical depressions Eta and Iota that occurred in the country during 2020 amount to approximately Q6,002,035,633 (USD 775.5 million).

It is estimated that the cumulative cost of the impact of climate change will be particularly severe for the agricultural and infrastructure sectors, although water resources and biodiversity are also greatly affected. In this sense, the economic impact is expected to represent between 2.13 and 63.63 % of gross domestic product (GDP)[6], depending on the climate scenario and period analysed (MARN & SEGEPLAN, 2021).

Based on the global climate risk index indicators for the period 2000-2019, Guatemala was ranked 16th out of 180 (Eckstein et al., 2021). At the Mesoamerican level, it ranks first in terms of vulnerability (Mapplecroft, 2014). This condition is not only due to its location and environmental factors, but is largely determined by its socio-economic vulnerability. For example, the country has one of the lowest Human Development Indexes (HDI) in the world; in the 2020 report with 2019 data, it ranked 127th out of 189 countries (UNDP, 2020). The HDI measures mainly three dimensions of development: life expectancy at birth, educational attainment and average income of the population (National Human Development Report, n.d.).

These socio-economic vulnerabilities of the population are being exacerbated by climate change, so that the country's living conditions and productive activities such as agriculture, water supply and hydroelectricity generation are affected. There are also health impacts and increased climate-induced migration (MARN et al., 2021). Finally, there are losses in biological diversity that have not yet been quantified, which makes it more difficult to plan measures to prevent their deterioration.

In conclusion, as the effects of climate change become more acute, risk increases and social and economic development is undermined.

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[5] The above-mentioned report clarifies that the available data do not allow differentiating the direct effect of climate change, but it is assumed that climate change has had an influence on the increase in losses from such events over time.

[6] GDP 2008 was used as the basis for this analysis. The lowest value (2.13 %) corresponds to scenario B2 in 2030 with a discount rate of 4 %. The maximum value (63.63 %) refers to scenario A2 in 2100 with a discount rate of 0.5 %.

economic situation of the Guatemalan population. This situation is exacerbated among the indigenous population, as their productive, social, cultural and economic practices are highly affected (MARN et al., 2021).

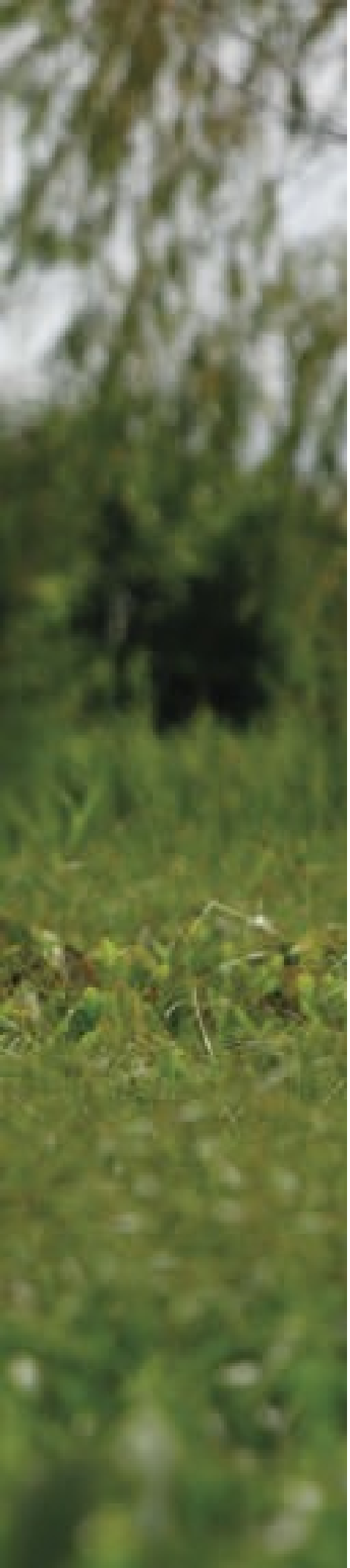
1.3 Country vision for change climate

As described in section 1.2, the country's natural characteristics and socio-economic situation are factors that determine its high risk to climate change. This manifests itself in strong environmental and economic impacts, damage to infrastructure and loss of human lives, as well as effects on the health and well-being of the population, as economic options and the provision of basic services are limited. Adaptation has therefore become a priority for Guatemala over mitigation, given its low contribution to global emissions, as demonstrated below.

Given that the effects of climate change have a greater impact on women, children and indigenous peoples (MARN et al., 2021), it is of great importance for the country that climate action focuses on reducing the risk to the most vulnerable populations. In this sense, Guatemala recognises the fundamental principles and guarantees of the Convention established in the Paris Agreement, particularly those related to the social sphere: equity, rights of indigenous peoples, local communities, migrants, children, people in vulnerable situations and the empowerment of women (Government of the Republic of Guatemala, 2021).

To carry out the necessary adaptation efforts, significant investment is required both with national resources and with the support of international funds and climate finance mechanisms. These resources would allow for more concrete interventions and the implementation of measures proposed in national policies (CNCC, 2021). For this reason, Guatemala has asked the UNFCCC to recognise it as a highly vulnerable country, so that it can have better access to the specific adaptation support offered to countries in this category (Government of the Republic of Guatemala, 2021).

Taking into account its context and needs, in its participation in the 26th Conference of the Parties (COP), Guatemala identified nine strategic axes to address climate change: 1) financing; 2) adaptation; 3) loss and damage; 4) participation in the Santiago Network; 5) mitigation; 6)



transparency, 7) technology transfer and capacity building, 8) indigenous peoples and local communities, and 9) gender.

Although adaptation has been made a priority, Guatemala is consistent with the commitments to stabilise global GHG emissions made in the Paris Agreement. It is therefore making mitigation efforts, taking into account the principle of common but differentiated responsibilities based on its national circumstances.

As a result, the country has several planning and legal instruments, many of which are in the implementation phase. Among these are the National Action Plan on Climate Change (PANCC) and the National Strategy for Low Greenhouse Gas Emissions Development (Estrategia Nacional de Desarrollo con Bajas Emisiones de Gases de Efecto Invernadero). Both documents have served as the basis for updating the adaptation and mitigation targets proposed by Guatemala in its NDC.

Likewise, the updated NDC took as a reference the National Development Plan K'atun: Our Guatemala 2032. It summarises the National Development Agenda in five axes and 10 priorities, which are broken down into goals, results and guidelines. One of the most relevant axes for the formulation of the NDC was "Natural resources today and for the future", as it directly raises priorities and goals related to climate change, but also links with the priorities of other axes (CONADUR, 2014).

The updated NDC proposes an integrated approach in which special emphasis is placed on climate change adaptation. However, this component is not seen as a stand-alone issue, but rather, priority has been given to those goals that also allow for the potential of mitigation measures and, therefore, for synergies between the two components. For their part, most of the mitigation measures are intended to provide co-benefits that contribute to rural development, improve food security, disaster risk management, job creation and just transition.

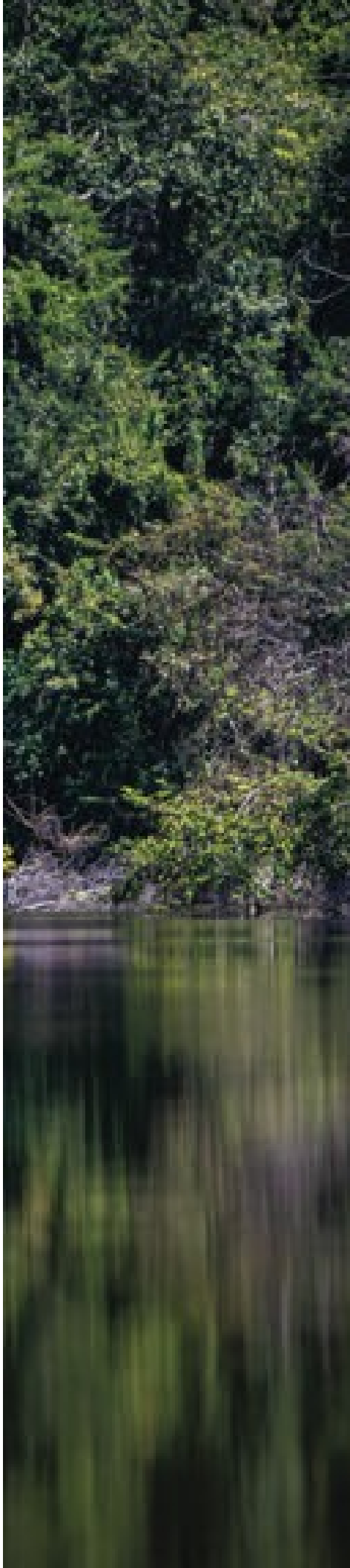
Finally, the updated NDC has taken equity as its basis, defined as a guiding principle of the National Development Plan K'atun: Our Guatemala 2032, which indicates that the incorporation of notions of sustainability and resilience is done in social, economic and environmental terms, within a framework of promoting social equity, respect for multiculturalism and the defence of human rights (CONADUR, 2014). Based on this, the goals and measures set out in the NDC focus on promoting equity between men and women of all ages, ethnic groups and socio-economic status.

These principles and comprehensive vision embodied in the NDC seek to promote the country's development in a sustainable manner. They are also highly relevant for Guatemala as they harmonise with other international commitments that the country has joined, such as: the 2030 Agenda; the Sendai Framework on Disaster Risk; the Convention on Biological Diversity and its post-2020 Strategic Framework for Biodiversity; the United Nations Convention to Combat Desertification; among others.

1.4 National regulatory and policy framework in relationship with the NDC

Despite the conditions of risk to climate change under which Guatemala finds itself, the country has been committed, from a very early stage, to contribute to mitigation and adaptation. In this sense, it has made progress in the policy and planning framework for addressing climate change (MARN et al., 2021). One of the most relevant was the ratification of the Paris Agreement (Decree 48-2016, 2016), which was submitted to the UNFCCC on 24 February 2017, making the INDC a commitment made by Guatemala at the international level. A few years later, the process of updating the NDC began, which articulated some of these policy instruments that are related to the goals set, as clarified below (MARN et al., 2021).

To define the goals, Guatemala relied on instruments such as the National Development Plan K'atun: Our Guatemala 2032 (CONADUR, 2014), the Sustainable Development Goals (SDGs), the National Climate Change Policy (MARN, 2009a), the Framework Law to Regulate the Reduction of Vulnerability, Mandatory Adaptation to the Effects of Climate Change and the Mitigation of Greenhouse Gases (Decree 7-2013, or framework law on climate change), the PANCC (CNCC, 2018), the National Strategy for Low Greenhouse Gas Emissions Development (Government of the Republic of Guatemala, 2018a), the National Strategy for the Reduction of Deforestation and Forest Degradation in Guatemala (GCI, 2018a) and the National REDD+ Strategy (GCI, 2020). The country has also taken into consideration instruments such as the Institutional Strategic Plans that were available according to the sectors directly linked to climate change.



Likewise, instruments have been used in terms of gender mainstreaming linked to climate change, such as: the Environmental Gender Policy (MARN, 2015), the Agenda for Climate Change Management, Integrated Risk Management and Capacity Building with a Focus on Equity and Equality between Men and Women (MARN & SEPREM, 2018), the Strategy to Incorporate Gender Considerations in Climate Change in Support of the Nationally Determined Contribution (MARN, 2020), the Manual for the inclusion of gender considerations in the activities and projects of the Green Climate Fund (MARN, 2018a), among others. These instruments are an example of the efforts that have been made to enhance gender in addressing climate change, and through them, to promote the full and effective participation of women in programmes, projects and policies on climate change adaptation and mitigation (MARN et al., 2021).

1.5 Institutional arrangements for addressing of climate change

In relation to the institutional framework, there are various bodies in Guatemala that are linked to the generation of public policies and their management for decision-making related to climate change. The Ministry of Environment and Natural Resources (MARN) is the designated lead agency for climate change and is also the country's political and technical focal point before the UNFCCC. Some government entities, such as the National Forest Institute (INAB), the National Council of Protected Areas (CONAP) and the Ministry of Agriculture, Livestock and Food (MAGA), have specific units to address climate change and institutional agendas or strategic plans related to the issue. Although climate change has been incorporated into various institutions that recognise the need to integrate the issue into their operations, it is necessary to continue with this effort and bring in other bodies that are closely linked to the issue, such as the Ministry of Communications, Infrastructure and Housing (CIV) or the Ministry of Public Health and Social Assistance (MSPAS) to include specific teams (for example units or directorates) to address climate change adaptation.

As progress has been made in the formulation of public policies and legal instruments, inter-institutional coordination spaces have also been created, the most relevant being the National Climate Change Council (CNCC), which constitutes a platform that includes multiple sectors of the country at the highest level. Its function is to regulate, supervise the implementation of actions and resolve conflicts related to Decree 7-2013 of the Congress of the Republic (Article 8). In addition, the Inter-Institutional Coordination Group (GCI)[7], the Indigenous Climate Change Roundtable of Guatemala (MICCG) and the Guatemalan Climate Change Science System (SGCCC)[8], among others, stand out.

With regard to indigenous peoples' participation, advocacy and decision-making, the MICCG represents an example of a high political level, as it is part of the CNCC. It also participates in the indigenous peoples and local communities platform of the UNFCCC.

In addition, mechanisms have been created to promote progress in meeting the country's targets, such as the National Climate Change Information System (SNICC, Decree 7-2013) and the National GHG Inventory System of Guatemala (SNIGT), the latter of which is in the consolidation phase. Both the SNICC and the SNIGT subsystem represent the main mechanisms for reporting to the UNFCCC. In this sense, there have been recent advances in the institutional arrangements to strengthen these systems, such as the creation of sectoral roundtables for adaptation and mitigation.

[7] Comprising MARN, MAGA, INAB and CONAP.

[8] This is an academic body made up of universities, research centres and governmental entities that serves as the scientific arm of the CNCC. Under the SGCCC, the Technical Group on Climate-Based Adaptation (TBA) is managed by the

Ecosystems.

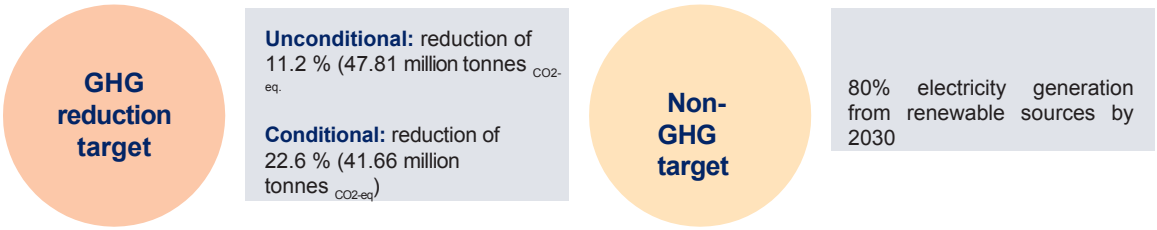
2. UPDATE PROCESS

2.1 Guatemala's first NDC

Guatemala, like many other countries, submitted its Intended Nationally Determined Contribution (INDC) in 2015 (Government of the Republic of Guatemala, 2015). This instrument became the NDC when the Paris Agreement was ratified by the Congress of the Republic.
emissions from Guatemala. Ambitious targets for reducing the country's emissions by 2030 were proposed for the commitments, despite the fact that data available at the time indicated that Guatemala contributed less than 0.08% of global emissions (Government of the Republic of Guatemala, 2015).

The mitigation targets set are national in coverage and focus on reducing the three main GHGs emitted: carbon dioxide ($_{CO2}$), methane ($_{CH4}$) and nitrous oxide ($_{N2O}$). The sectors identified as emitters were Energy, LULUCF, Agriculture, Waste[9] and Industrial processes. Figure 1 summarises the targets, taking into account the country's own resources (unconditional target) and with support from international cooperation (conditional).

Figure 1 Mitigation targets stipulated in the NDC 2015



Adapted from Government of the Republic of Guatemala (2015).

[9] Now categorised as *Waste*.

In addition to the mitigation goals, the development of an adaptation component was identified as highly relevant. To this end, the goal was established to reduce vulnerability in a cross-cutting manner and to promote the improvement of adaptation processes in key sectors (Government of the Republic of Guatemala, 2015):

1. Human health,
2. Marine-coastal zones,
3. Agriculture, livestock and food security,
4. Forest resources, protected areas,
5. Conservation and management of strategic ecosystems,
6. Infrastructure,
7. Integrated water resources management,
8. Quality of productive infrastructure,
9. Soil protection and
10. Integrated disaster risk reduction management

Although the NDC 2015 proposes mitigation targets, and a very general adaptation target listing the related sectors, it does not specify the measures that will be implemented to achieve them, nor does it describe the protocols for monitoring and evaluation. During the development of the update, it was proposed to improve these issues through a consultation process and a more specific methodological process, which is presented below.

2.2 NDC update process and progress in implementation

To provide greater clarity on the targets, the first step in the formulation of the updated NDC was a review of available information on the status of implementation of mitigation and adaptation measures related to the targets set out in the 2015 NDC. This process involved consultation with different stakeholders linked to the identified measures.

Another important step was the generation of information that would serve as input for updating the NDC. In this sense, the national GHG inventories were updated, which serve as the basis for emission projections and evaluation of mitigation options to achieve the proposed targets. These inventories were published in the Third National Communication on Climate Change of Guatemala (3CNCC) (MARN et al., 2021)[10] and the First Biennial Update Report of Guatemala (1IBA)[11]. In addition to the inventories, the inputs provided in the National Strategy for Low Greenhouse Gas Emissions Development (Government of the Republic of Guatemala, 2018a) were used as a starting point for the prioritisation of mitigation options.

In the case of the adaptation component, a sector prioritisation exercise was carried out based on the 2015 NDC and the NAPCC, as well as inputs from the analysis and prioritisation of sectors and adaptation measures carried out by IUCN and the World Bank for the NDC update (World Bank et al., 2020). Following the review of this documentation, the sectors to be included in the update were agreed.

This process of reviewing and updating the NDC began in November 2020, for which a work route was defined. This process was supported by donors and the committed participation of the lead institutions of the prioritised sectors. Then, the governance of the updating process was established, forming a team for the coordination and development of the updated NDC document. This included dialogue and decision-making teams at three levels (Figure 2):

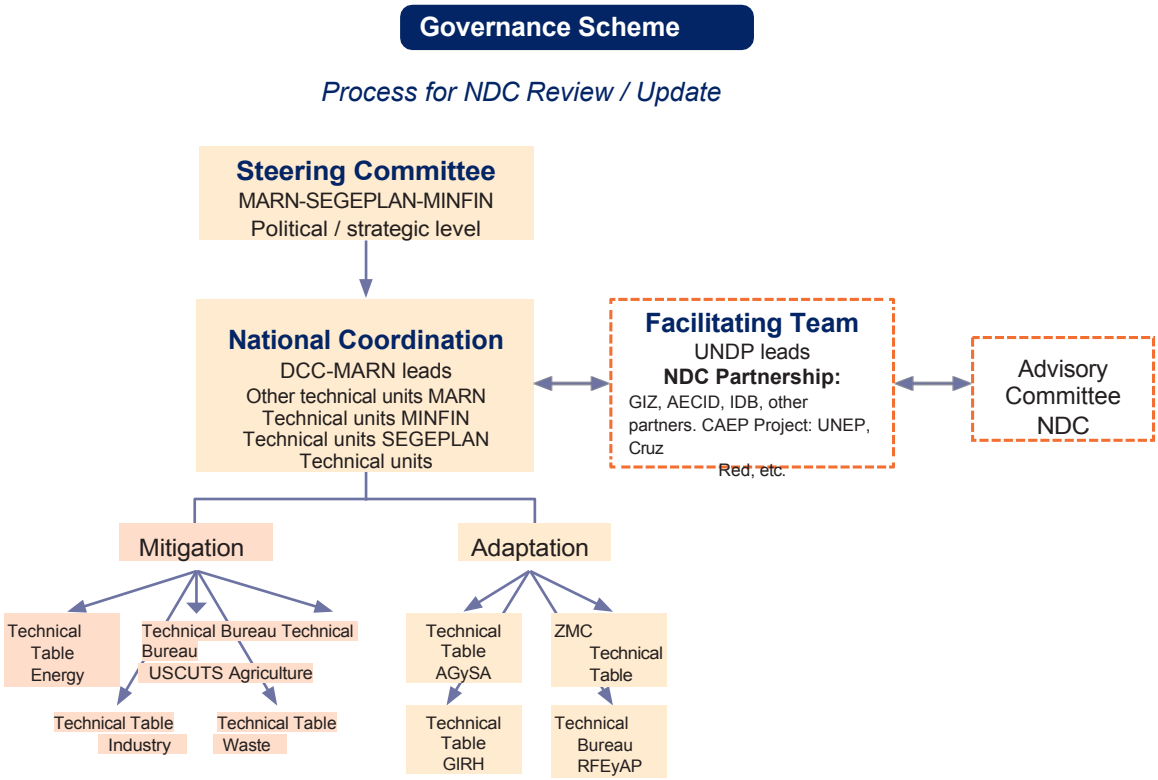
1. **Sectoral roundtables:** these are the basis for the discussion and endorsement of the proposed goals and measures. These are divided into adaptation and mitigation components and include the participation of the main actors from government, civil society, indigenous peoples, the private sector and academia, among others. The roundtables have already been involved in previous processes such as the updating of the PANCC, the design of the National Strategy for Low Greenhouse Gas Emissions Development, and the national GHG inventories.

[10] Contains previous inventories (1990, 1994, 2000 and 2005), plus new inventories for 2010, 2014 and 2016.
[11] It contains a review of the inventories presented in the 3CNCC, a new inventory (2018) and the time series 1990-2018.

2. **Coordinating committee and facilitating team:** Coordination was led by the MARN, through the Directorate of Climate Change, but other MARN agencies and some government bodies that are in charge of the prioritised sectors also participated, as well as technical representatives of the Secretariat of Planning and Programming of the Presidency (SEGEPLAN) and the Ministry of Public Finances (MINFIN). The facilitating team corresponds to a technical group that developed the process of updating the NDC and the elaboration of the resulting document. This was led by the United Nations Development Programme (UNDP) and had the direct collaboration of the German Agency for International Cooperation (GIZ), the Universidad del Valle de Guatemala (UVG) and the Inter-American Development Bank (IDB). It also benefited from the technical collaboration of other partners such as the United Nations Environment Programme (UNEP) and the Red Cross, through the NDC Partnership. At this level, the NDC Advisory Committee was also involved, made up of professionals with recognised experience in climate change and related issues, who were invited by the MARN to support the process ad honorem, providing technical inputs and political and strategic guidance throughout the process.

3. **Steering Committee:** This was formed by the Vice-Ministry of Natural Resources and Climate Change of MARN as leader, the Sub-Secretariat of Strategic Development Analysis of SEGEPLAN and the Vice-Ministry of Revenues and Fiscal Evaluation of MINFIN. Its role was to provide strategic direction and political support to the process of updating the NDC. In this way, he was in charge of providing endorsement at the highest level.

Figure 2 General governance scheme for Guatemala's NDC update



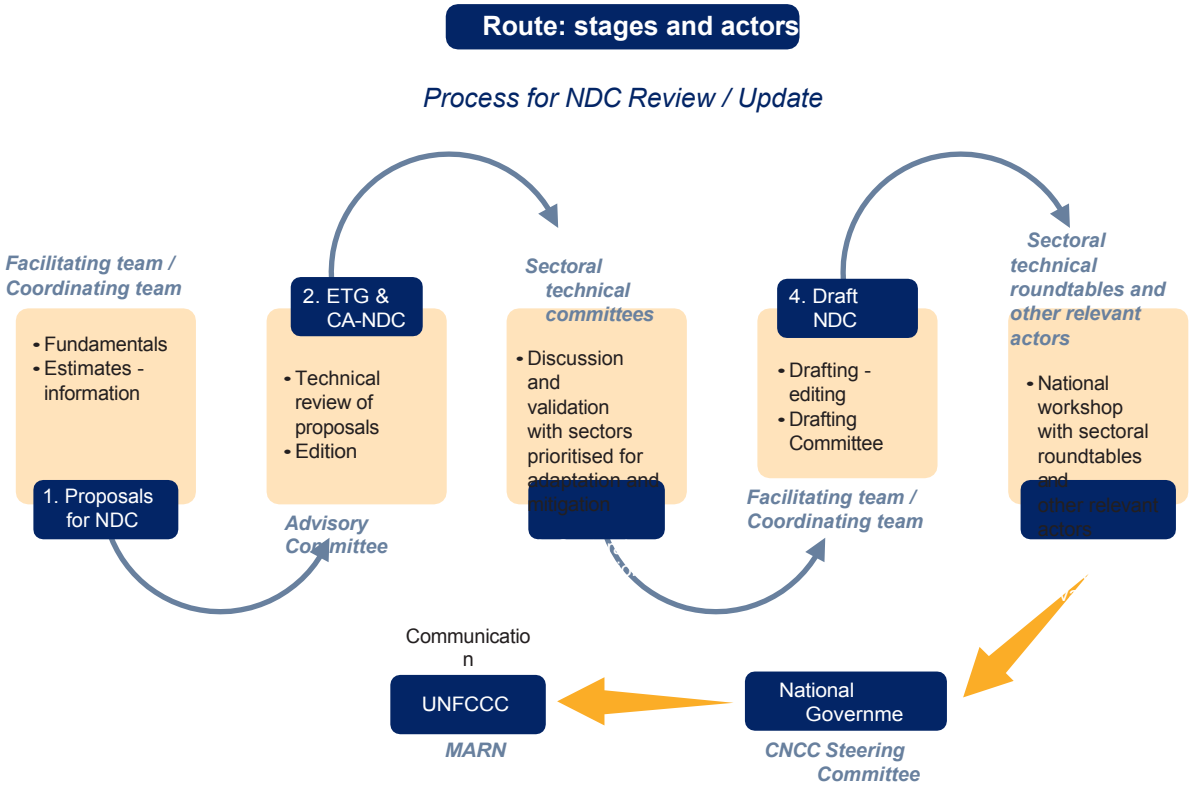
The work route for the NDC update (technical process) consisted of five stages (some parallel), which were differentiated by the type of tasks executed in each stage and the actors involved (Figure 3):

a. **Proposals:** this stage involved the identification and analysis of the available information that allowed for the review and proposal of goals and measures.

b. **Review by government technical teams and the NDC advisory committee:** the proposals put forward in the first stage were reviewed by both teams, providing input to improve the proposals.

c. **Sectoral validation:** the proposed revised targets and measures were presented to the sectoral roundtables for review, feedback and validation.

Figure 3 Work path, information flow and actors involved in the updating of Guatemala's NDC



d. **Draft NDC:** with the information validated in the previous stage, the document that forms the update of the NDC and includes the proposed targets and measures was written and consolidated. This was revised again (section b).

e. **National validation:** the document, refined thanks to the inputs from the technical teams and advisors, was socialised and validated with actors at the national level, including the technical roundtables, as well as relevant actors linked to climate change in Guatemala.

Due to restrictions and precautionary measures due to the COVID-19 pandemic, the workshops and meetings during the process were conducted through virtual platforms.

Once the technical process had been exhausted, the validated document was transferred to the MARN and the steering committee, who sought endorsement at the highest level: the Presidency of the Republic. In this process, the CNCC was also informed.

3. CROSS-CUTTING ISSUES

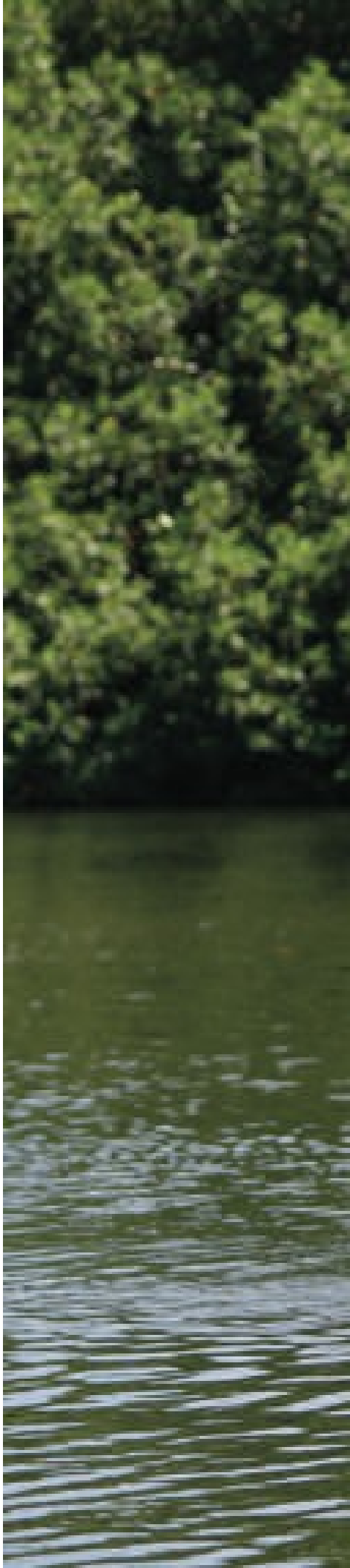
Country-specific circumstances with regard to climate change are determined by biophysical, social, political and economic conditions. These are mostly linked to people and the way in which available resources are managed.

Guatemala is a country with a diversity of cultures that converge in its territory, where almost half of the population (43.6 %) self-identifies as one of the three indigenous peoples: Mayan, Xinca or Garífuna (INE, 2019). Aware of this and of respect for the human rights of all groups that make up society, the country has made commitments in this regard, being a signatory to the main instruments concerning human rights and indigenous peoples. As a result, it has formulated specific policy and regulatory instruments to implement some of these commitments.

Guatemala, for its part, faces a major challenge, as indigenous peoples, the rural population and women are in a situation of backwardness and exclusion. This situation is reflected in poverty rates and access to basic services, to mention a few examples (section 1.2).

For this reason, in the process of updating the NDC, considerations were integrated to ensure the effective participation of these groups in decision-making and in the distribution of benefits from climate action. To this end, the main instruments of the legal and planning framework in this area were used as a basis and the participation of the people in charge of addressing these issues at the institutional level was promoted. In this way, the formulation of goals and measures (mainly in the adaptation component) sought to ensure that the benefits of their implementation would be equally accessible to the entire population. These issues are addressed in the fact sheets of the adaptation targets and mitigation measures where applicable.

In turn, GHG reduction entails changes that bring opportunities, but also costs. These changes in the development model have consequences for livelihoods, employment opportunities and working conditions, and a just transition is required (ILO, 2018).



To achieve effective implementation of the measures and actions identified in this NDC, it is necessary to be clear about the costs and sources of funding that can be invested to cover them, and to identify the support needed to improve ambition. This analysis is part of the process of updating and improving the NDC.

The following is a description of how these cross-cutting issues have been addressed in a general way during the update process.

3.1 Gender

The Strategy for Mainstreaming Gender Considerations in Climate Change in Support of the Nationally Determined Contribution (MARN, 2020) was used as the main instrument to address gender considerations in the process of updating the NDC.

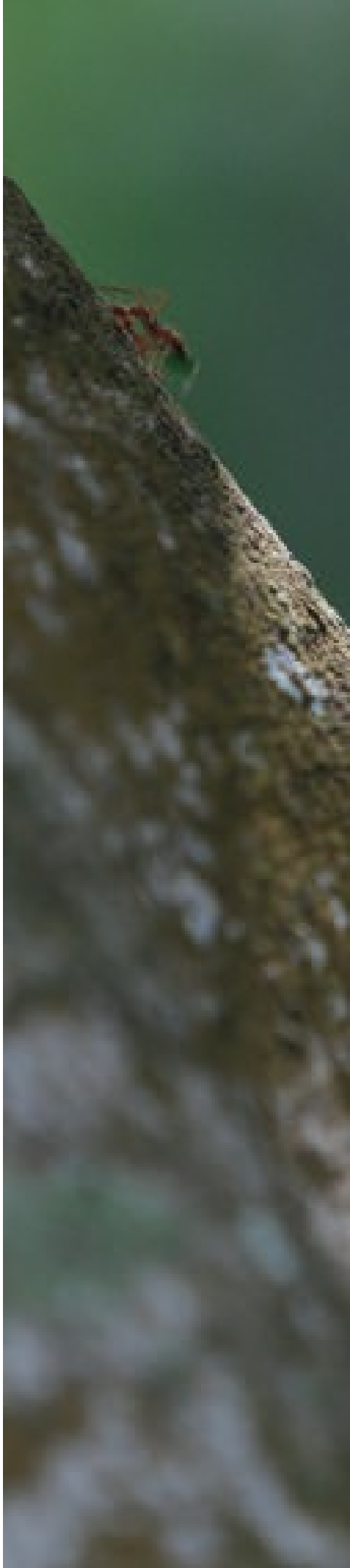
Gender considerations relevant to the proposed goals and measures were then identified. These were reviewed with representatives from the gender offices of the lead agencies to ensure three aspects: 1) that their approach is appropriate; 2) that the proposed options contribute to reducing women's vulnerability to climate change; and 3) that women will benefit from the implementation of the measures. The review process consisted of sending the proposals electronically for comments and input, and a virtual meeting to discuss the measures and agree on how best to reflect gender considerations.

3.2 Indigenous peoples and communities premises

As for gender, climate change adaptation targets were formulated including considerations for vulnerable populations such as indigenous people and local or rural communities. The proposed targets were reviewed and fed back in a meeting with the MICCG, considering that this is a platform representative of the indigenous peoples of Guatemala and linked to climate change.

3.3 Just transition

To follow up on the process of updating the NDC to be presented in 2022, the International Labour Organisation (ILO) and MARN will conduct an analysis of the proposed targets and measures to identify opportunities to ensure that changes are made to the NDC.



The implementation of these measures should be carried out within the framework of a just transition. In this way, care will be taken to ensure that the working conditions, benefits and rights of workers are not limited as a consequence of implementing these measures.

3.4 Funding for implementation of the NDC

As a complement to the NDC update, an analysis of the costs and financing gaps for implementing adaptation and mitigation measures in compliance with the NDC targets is being carried out.

This analysis will identify the funding needs for each measure and also suggest available financial sources. This will be a very relevant input to establish the implementation path of the updated NDC.

The country already has some financial studies linked to climate change, such as the Analysis of Climate Finance in Guatemala (MARN, 2019)[12] and three studies conducted by the Biodiversity Finance Initiative (BIOFIN) on public and private climate change spending in Guatemala (UNDP, 2018a, 2018b). These inputs will serve as the basis for the analysis of specific financing for the updated NDC.

[12] This corresponds to the period from 2016 to 2018 and was carried out in the framework of the preparatory programme of the Green Climate Fund (GCF).

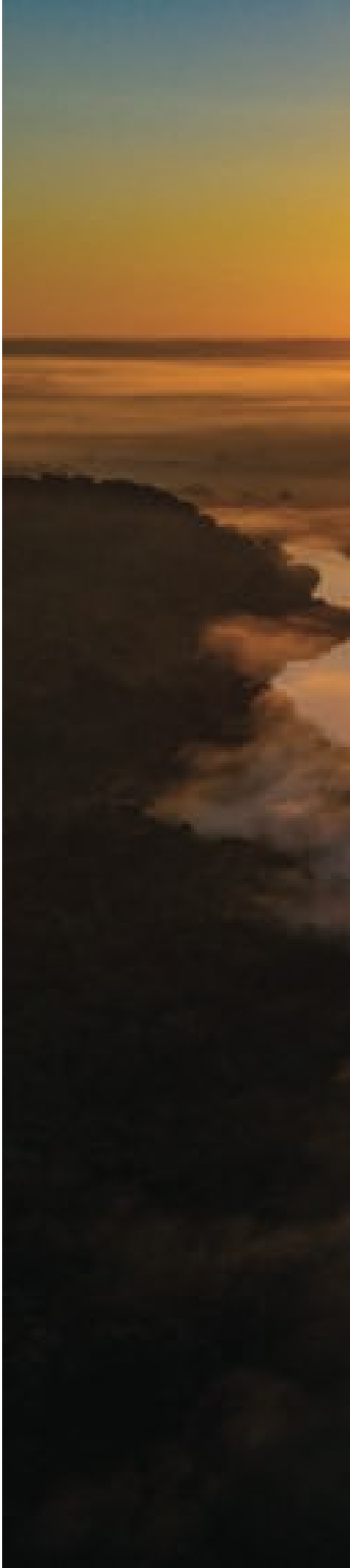
4. ADAPTATION

Given Guatemala's vulnerability to climate change impacts, adaptation is a priority component for the country. As mentioned in section 2.1, the adaptation goal established in the 2015 NDC is "the cross-cutting reduction of vulnerability and improvement of adaptation processes in key sectors" (Government of the Republic of Guatemala, 2015, p. 8).

Given the general nature of this target and the fact that a Monitoring, Evaluation and Reporting (MER) system was not yet in place, it was impossible to systematically determine progress in its implementation. However, it is recognised that an important step towards laying this foundation was the formulation of the NAPCC (CNCC, 2016) and its update (CNCC, 2018). This instrument brings together proposals for measures and indicators focused on six sectors.

With the process of updating the NDC, the national ambition to achieve climate change adaptation increased, and measurable and reportable sectoral targets were developed. For each target, the baseline was analysed and the entities responsible for its implementation were designated. This is a significant step forward as it allows for monitoring and transparency of implementation and communication of progress.

Many of the adaptation measures included in the updated NDC targets will yield significant benefits that, in addition to promoting long-term climate resilience, will directly contribute to rural development, improved food security and disaster risk management, job creation and just transition. In turn, they have important synergies with mitigation, as they can contribute to reducing the country's GHG emissions.



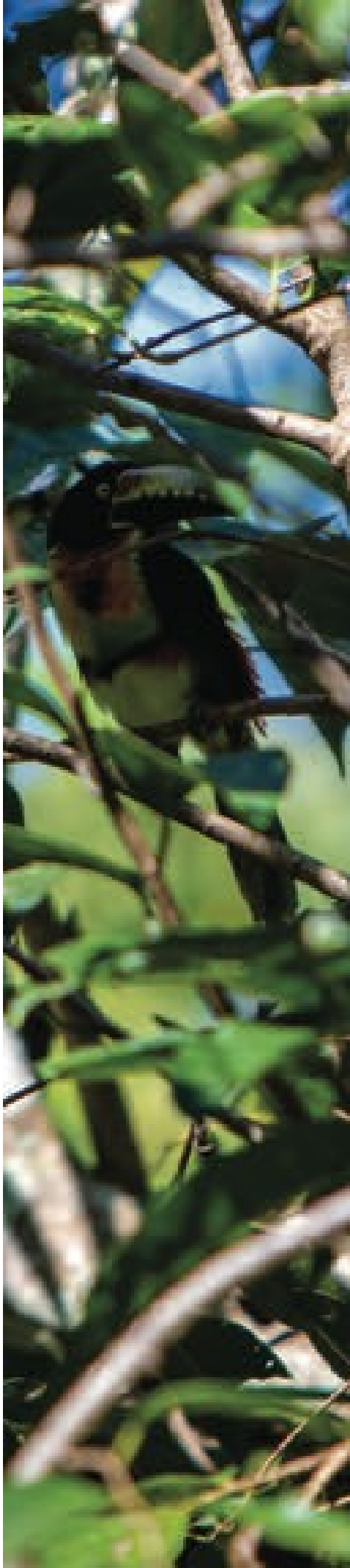
4.1 Priority sectors for setting adaptation targets

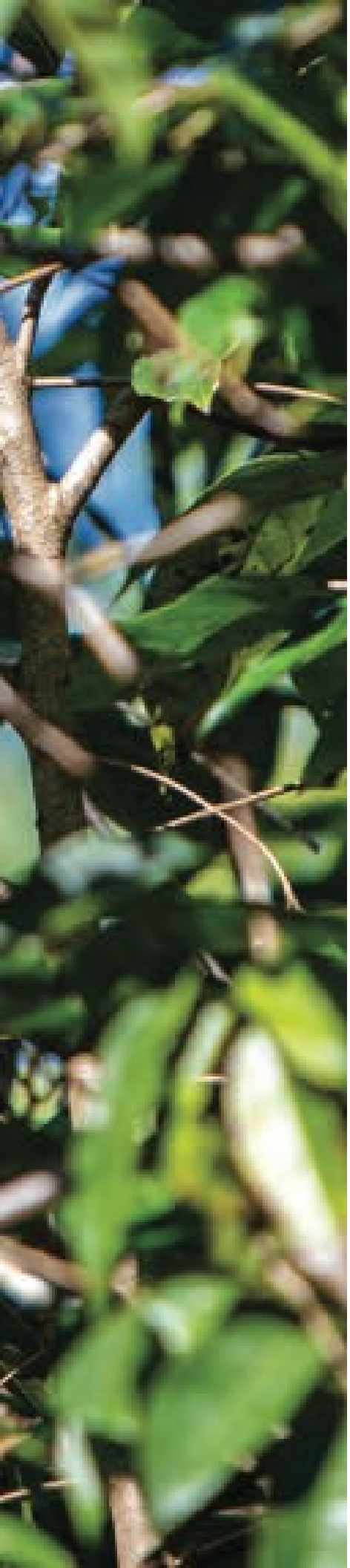
The 2015 NDC identified 10 priority sectors for the adaptation (Government of the Republic of Guatemala, 2015) (section 2.1). Subsequently, with the formulation of the NAPCC (CNCC, 2018), six of these sectors were prioritised. Recently, a participatory exercise was carried out to prioritise sectors and adaptation measures to support the implementation of the NDC in Guatemala (World Bank et al., 2020), in which the following sectors were chosen: Agriculture, livestock and food security; Marine-coastal zones; and Forest resources and protected areas, with Risk management and vulnerability as a cross-cutting theme. Taking into account these exercises, MARN defined six sectors of priority importance in the formulation of the adaptation goals of the NDC update:

1. Agriculture and food security,
2. Marine-coastal zones,
3. Forest resources, ecosystems and protected areas,
4. Integrated water resources management,
5. Human health,
6. Infrastructure

In the first four sectors, targets with an impact on climate change adaptation were defined, considering cross-sectoral synergies as well as climate change mitigation targets and measures.

Considering that progress in implementing climate change adaptation measures is still incipient in the Human Health and Infrastructure sectors, it was not possible to formulate goals with a direct impact on adaptation. However, five workshops were held with key actors in these sectors to make progress in addressing these issues. The first aimed to initiate an inter-institutional dialogue, create a common language in relation to climate change and identify stakeholders. Subsequently, two working sessions were held with each sector separately to develop a roadmap, which will serve for the inclusion of the climate change adaptation component in the planning of the governing bodies.





4.2 Methodological process for the definition of adaptation component targets

The first step used to update the adaptation component of the NDC was an exercise to identify key actors and their roles. This was based on the analysis carried out for the Third National Communication on Climate Change in Guatemala and the PANCC, in addition to the actors established by Decree 7-2013 of the Congress of the Republic. For their part, the leading institutions of the different sectors contributed by proposing other relevant actors, including indigenous peoples' organisations, chambers of commerce and trade unions, development foundations and local organisations.

Thanks to this exercise, it was possible to carry out the updating process. in a participatory manner. The broad participation o f governmental entities alongside representatives of non-governmental organisations, international cooperation, the private sector, academia and civil society guaranteed inter-sectoral collaboration, transparency and, therefore, ownership of the goals set.

The next step was the review and analysis of national and sectoral information aimed at determining the adaptation priorities that the country has defined in different instruments. For this purpose, national planning documents were analysed; recent studies and documents on the impacts of climate change in the country and the region; previous works conceived as inputs for the updating of the NDC and documents elaborated by other Latin American countries for their target updating processes. It is important to mention that it was not possible to include the vulnerability analysis at national and departmental level, as well as the departmental adaptation plans, as these were in the process of being elaborated and their publication was planned after the definition of targets for the NDC update.

In addition to the literature review, interviews were carried out with relevant actors.

The targets were formulated following the recommendations set out in Improving NDCs: A guide to strengthening national climate plans in 2020 (WRI & UNDP, 2020), which suggests analysing the linkages of the NDC with other planning processes in the country. In this case, we used the PANCC, the Third National Communication on Climate Change, the National Development Plan K'atun: Our Guatemala 2032, the Strategy for the Development of Guatemala 2032, and the National Climate Change Strategy.

Incorporate Gender Considerations in Climate Change in Support of the Nationally Determined Contribution (MARN, 2020) and the SDGs, as well as other sectoral planning instruments.

To link the impact of the updated NDC to the SDGs, the targets were formulated to contribute to the achievement of more than one goal. Clearly, we considered urgent actions to combat climate change and its effects (SDG 13), but also sought to contribute to the themes of food security and sustainable agriculture (SDG 2); gender equality (SDG 5); ensuring availability and sustainable management of water (SDG 6); resilient infrastructure (SDG 9); ensure sustainable consumption and production patterns (SDG 12); conserve and use oceans, seas and marine resources for sustainable development (SDG 14); and to sustainably manage forests, combat desertification, halt and reverse land degradation and halt biodiversity loss (SDG 15).

The targets were intended to promote the resolution of the country's gaps and shortcomings, either by updating or adding information and other inputs on (WRI & UNDP, 2020):

- Trends, impacts and vulnerability.
- Current and short-term planning.
- Planning on SRM systems methods.
- Long-term national objectives.
- Gender and multicultural issues.

For each target, 2021 was set as the starting year for the implementation of the measures for all identified sectors. For this, key inputs were used: the statistical annex of the revision of the National Development Priorities (SEGEPLAN, 2019); information generated by the National Institute of Statistics (INE); data provided by the governing bodies of each adaptation sector; and the MER systems of the Agriculture, Livestock and Food Security, and Marine-Coastal Zones sectors.

For the formulation of targets, several criteria were considered that will allow for monitoring and evaluation:

- Availability of open and official information or from recognised bodies.

- Existence of a published baseline.
- Possibility of periodic reporting.
- Possibility of synergistic actions between sectors and prioritised mitigation measures.
- Political, technical and financial feasibility of implementation for the duration of the NDC.

The proposed goals were reviewed and validated in two virtual workshops per sector. In addition, two additional workshops were held to incorporate gender and indigenous peoples' considerations, working with gender specialists from MARN, MAGA, CONAP and INAB, and with the MICCG.

4.3 Sectoral targets stipulated for the NDC update

Table 2 shows a summary of the proposed targets by sector. Then, the most relevant aspects of these targets are described, such as their scope and the institutions involved in the implementation of measures to achieve each target[13].

Table 2 Prioritised targets for the updated NDC in the adaptation component

Sector	Code	Target
Agriculture, livestock and food security	AGS-1	By 2025 soil conservation measures have been implemented in the following areas 19 500 hectares additional to the existing baseline in 2020
	AGS-2	By 2024, the prevalence of chronic malnutrition in children under five years of age has been reduced by 7.00 percentage points, with a reduction of 1.75 % per year.
	AGS-3	By 2025, a system of access to climate information has been implemented and strengthened that disseminates the data generated by the Agroclimatic Technical Tables, by means of bulletins and an application that facilitates the updating of climate information to all persons and user entities.
	AGS-4	By 2025, the agricultural area under irrigation systems is increased by at least 4500 ha.
	AGS-5	By 2025, at least 600 producers in the department of Petén implement improved sustainable livestock practices on 13,500 hectares. These include silvopastoral systems, soil protection, pasture recovery, conservation of forest remnants, among others.
	AGS-6	By 2025, Guatemala submits at least one project proposal addressing sustainable livestock production to international climate finance funds.

[13] A technical sheet was developed for each target. These can be requested from MARN's Climate Change Directorate.

Sector	Code	Target
Marine-coastal zones	MCZ-1	At least 1500 hectares of mangrove ecosystems are restored and reforested by 2025, with the full participation of local communities, indigenous and Garifuna peoples, women's groups and youth.
	MCZ-2	By 2025, fisheries management with an ecosystem approach is achieved in at least one of the country's main fisheries, the shark fishery. This target covers both industrial and artisanal levels, and includes the participation of men, women, youth and local communities.
	MCZ-3.1	By 2025, CONAP has approved technical studies for at least two (2) new protected areas in the Pacific marine-coastal zone to be incorporated into the Guatemalan System of Protected Areas (SIGAP). The technical studies will involve the participation and knowledge of women, men and local communities and will have an approach to guarantee their livelihoods.
	MCZ-3.2	By 2025 at least one (1) new protected area has been incorporated into the SIGAP in the Pacific marine-coastal zone. This process will have been socialised with women, men and local communities.
	MCZ-4	By 2025, Guatemala's Reef Health Index (RHI) remains at the same level as the 2020 baseline.
Forest resources, ecosystems and protected areas	REA-1	By 2025, 32 % of the national territory (3 479 124 ha) is covered by forests and at least 30 % of them under management is managed by indigenous and non-indigenous women.
	AER-2	By 2025, the rate of forest fire degradation will be reduced to 36 972 hectares per year, a 5% improvement over the baseline rate. Prevention of forest fires will be improved by addressing strategies related to the short term problems from a societal perspective. The area affected by forest fires will not exceed the limit of 20 000 hectares on average per year by the period 2021-2025.
	REA-3	By 2025, forest restoration and area under management through "forest plantations" has been increased by 30,300 hectares, "agroforestry systems" and "restoration of degraded forest land" of the forestry incentive programmes PROBOSQUE (26 900 ha) and PINPEP (3400 ha).
	FRA-3.1 (SUB-GOAL)	(sub-goal) Increase by 10 659 hectares the area under the "agroforestry systems" modality of the forestry incentive programmes PROBOSQUE (7587 hectares) and PINPEP (3072 hectares).
	REA-4	By 2025, the Ecosystem-based Adaptation (EbA) approach will be integrated into the institutional strategic instruments of the governing governmental entities such as MAGA, MARN, CONAP and INAB.
Integrated management of water resources	IWRM-1	By 2025, at least 35% of the country's basins, sub-basins and micro-basins have implemented programmes, plans, strategies and technical manuals for the integrated management of water resources at territorial level, respecting their governance, with a gender approach and cultural relevance.
	GRH-2	By 2025, 50% of watersheds and strategic sites of hydrological importance have plans for area protection and sustainable management. These plans have a watershed and land-use planning approach with cultural relevance and gender focus, in accordance with the social context.
	GRH-3	By 2025, all 38 river basins in the country have a guide to measure water quality and flow, and allow reporting on their status. 10% of the basins have water quality and flow indices.
	GRH-4	More than 3000 ha of restored riparian forests by 2025
	GRH-5	By 2025, the creation of a national early warning system will be initiated. To this end, a comprehensive mapping of all existing systems and those in the process of implementation will be carried out, which will serve as an input for their integration at the national level.
Human health	NA	No targets were defined, but a roadmap was defined
Infrastructure	NA	No targets were defined, but a roadmap was defined

Notes: NA = Not applicable.

4.3.1

Agriculture, livestock and food security

agricultural activities have high vulnerability

The
to climate change, as they are particularly affected by the occurrence of droughts and floods and changes in temperature. These impacts have determining consequences on food security (CNCC, 2018; MARN et al., 2021).

Moreover, this is a sector with a high relevance for indigenous peoples and local communities. Therefore, it was considered a priority to include targets that recognise and respect their traditional knowledge and practices.

Six targets were formulated for this sector. The main body responsible for their implementation, monitoring and reporting is MAGA, as it is the sector's governing body. Only target AGS-2 is the responsibility of the Secretariat of Food and Nutritional Security of the Presidency of the Republic (SESAN), the entity that coordinates the Food and Nutritional Security System and the Food and Nutritional Insecurity Information, Monitoring and Alert System (SESAN, 2006).

Target AGS-1. By 2025, soil conservation measures have been implemented on an additional 19 500 hectares over and above the 2020 baseline.

This target takes into account mainly actions to be implemented by MAGA within its soil conservation programmes and also a contribution of the Fundación Defensores de la Naturaleza in the Sierra de las Minas Biosphere Reserve. In these areas, actions will be promoted taking into account the traditional practices of the indigenous populations in the territories, in relation to soil use and management.

Actions to achieve this goal are expected to increase agricultural productivity, improving the response capacity and resilience of families, contributing to food security (MAGA et al., 2019). Conserved soils reduce the risk of impacts from recurrent extreme weather events, such as droughts and floods (CNCC, 2018; MAGA et al., 2019).

If the country undertakes the necessary studies to gather information to establish a soil carbon baseline, this target could synergise with mitigation, for which a specific target could be set in the future.

Target AGS-2. By 2024, the prevalence of chronic malnutrition in children under five years of age has been reduced by 7.00 percentage points, with a reduction of 1.75 % per year.

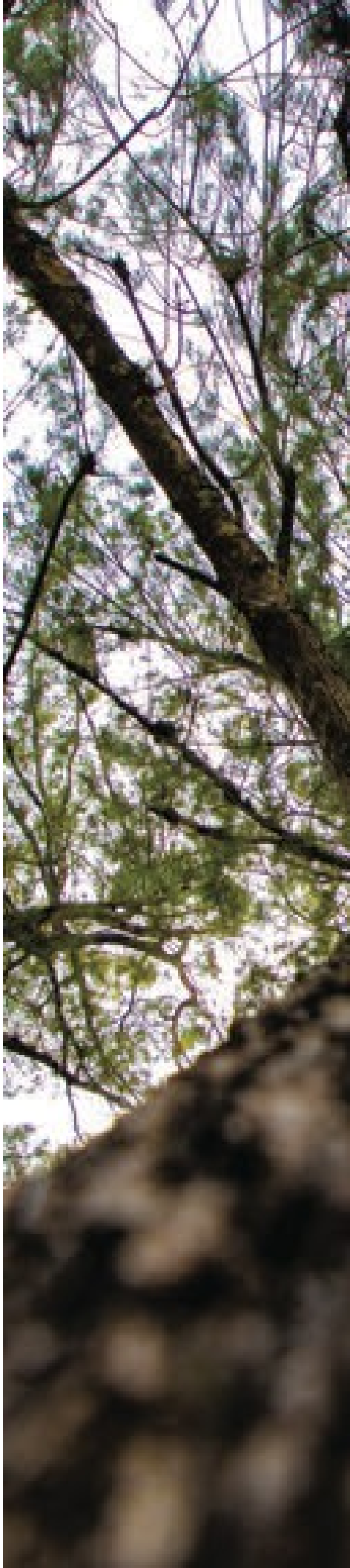
To achieve this goal, measures must be implemented to enable access to and availability of food in order to reduce the vulnerability of households and communities, especially the rural and indigenous population living in extreme poverty (CNCC, 2018). For the period of validity of the updated NDC, the government has the implementation of the Great National Crusade for Nutrition, whose goal is to reduce the country's malnutrition rate by between five and seven percent (Government of the Republic of Guatemala, n.d.).

This target has a timeframe until 2024, as it is planned in this way by the Secretariat of Food and Nutrition Security (SESAN), the sector's governing body. Depending on the update of the sector planning, another target may be projected for the following years.

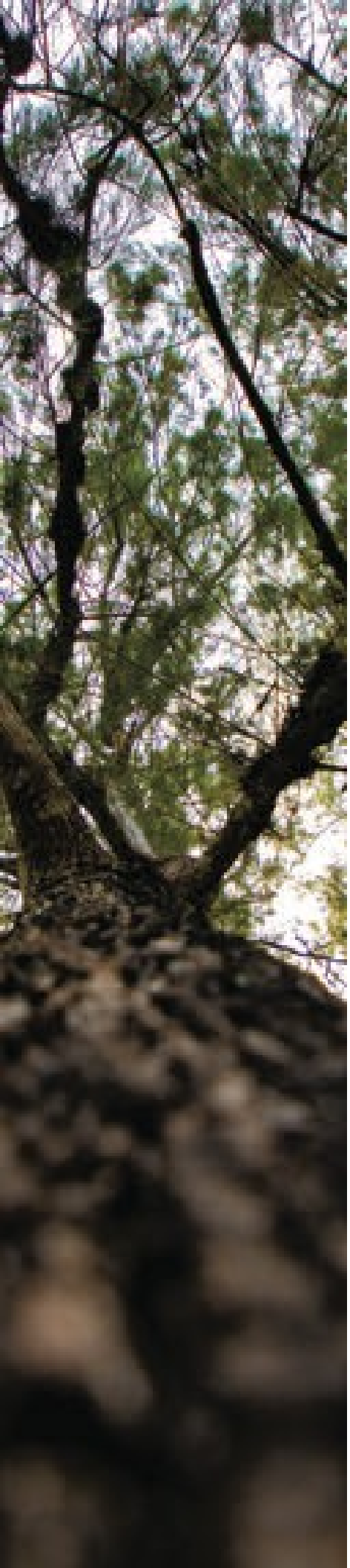
Target AGS-3. By 2025, a system of access to climate information has been implemented and strengthened that disseminates the data generated by the Agroclimatic Technical Tables, through bulletins and an application that facilitates the updating of climate information to all persons and user entities.

This target was considered given the importance of access to climate information to strengthen the resilience of agricultural production systems (MAGA et al., 2019). With this, it is stipulated to create mechanisms that facilitate access to this information for the rural population and indigenous peoples, considering local languages.

There are currently 19 Agroclimatic Technical Tables (MTA), distributed throughout most of the [country14] . These are an initiative of the National Institute of Seismology, Volcanology, Meteorology and Hydrology (INSIVUMEH) and MAGA, and are supported by cooperation projects. The dialogue generated in the roundtables has allowed for better coordination for the generation and compilation of climate information at the local level. As a result, an agro-climatic bulletin is produced with climate predictions, possible impacts on crops and recommendations. In the framework of the NDC, it is expected to complete the coverage of the roundtables to all departments, as well as to establish mechanisms to make the information accessible to all agricultural producers in the region.



[14] Agro-climatic technical roundtables are spaces for dialogue that bring together different actors to improve understanding of climate at the local level and make recommendations to reduce risks associated with climate variability (INSIVUMEH, n.d.).



Target AGS-4. By 2025, the agricultural area is increased under irrigation systems on at least 4500 hectares.

This goal will be implemented in the areas considered within the National Irrigation Policy[15] , in addition to the areas considered within other MAGA projects.

The importance of this goal lies in the fact that irrigation systems increase the capacity to respond to droughts and changes in rainfall patterns, thus helping to provide food security to small and medium-sized farming families (MAGA et al., 2019).

Target AGS-5. By 2025, at least 600 producers in the department of Petén implement improved sustainable livestock practices on 13 500 hectares. These include silvopastoral systems, soil protection, pasture recovery, conservation of forest remnants, among others.

Target AGS-6. By 2025, Guatemala submits at least one project proposal addressing sustainable livestock production to international climate finance funds.

Targets AGS-5 and AGS-6 were formulated considering that the implementation of improved sustainable livestock practices increases livestock productivity and the responsiveness and resilience of producers (MAGA et al., 2019). In addition, these measures have mitigation benefits, as they reduce pressure on natural forest and avoid GHG emissions caused by deforestation.

Meeting these targets could have a considerable impact, given that cattle ranching was responsible for 35% of deforestation in the country for the period 2001-2013. The areas with the highest occurrence were the Laguna del Tigre National Park and the Buffer Zone of the Maya Biosphere Reserve (MBR) in Petén, and the Punta de Manabique Wildlife Refuge in Izabal (GCI, 2018b).

Both targets have direct synergy with the mitigation measure AGR-1 National Low Emission Sustainable Cattle Ranching Strategy.

[15] This policy is still in the process of being updated and revised. is not published.

4.3.2 *Marine-coastal zones*

Guatemala's marine-coastal zones are located between the boundaries of the Exclusive Economic Zone[16] and a terrestrial boundary that encompasses tidally influenced freshwater ecosystems, including the three kilometres reserved by the State of Guatemala (MARN, 2009b). The main ecosystems in these areas are marine waters, estuaries, seagrasses, coral reefs, dry forests, mangroves and beaches. These are strategic for the socio-economic development of the country, given the abundance of environmental goods and services they provide and for offering a protective barrier against extreme weather events (CNCC, 2018).

According to the Intergovernmental Panel on Climate Change (IPCC, 2021), the main impacts on coastal-marine areas due to climate change are sea surface temperature rise, ocean acidification and sea level rise. In addition, extreme events lead to increased wave height and frequency of storm surges that cause flooding of urban and agricultural areas, as well as salinisation of wells and collapse of infrastructure networks (CNCC, 2018; MARN et al., 2020).

One of the advantages of this sector is that it has a governance mechanism led by the Technical Roundtable for Integrated Marine-Coastal Management of Guatemala (Ministerial Agreement 154-2019, 2019). This body is responsible for advising on the management and sustainable use of marine-coastal ecosystems and their environmental services, as well as coordinating actions for the implementation of the Policy for the Integrated Management of Marine-Coastal Zones of Guatemala (MARN, 2009b)[17]. The Roundtable also plays a key role in reviewing and endorsing the information that feeds the MER and NDC indicators.

Four targets were formulated for this sector, which are described below. below.

Target ZMC-1. By 2025 at least 1500 hectares of mangrove ecosystems are restored and reforested, with the full participation of local communities, indigenous and Garifuna peoples, women's groups and youth.

This goal was formulated given the vulnerability of the mangrove ecosystem, related to the social and economic dynamics and conditions that cause deforestation and changes in land use. With the restoration of this ecosystem, the adaptive capacity of the marine-coastal zones is increased, as the natural barrier that protects the coast and communities is recovered.

[16] The *Exclusive Economic Zone* is an area of the sea in which a sovereign state has special rights in relation to the exploration and use of marine resources, including the production of energy from water and wind (UN, 1982).

[17] The objective of this policy is that marine-coastal ecosystems and their watersheds are protected, managed and exploited to ensure their permanence and the equitable development of the population.

from winds, floods and other extreme weather events (MARN et al., 2020). In turn, it contributes to maintaining habitat and refuge for the biological diversity of fish, crustaceans, birds and reptiles. As a consequence, the livelihoods of the people who depend on these species are strengthened. In particular fisheries, which also contribute to improving food security and tourism.

This target has synergies with the mitigation component by increasing forest carbon stocks and blue carbon potential. Coastal ecosystems such as mangroves and seagrasses are key sites, as they fix and store more carbon per unit area than terrestrial ecosystems (Herr & Landis, 2016).

This goal is implemented by various actors from civil society, local governments and the central government, under the coordination and reporting responsibility of INAB. In this sense, INAB grants the forestry incentives. It is also the entity designated as the technical secretariat of the National Forest Landscape Restoration Roundtable and the South Coast Restoration Roundtable. It also compiles, systematises and reports on the country's progress in mangrove ecosystem restoration and reforestation.

Target ZMC-2. By 2025, fisheries management with an ecosystem approach is achieved in at least one of the country's main fisheries, the shark fishery. This target covers both industrial and artisanal levels, and includes the participation of men, women, youth and local communities.

Fisheries management with an ecosystem approach under this target includes the formulation and use of regulatory instruments, agreements and governance platforms; the reporting of information; the implementation of fishing licences; and the zoning and establishment of temporary closures. Their implementation will reduce sensitivity to climate change by managing the use of marine-coastal biodiversity. It would thus ensure the maintenance of livelihood opportunities and diversification options, as well as the functioning and health of coastal ecosystems (MARN et al., 2020).

This goal is implemented by civil society and the central government. MAGA is responsible for its reporting, as it is the governing body of the hydrobiological resource. It is also supported by CONAP in this task.

Target ZMC-3.1 By 2025, CONAP has approved technical studies for at least two (2) new protected areas in the Pacific marine-coastal zone to be incorporated into the Guatemalan System of Protected Areas (SIGAP). The technical studies will involve the participation and knowledge of women, men and local communities and will have a livelihoods approach.

Target ZMC-3.2 By 2025 at least one (1) new protected area has been incorporated into the SIGAP in the Pacific marine-coastal zone. This process will have been socialised with women and men and local communities.

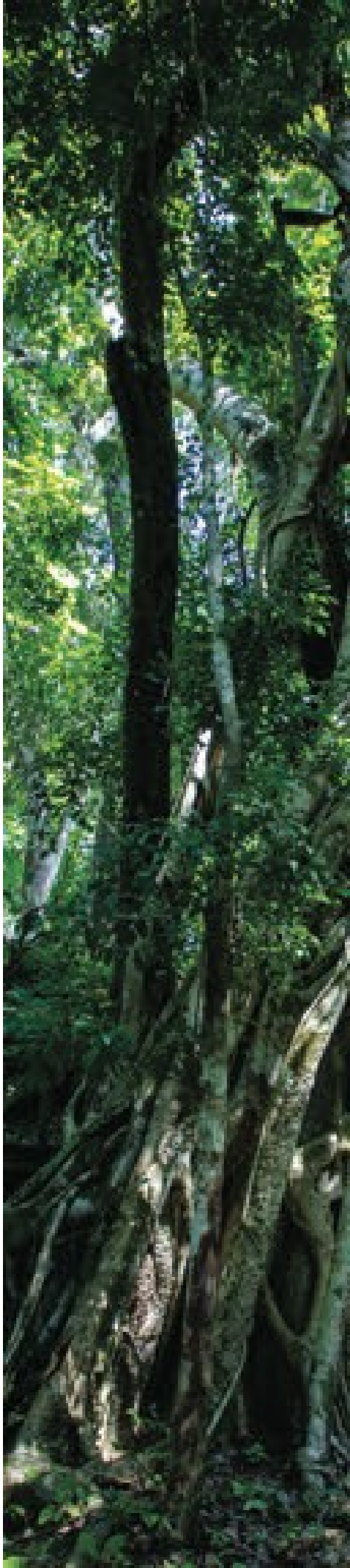
This goal was divided in two, as the process of declaring protected areas in Guatemala includes two phases. The first corresponds to the approval of the technical study by the governing body, and the second to the declaration by legislative decree by the Congress of the Republic.

In the baseline (2020), the extent of coastal protected areas covers only 5.8% of the SIGAP, which is insufficient to conserve the ecosystem representativeness of this area (CNCC, 2018). Expanding the coverage of these ecosystems in SIGAP can increase adaptive capacity by promoting sustainable management and biodiversity management (MARN et al., 2020). It also ensures the conservation of strategic ecosystems such as mangroves, which serve as a natural barrier to protect communities from extreme tidal events. In turn, it contributes to maintaining the habitat and refuge of a large number of species, as well as the associated livelihoods of the people living in the surrounding area.

Both sub-targets are implemented by CONAP, the Congress of the Republic and civil society. In both cases, the entity responsible for reporting and quality is CONAP, as it is the governing body for the country's protected areas and biological diversity.

Target ZMC-4. By 2025, Guatemala's Reef Health Index (RHI) remains at the same level as the 2020 baseline.

The ISA is an index of the state of health of the reef. It takes into account four indicators: 1) live stony coral cover, 2) fleshy macroalgae cover, 3) biomass of herbivorous fish and 4) biomass of commercially important fish. The rating ranges from 1 (critical) to 5 (very good) (Williamson Cuthbert et al., 2019). In the case of Guatemala, the ISA value in 2020 was 2.0 (McField et al., 2020).



The implementation of measures to follow up on the ZMC- 4 target is intended to increase adaptive capacity by maintaining the health of an ecosystem that is fundamental to the balance of the coasts. A determining factor for this is the promotion of sustainable management and management of biological diversity, which in addition to maintaining the habitat, guarantees the continuity of related livelihoods, such as fishing and tourism (MARN et al., 2020).

It should be noted that, with the implementation of these measures, positive changes in coral reefs are expected. However, as it is an ecosystem highly threatened by human activities and also affected by the effects of climate change, an improvement in the ISA in such a short period is not envisaged, but at least a maintenance of the ISA. On the other hand, the recovery of reef health is a process that takes longer than the time horizon of the updated NDC targets.

This goal is implemented by the central government, through CONAP and the Directorate of Fisheries and Aquaculture Regulations of MAGA (DIPESCA), in addition to civil society (non-governmental organisations working in the marine-coastal zone) and academia. *Healthy Reefs for Healthy People Initiative* is responsible for reporting and quality.

4.3.3 *Forest resources, ecosystems and protected areas*

Forests play a critical role in climate stabilisation, due to their carbon absorption capacity and their participation in the water cycle (FAO & IDFAC, 2021). Tropical forests, such as those in Guatemala, are also one of the most important terrestrial ecosystems for global biological diversity (Myers, 1988). However, they are very vulnerable ecosystems. One of their main threats is deforestation. The underlying reasons have to do with population pressure on these ecosystems. For example, agricultural activities such as extensive cattle ranching and medium and large-scale agriculture (monocultures), which are the main cause of deforestation (GCI, 2020); forest fires, mainly caused by poorly controlled agricultural burning; pests and diseases; unsustainable consumption of firewood; illegal logging; encroachment and illicit drug trafficking; among others (CNCC, 2018).

To solve these problems and to facilitate adaptation to climate change at the national level, it is essential to implement measures to conserve forest resources, other threatened ecosystems and protected areas, and to restore degraded areas. Therefore, four goals were set for this sector.

Target AER-1: By 2025, 32% of the national territory (3 479 124 ha) is covered by forests and at least 30% of the managed forests are managed by indigenous and non-indigenous women.

The 2016 forest cover, established through the *Collect Earth* grid of sampling points (GIMBUT, 2019), was used as the baseline for this target.

The achievement of this goal constitutes an important basis for the conservation of biological diversity, essential for a country "megadiverse "[18] like Guatemala. It will also contribute to increasing resilience to climate change by regulating the local microclimate, and by helping to conserve soil and water resources.

This target also provides important synergies with the mitigation component, thanks to the decrease in GHG emissions from reduced deforestation and carbon sequestration, which will be reflected in increased removals in the country.

The entities in charge of the implementation of this target will be the government (through CONAP, INAB and MAGA), as well as non-governmental organisations, municipalities, indigenous and local communities, indigenous authorities and the private sector. CONAP (inside protected areas) and INAB (outside protected areas) will be responsible for reporting. MARN will be responsible for quality control.

Target AER-2: By 2025, the rate of forest fire degradation will be reduced to 36 972 hectares per year, a 5% improvement over the baseline rate. Prevention of forest fires will be improved by addressing strategies related to the short term problems from a societal perspective. The area affected by forest fires will not exceed the limit of 20 000 hectares on average per year by 2021-2025.

The definition of this target was based on official data on the rate of forest fires available in the country for the period 2001-2020 (CONRED, 2020) and a report on fire scars from 2006-2016 (GIMBUT, 2022).

The relevance of this target is that by improving fire management, threats to forest biodiversity are reduced, while increasing the resilience of ecosystems and local communities to the impacts of climate change.

[18] It is a group of 20 countries that are home to the highest rates of biodiversity on earth (CONAP, 2020).

In synergy with target REA-1, it is of utmost importance to monitor burned areas and prevent changes in land use, such as the establishment of crops or grazing areas.

The entities that will be in charge of the implementation of this goal are the National Coordinator for Disaster Reduction (CONRED), INAB, CONAP, and MARN, the municipalities and indigenous and local communities. The entity in charge of reporting is CONRED and CONAP will be responsible for quality control.

Target REA-3 By 2025, forest restoration and area under management through the modalities of "forest plantations", "agroforestry systems" and "restoration of degraded forest lands" of the forestry incentive programmes PROBOSQUE (26 900 hectares) and PINPEP (3400 hectares) has been increased by 30 300 hectares.

Sub-goal REA-3.1: Increase by 10 659 hectares the area under the "agroforestry systems" modality of the forestry incentive programmes PROBOSQUE (7587 hectares) and PINPEP (3072 hectares).

The entities in charge of the implementation of this target will be INAB, CONAP, MAGA and MARN, as well as non-governmental organisations, municipalities, community organisations and the private sector. INAB, CONAP and MAGA will be responsible for reporting. MARN will be in charge of quality control.

Meeting this target also supports the country's objectives in the mitigation component by increasing the carbon sequestration capacity of agricultural areas.

Target AER-4: By 2025, the Ecosystem-based Adaptation (EbA) approach will be integrated into the institutional strategic instruments of the governing governmental entities such as MAGA, MARN, CONAP and INAB.

EbA is a key concept for increasing resilience to climate change and food security, as it considers the establishment of sustainable production systems, biodiversity conservation and integrated water resource management. It is inclusive and participatory, taking into account the traditional practices of indigenous peoples and local communities, and involving youth and women (Girardin et al., 2021; Seddon et al., 2020).

Achieving this target will enable actions that use ecosystem services to increase the resilience of the population and the landscape.

The entities tasked with the implementation of this target are will be INAB, CONAP, MARN, MAGA and SEGEPLAN. The MARN and SEGEPLAN will be in charge of reporting. MARN will be responsible for of quality control.

4.3.4 *Integrated water resources management*

Climate change causes variations in the quantity and intensity of hydrometeorological phenomena, which affects the quality and quantity of water, jeopardising the proper management of water resources (CNCC, 2018).

The most notorious impact is reflected in water availability scenarios, in which the availability of water for human consumption and productive activities is expected to decrease. Addressing this sector is a major challenge for the country, as the institutional framework for water resources management is dispersed among several governmental entities, which makes integrated management difficult. In addition, the country does not have a unified and comprehensive regulation of the resource.

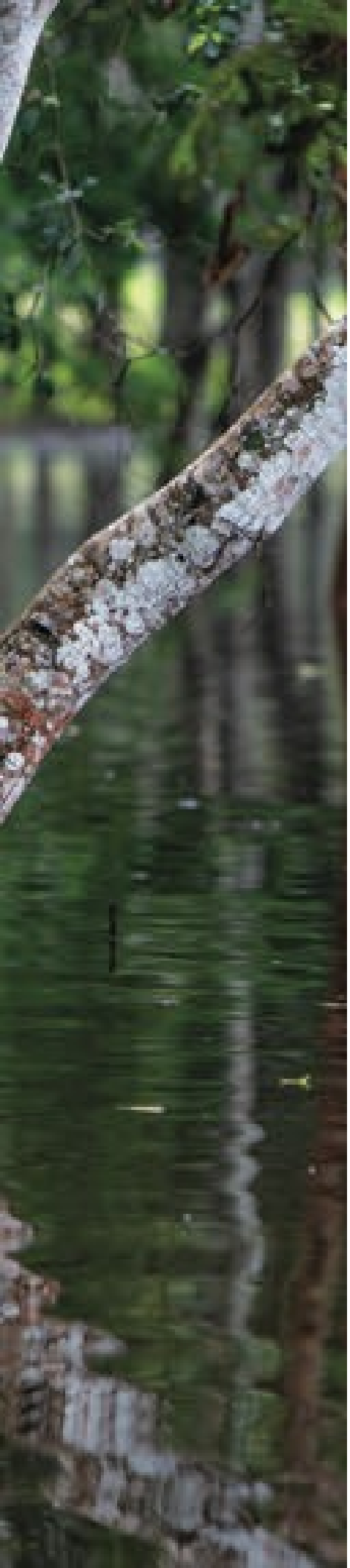
To overcome these barriers, it is necessary to implement measures focused on improving the integrated management of river basins and water resources. To this end, five goals have been defined.

Target GRH-1: By 2025, at least 35% of the country's basins, sub-basins and micro-basins have implemented programmes, plans, strategies and technical manuals for the integrated management of water resources at the territorial level, respecting their governance, with a gender approach and cultural relevance.

The importance of this target lies in the fact that integrated water resources management contributes to soil conservation, increased water resources in rural and urban areas, increased resilience to climate change impacts and disaster risk management (Governmental Agreement 19-2021, 2021).

This target also brings synergies to the mitigation component, thanks to the potential development of hydropower and consequent decrease in GHG emissions, as well as potential decreases in methane emissions from watersheds.

The entities in charge of the implementation of this target will be MARN, SEGEPLAN, the basin authorities and MAGA, as well as the mancomunidades. MARN, through the Vice-Ministry of Water, will be responsible for reporting. SEGEPLAN will be in charge of quality control.



Target GRH-2: By 2025, 50% of watersheds and strategic sites of hydrological importance have plans for area protection and sustainable management. These plans have a watershed and land-use planning approach with cultural relevance and gender focus, in accordance with the social context.

The strategic sites considered in this target correspond to those areas where it is vital to establish governance models given their proximity to agricultural areas, water recharge areas or drinking water sources and watersheds that directly influence the marine-coastal zone.

Having plans in place for the protection of these strategic sites will allow for the linkage with other goals related to forest incentives for the sustainable management of these areas of utmost importance for water resources (INAB, 2017). These plans will include the actions currently being carried out by the existing technical roundtables in certain regions of the country.

The entities in charge of the implementation of this target will be the government (through the basin authorities, CONAP, INAB, MARN, MAGA and SEGEPLAN), as well as the municipalities (through the municipal water and sanitation offices), CONADUR, the Departmental and Municipal Development Councils and the Regional Urban and Rural Development Councils (COREDUR). The entities responsible for reporting are the basin authorities. MARN will be in charge of quality control.

Target GRH-3: By 2025, all 38 river basins in the country have a guide to measure water quality and flow, and enable reporting on their status. 10 % of watersheds have water quality and flow indices.

The country is making important efforts in monitoring water quality and quantity (Governmental Agreement 236-2006, 2006; Governmental Agreement 73-2021, 2021). However, it is necessary to harmonise the existing information and integrate it into a national platform to systematise the information collected in the environmental management reports of entities with approved environmental licences. In this sense, it is stipulated that the information contained in the existing guides and indexes will be uploaded to a national repository that will generate content for the public.

The implementation of this target is a fundamental step to establish the conditions for the fulfilment of a water inventory and to set up the indices to be used in the basins with international standards (Governmental Agreement 73-2021, 2021).

The entities in charge of the implementation of this target will be the government (through MARN, SEGEPLAN, MAGA, MSPAS and INSIVUMEH), as well as academic institutions, municipalities and the private sector (including the National Coffee Association - Anacafé). The entity in charge of the report is the MARN. MSPAS will be responsible for quality control.

Target GRH-4: By 2025 there will be more than 3000 ha of restored riparian forests.

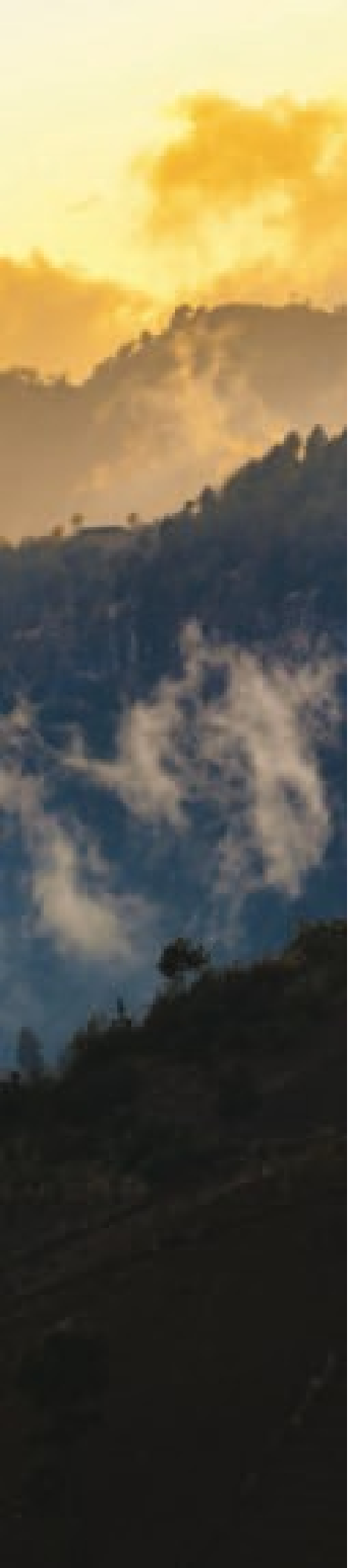
Riparian forests, also known as gallery forests, are ecosystems that inhabit the margins of rivers, wetlands and other freshwater aquatic ecosystems. They are key sites for both rivers and aquatic ecosystems, as well as for adjacent terrestrial ecosystems, as they provide multiple ecosystem services. For example, they help soil conservation and erosion abatement, provide refuge for the biological diversity of the area, among others (CNCC, 2018; Oldén et al., 2019; Yirigui et al., 2019). Directly in terms of climate change adaptation, the restoration of these ecosystems offers enormous adaptation benefits to increase resilience against floods and other extreme events (MARN et al., 2021).

The territorial extension considered in this target covers the implementation of restoration techniques in pilot sites to achieve the national target foreseen in the NAPCC by 2050 (CNCC, 2018). This target is also synergistic with the mitigation component, as its implementation will increase carbon sequestration and thus increase the country's removals.

The entities in charge of the implementation of this target will be MARN, INAB, CONAP and MAGA; as well as academic institutions, municipalities, the private sector and indigenous peoples' and local communities' organisations. The entities responsible for reporting are INAB and CONAP. MARN will be responsible for quality control.

Target GRH-5: By 2025, the establishment of a national early warning system is initiated. To this end, a comprehensive mapping of all existing systems and those in the process of implementation will be carried out, which will serve as an input for their integration at the national level.

Early warning systems are an effective measure for adaptation to extreme events, such as droughts, floods, heat waves, among others (Government of the Republic of Guatemala, 2015). In order to function, four key elements are required as measures that national governments, community organisations and partners of the



different sectors and cross-sectoral sectors should be used as a reference: a) risk awareness, b) monitoring and follow-up, c) dissemination, and d) communication and response capacity. Centralised harmonisation of local early warning systems at the national level will allow for coordinated responses.

The entity that will coordinate the implementation of this goal will be CONRED, which will be supported by INSIVUMEH, MAGA and SESAN; as well as by research institutions (Universidad del Valle de Guatemala -UVG-, Universidad de San Carlos de Guatemala -USAC-, the Instituto de Investigación y Proyección sobre Ambiente Natural y Sociedad de la Universidad Rafael Landívar -Iarna URL- and the Instituto Privado de Investigación sobre Cambio Climático -ICC-), the Alianza por el Agua and the agro-climatic technical roundtables. Each of these institutions will carry out actions within their competence and specialities to develop the four elements of the early warning systems. The entity in charge of reporting is MAGA.

4.3.5 *Human health*

The Third National Communication on Climate Change (MARN et al., 2021) identified several health risks from climate change. Some causes of morbidity and mortality in the country are considered likely to be exacerbated by projected changes in some environmental determinants. For example, vector-borne diseases such as malaria, dengue, chikungunya, Zika, Chagas disease and leishmaniasis; zoonotic diseases such as rabies and leptospirosis; skin diseases; cardiovascular diseases, among others (CNCC, 2018). It is therefore necessary to formulate climate change adaptation policies that establish the necessary guidelines to reduce the vulnerability of human health to these impacts.

As mentioned in section 4.1, it was not possible to set concrete targets for this sector as in the case of others. However, a roadmap was established with lines of work that will allow the sector to be included in the next update of the NDC. To this end, six lines of work were defined, with an implementation horizon of two years:

1. **Improve internal coordination within the MOHSS.** **Achievement:** by 2023, the MOHSS has a clear and efficient coordination of activities related to reducing the impacts of climate change on the human health sector.

2. **Improve inter-institutional coordination.** **Achievement:** by 2023, climate change actions are incorporated into the MSPAS institutional strategic plan.

3. **Intersectoral technical roundtable. Achievement:** By 2023, a sectoral technical roundtable approved by MARN and MSPAS has been established. This will constitute a space for dialogue to plan joint actions, present ideas and establish work plans that can strengthen adaptation to climate change in the sector.

4. **Establishment of funding sources. Achievement:** By 2023, at least two climate change adaptation projects in the sector have been submitted for funding review.

5. **Technical capacity building. Achievement:** by 2023, a t least 50% of key staff in institutions are trained and sensitised on climate change issues.

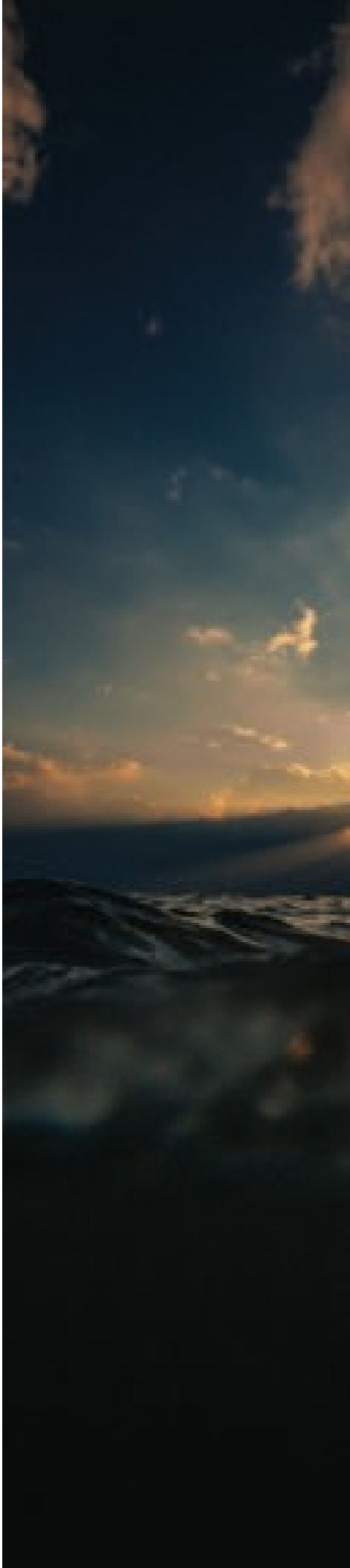
6. **Strengthening research. Achievement:** By 2023, research priorities on climate change impacts on the health sector have been clearly defined and the results of initial research are shared with the population.

4.3.6 *Infrastructure*

Extreme hydro-meteorological events, in addition to the cost in human losses, have caused damage and losses to infrastructure that is essential for the functioning of the country, such as schools, roads, bridges, basic sanitation systems, energy transmission and distribution infrastructure, among others.

Among the main needs of the infrastructure sector are: strengthening communication and coordination processes between government entities in order to develop projects, targets and indicators; identifying information gaps; establishing and applying design and construction standards that consider climate change; implementing risk management and vulnerability reduction measures; and consolidating land-use plans.

As with the human health sector, there was insufficient information and institutional capacities related to climate change to set targets. In the medium term, the VIC is expected to develop an institutional strategic plan for vulnerability reduction, adaptation and mitigation to climate change and to adopt design and construction standards for physical works that take into account climate variability and change, in compliance with Article 15, paragraph "e" of Decree 7-2013 of the Congress of the Republic.



In the short term, the roadmap focuses on initiating dialogue and creating the enabling conditions to bring the sector into the NDC. To this end, seven lines of work have been defined for implementation by 2023. These will be the responsibility of the CIV as the sectoral lead agency and the MARN as the lead agency for climate change:

1. **Inter-institutional communication.** **Achievement: there is** a dialogue table made up of the institutions related to the sector, which will meet every four months. For this purpose, the technical and political contact of each institution will be appointed. This roundtable will include at least representatives of the VIC, the National Association of Municipalities (ANAM) and the MARN. Among the functions of the roundtable will be to elaborate and present a sector action plan for climate change.

2. **Territorial development planning regulations and sustainable and resilient infrastructure.** **Achievement: there** is a proposal for SEGEPLAN, municipalities and ANAM to incorporate guidelines in the process of updating territorial planning and development plans with the inclusion of an axis of adaptation to climate change and resilience.

3. **Dissemination and promotion of the relevance of climate change in the infrastructure sector.** As there is little knowledge on the subject, it is necessary to communicate to sector actors and the general public the importance of incorporating climate change vulnerability and adaptation considerations into the infrastructure planning process. **Achievement:** A dissemination and promotion plan is in place.

4. **Technical capacity building.** The VIC, sector actors and local governments require technical support to strengthen their capacities on climate change, green infrastructure and nature-based solutions, among others. **Achievement:** A capacity building plan for stakeholders is in place.

5. **Sector representativeness.** The VIC is a member of the CNCC. However, it is important to facilitate the participation of other actors in it. **Achievement:** An analysis of relevant actors in the sector is available.

6. **Measurement and monitoring of sector data.** The collection of basic statistical information on the sector is important for informed decision-making. A platform for sharing information on policy initiatives, innovation, education, education, funding and projects is considered a priority. **Achievement:** A design for the sector information system is in place.

7. **Innovation, research and development in the sector.** Innovative ways are required for sustainable infrastructure development, exploring design optimisation and the use of local materials with a lower carbon footprint that contribute to adaptation and resilience. **Achievement:** Partnerships have been established for the creation of an innovation promotion group in the sector.

4.4. Monitoring, Evaluation and Reporting (MER)

In compliance with the Paris Agreement and the Enhanced Transparency Framework, Guatemala must submit reports both on measures taken to address climate change and on support provided or received (European Union, 2020). Within these reports, progress on NDC compliance must be monitored, for which MER19 systems are required.

Guatemala currently has two SRM systems developed and being implemented, which were useful in formulating the targets. These respond to the sectors of Marine-coastal zones (MARN et al., 2020) and Agriculture, livestock and food security (MAGA et al., 2019).

In the case of the MER of the Marine-Coastal Zones sector, the Technical Committee for Integrated Marine-Coastal Management of Guatemala (Ministerial Agreement 154-2019, 2019) is in charge of reviewing and validating the information that feeds the indicators and, therefore, the goals of the NDC. Regarding the Agriculture, Livestock and Food Security sector, MAGA was designated as the lead agency and the entity in charge of implementing the MER system.

The rest of the sectors prioritised for adaptation in the NDC lack SRM systems. However, during the participatory process under which the goals of the NDC update were formulated, a roadmap was developed for the development of SRMs for the Forest Resources, Ecosystems and Protected Areas and Integrated Water Resources Management sectors. The aim is to create institutionally recognised and accepted SRM systems within the next five years. This is a key task for

[19] These systems are tools that involve several processes, such as the collection of statistical data; the synthesis and analysis of information for reporting and monitoring progress, among others.

increase the transparency of the implementation of targets in such complex and significant sectors for the country. However, even without the support of an official SRM system, the targets in these sectors were formulated clearly indicating the institutions responsible for their implementation, as well as for reporting and quality control. Therefore, emphasis was placed on clarifying the indicators, metrics and baseline for each proposed adaptation target.

Once the monitoring indicators for each sector have been established, the aim is to integrate the information monitored at sectoral or target level into the SNICC. Currently, the SNICC does not yet have fully integrated information from the MER systems already developed, nor the information collected in the sectors where MER systems are in the development phase. Therefore, it is essential to comply with the information integration programmes, through bilateral agreements with the governing institutions of the sectors. Full integration of local information in the next five years will boost coordination capacity for the implementation of climate change adaptation measures.

In this regard, during the period 2022-2025, the CBIT (*Capacity-building Initiative for Transparency*) project will be implemented. Its objective is to implement the Enhanced Transparency Framework for Guatemala, which will implement the NDC indicators and targets included in the monitoring systems. With regard to adaptation, component 3 stands out, entitled: Monitoring system for the adaptation component of the NDC, designed and implemented. This project also includes three components related to mitigation (section 5.3) and component 4, which corresponds to the system for monitoring the support planned and received. This project will be complementary to the preparation actions for the First Biennial Transparency Report of Guatemala, set for the end of 2024.

5. MITIGATION

Eight national GHG inventories have been conducted in Guatemala. The first four (1990, 1994, 2000 and 2005) were analysed based on the methodologies set out in the 1996 revised IPCC guidelines. The most recent four (2010, 2014, 2014, 2016 and 2018) were analysed under the 2006 IPCC guidelines. In addition, estimates have been made for an annual time series for the period 1990-2018, also based on the 2006 IPCC guidelines.

The 2018 inventory[20] showed that total emissions were 63.55 million tonnes of $_{CO2\text{-}eq}$, exceeding the value of removals (31.66 million tonnes of $_{CO2\text{-}eq}$) and resulting in a balance of 31.57 million tonnes of $_{CO2\text{-}eq}$(MARN et al., 2022).

The sector with the highest contribution to total emissions was LULUCF with 54.8 %, followed by Energy with 30.7 % and Agriculture with 9.3 %. Finally, the PIUP and Waste sectors contributed 2.9% and 2.3%, respectively (Figure 4).

Under a baseline scenario (BAU)[21], the
estimates that the country's total GHG emissions are expected to increase by 22.7% between 2015-2030, at a rate of 1.5% per year. This increasing trend is mainly driven by three factors:

- Deforestation, as in the period 2010-2016 the annual gross rate of forest loss was 122 985 hectares (SIFGUA, 2021).
- Fuel consumption for electricity generation, mainly by coal-based generation (MARN et al., 2021).
- The consumption of fuels for the transport of persons and goods is goods (MARN et al., 2021).

[20] The NDC update was conducted in a parallel process to the analysis of national GHG inventories for Guatemala's First Biennial Update Report, so the data presented were still under review at the time of writing and may therefore have changed.

[21] In this document, the BAU scenario will be referred to by its acronym BAU, which stands for business as usual, as it is more widely known in this form among the entities participating in the process.

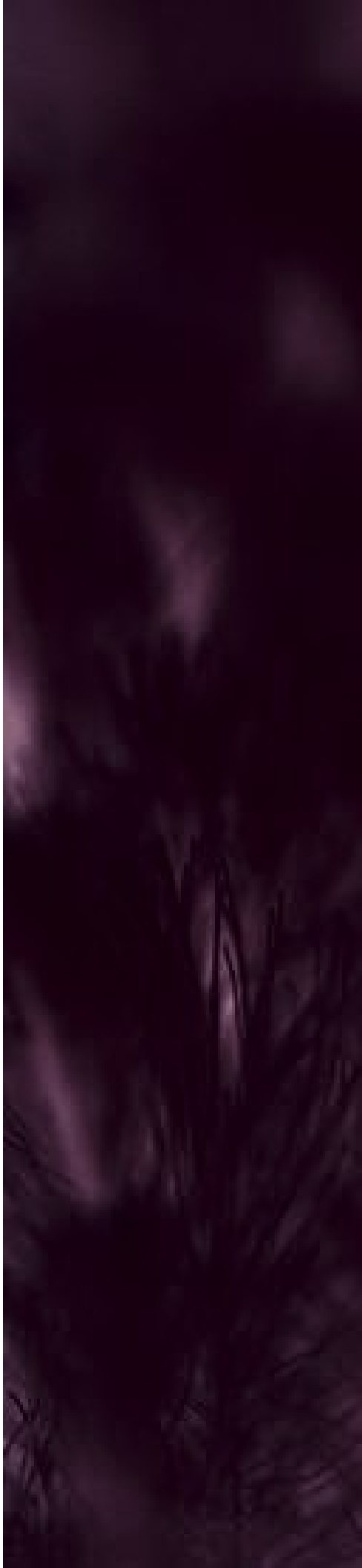
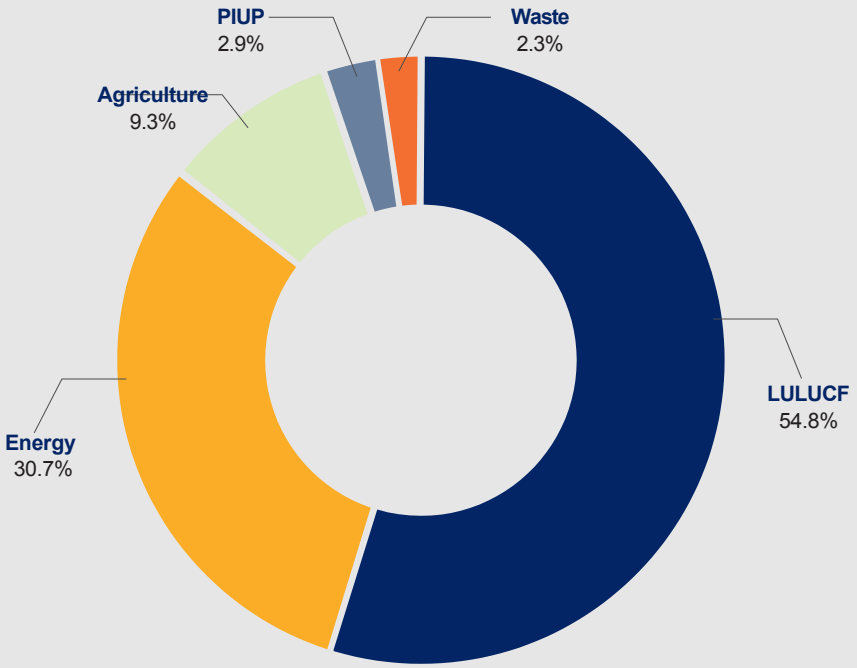


Figure 4 Emissions as of 2018 by sector



Note: Percentage contribution to total emissions per sector is shown. Own elaboration, based on MARN et al. (2022).

Since its accession to the UNFCCC and in accordance with the principle of "shared but differentiated responsibilities", the country has made efforts with its own resources and with funds from international cooperation in the area of mitigation. This commitment has been reflected in national planning, through numerous policy instruments, including the National Climate Change Policy (MARN, 2009a), Decree 7-2013 of the Congress of the Republic, the PANCC and the National Strategy for Low Greenhouse Gas Emissions Development (Estrategia Nacional de Desarrollo con Bajas Emisiones de Gases de Efecto Invernadero).

Another example is the National Development Plan K'atun: Our Guatemala 2032, which aims to stabilise $_{CO2\text{-}eq}$ emissions per capita at 2.5 tonnes (CONADUR, 2014). Despite the fact that the trend continues to [increase22] , the country is maintaining its efforts with planning focused on achieving the established goal.

Since the presentation of the NDC in 2015, efforts have been made from both the governmental and private sectors. These have been aimed at updating public and investment policies; reinforcing current regulations; incorporating the component of capacity building and strengthening; and implementing adaptation and mitigation projects with national and international technical and financial support.

22As of 2018, per capita emissions amounted to 3.87 tonnes CO2-eq (MARN et al., 2022).

Guatemala's NDC update is proof of the country's commitment to reduce its GHG emissions and contribute to the global target. The information that was available for the NDC update made it possible to have greater certainty on the baseline emissions scenario and on the sectors, categories and subcategories with the highest emissions. This situation is allowing the country to analyse the measures to be implemented to reduce as much emissions as possible. The processes involved in this update are described below.

5.1 Methodological approach for updating the target and defining mitigation measures

The update of the mitigation component was developed considering the available information on GHG emissions from national inventories from 1990 to 2018. For this, the five emitting sectors were taken into account: LULUCF, Agriculture, Energy[23], Waste and IPP. This NDC update did not identify any measures from the Industrial Processes and Product Use (IPPU) sector, however, the Biennial Update Reports propose to report on the implementation of voluntary emission reduction or mitigation actions from this sector that impact both the sector itself and other sectors.

First, the priority measures for meeting the country's emission reduction target were defined. This exercise was carried out taking into account the planning instruments and activities that are already being developed in the country or are planned for implementation. These measures were analysed and prioritised through a participatory process (section 5.1.1).

An analysis of the BAU scenario based on the time series of GHG emissions data 1990-2018 was carried out and the amount of emissions to be reduced to reach the percentage target set in the 2015 NDC was recalculated (section 2.1). Finally, the contribution of the prioritised measures in meeting the target was calculated to determine their contribution to meeting the mitigation target (subsection 5.1.2).

5.1.1 *Participatory process for defining of mitigation measures*

For the initial selection of mitigation measures to be considered for the NDC update, the country's main climate change mitigation instruments were analysed, both at the general and sectoral levels.

23 The energy sector also includes transport.

issuers. These include: the National Development Plan K'atun: our Guatemala 2032 (CONADUR, 2014), National Development Priorities of Guatemala (SEGEPLAN, 2018), Decree 7-2013 of the Congress of the Republic, National Action Plan on Climate Change (CNCC, 2018), National Strategy for Low Greenhouse Gas Emissions Development (Government of the Republic of Guatemala, 2018a), National REDD+ Strategy of Guatemala (GCI, 2020), as well as other specific planning instruments related to each sector. Subsequently, the following process was carried out:

1. **Working meetings, consultations and feedback with governing institutions:** meetings were held with the governing bodies of each sector, in which the measures proposed in the national instruments were analysed and those most relevant to the NDC context were preliminarily selected. In cases where discrepancies were found among the measures, those that are consistent with the national and institutional reality were chosen, so that compliance could be ensured according to the country's technical, financial and managerial capacity. The selected measures served as a reference for the formulation of the proposed measures for the NDC update.

2. **Development of a prioritisation criteria analysis tool:** this was designed to be able to analyse each of the mitigation policies and measures selected in the previous step, for which 17 evaluation criteria categorised into four components were chosen:

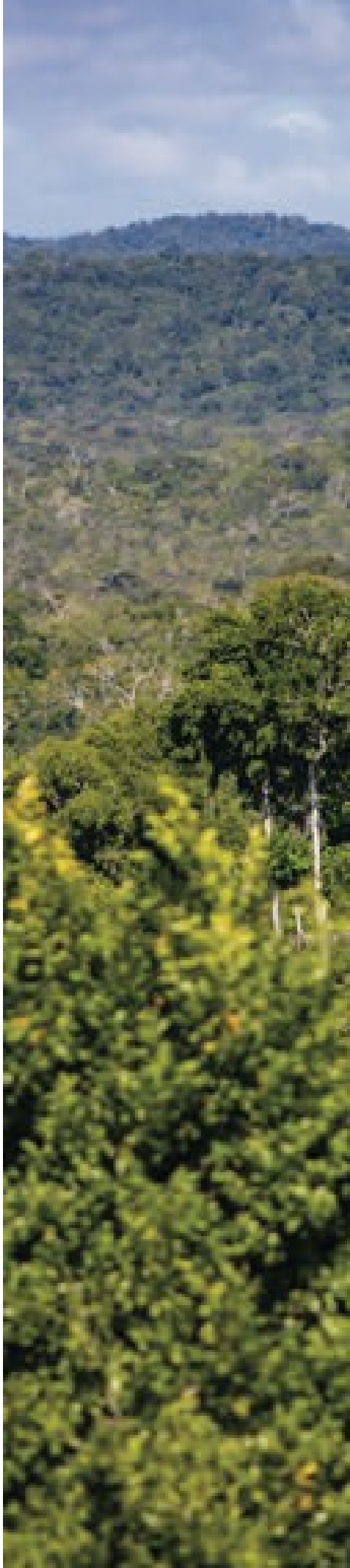
    - *Environmental benefits: this* includes aspects related to the contribution to the reduction of emissions, the design or implementation phase, the continuity or sustainability of the measure over time and the associated environmental benefits.

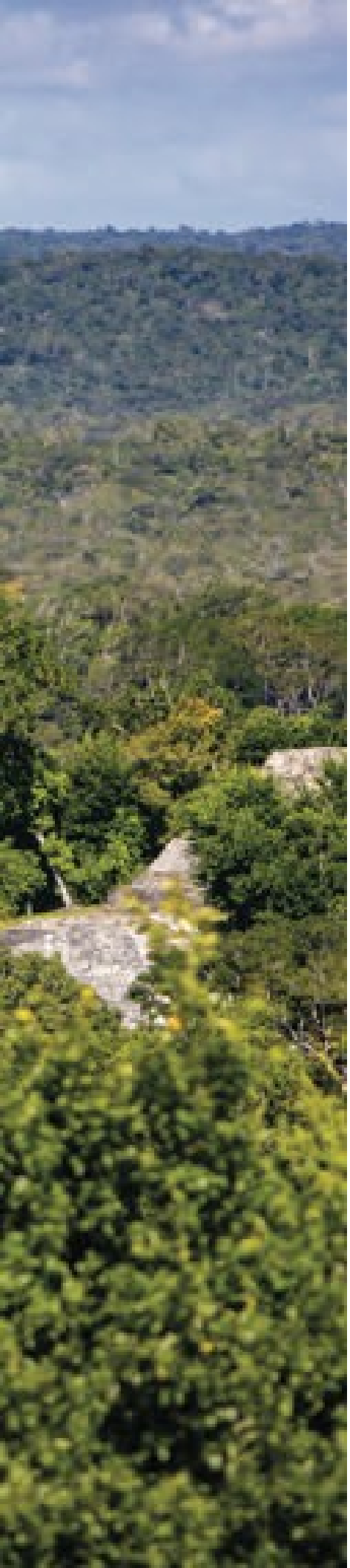
    - *Social benefits: takes into account* synergies with adaptation measures and the generation of new jobs.

    - *Economic benefits:* considers cost-effectiveness and the feasibility of trading emission reductions.

    - *Feasibility of implementation:* includes associated criteria to institutionalisation, financing and monitoring.

3. **Sectoral workshops for the prioritisation of mitigation measures:** at this stage, sectoral actors were convened, including organisations from the public, private, academic and civil society sectors. Priority was given to the participation of those bodies responsible for the measures, as well as to those responsible for the mitigation measures.





those likely to be affected by its implementation. The workshops served two purposes. The first was to socialise the process of updating the NDC, as well as to explain the sectoral contributions to emissions; description of the measures; and the criteria used for assessing the feasibility of the measures. The second was to gather information to prioritise the measures selected in a preliminary way, for which the tool designed in step 2 was applied. This exercise was done in working groups, according to mitigation sectors.

4. **Analysis of the results of the prioritised targets:** the information obtained in step 3 was analysed in order to identify whether the conditions for the implementation of each measure were acceptable, or whether the means for their implementation did not exist. As a result, a final prioritisation of measures for the mitigation sectors was obtained.

5. **Development of fact sheets per measure:** a fact sheet[24] was completed for each prioritised measure. For this purpose, the Biennial Update Report Template prepared by GIZ (2017) was adapted. In this way, the aim is to standardise the formats of the country's various mitigation monitoring and reporting instruments.

5.1.2 *Accounting approach of the emissions*

To update the overall mitigation target, the procedure to establish NDC accounting was carried out based on the guidance of Öko-Institut e.V. and GIZ (2018), which is based on the requirements of the Paris Agreement. For this purpose, data from the historical emission series of the national GHG inventories 1990-2018 were used, with which a baseline and projections of the BAU scenario to 2030 were elaborated. The projection and target setting processes were first worked on at the sectoral level and then scaled up to the national level.

Subsequently, the contributions of each proposed mitigation measure (section 5.1.1.) were related, establishing a type of target known as "deviation from the baseline". This consists of relating the emissions projection of the BAU scenario to the emissions reductions estimated from the identified mitigation measures. For this, three steps were followed:

1. **Detailing the target:** to include measures in the baseline and mitigation scenario, the "dividing point definition" was used, which involved taking into account measures adopted up to 2015 as part of the baseline[25] and those adopted thereafter.

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[24] If you wish to consult them, they can be requested from the MARN's Climate Change Directorate.
[25] This is why the timeframe from 2015 to 2030 is presented in the graphs that show the emission reduction potential of the measures contemplated in the updated NDC. (figures 5 to 10).

of this dividing point, as part of achieving the NDC target. In this case, the dividing point was 2015, because in this year the Paris Agreement was adopted, and with it, the NDC became a commitment to the UNFCCC.

2. **Define the calculation:** the "NDC mitigation target" was used, which determines the country's proposed emission reduction in millions of tonnes of $_{CO2-eq}$ and its percentage in relation to the BAU scenario. This option was selected considering the country conditions in terms of the type of national Monitoring, Reporting and Assessment (MRV) that will b e used for monitoring[26]. Therefore, this target is the result of the sum of the prioritised emission reduction measures in the mitigation sectors.

3. **Data structure:** Consistency and alignment was ensured between historical emissions and projections from the NDC and information from the 1IBA GHG inventories 1990-2018, which are the most up-to-date data on emissions and removals in the country. This allows for compliance with the principles of "transparency', 'accuracy', 'completeness', 'consistency' and 'coherence'. "comparability", which are mandatory for the accountability of anthropogenic emissions and removals. The BAU scenario projections are linear and cover the period 2019-2030. Emissions and removals were projected for each category and in some cases for some subcategories of the inventory. These projections were then summed to obtain values by sector and finally at the national level.

5.2 Target and mitigation measures

As a consequence of the steps described in section 5.1 and taking into account the responsibility assumed in the Paris Agreement, the BAU scenario and thus the mitigation target was updated. In addition, concrete measures have been defined to meet the BAU target. These will contribute to the achievement of the "unconditional" target to which Guatemala has committed. This target is based on the percentage reduction by 2030 compared to the BAU scenario (which corresponds to 73.2 million tonnes of $_{CO2-eq}$). It is important to mention that measures to reach the "conditional" target are still under analysis.

Guatemala remains committed to achieving the 2015 NDC target by 2030. To this end, the country formulated the National Strategy for Low Greenhouse Gas Emissions Development and prioritised it as the public policy instrument that will guide the actions of the NDC. In t h i s , the following were identified 43 "mitigation options "[27] (Government of the Republic of Guatemala, 2018a), which are in different stages of development.

27Although they are referred to in the Strategy as "mitigation options", due to their holistic approach, they are considered to be as mitigation measures.

planning and implementation. The implementation of these measures will achieve the NDC's goal of reducing the number of people living in rural areas.
11.2 % of total projected emissions by 2030 (Government of the Republic of Guatemala, 2015). For its part, to meet the conditional target, the country remains committed to seeking additional external technical and financial support in order to increase national ambition and achieve the 22.6% reduction in projected emissions by 2030. In this sense, with the update of the BAU scenario data, the mitigation targets would be as follows:

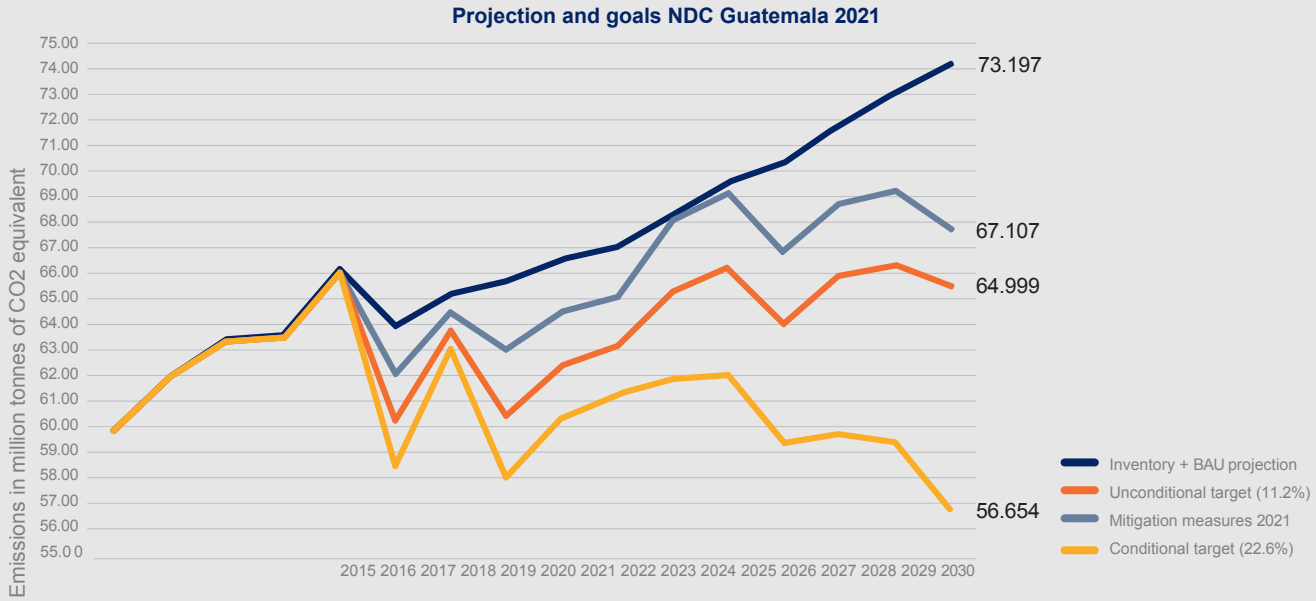
Target not conditional on international support: By 2030, 11.2 % of GHG emissions have been reduced compared to the BAU scenario, leading to a reduction of emissions to 64.9 million tonnes $_{CO2\text{-}eq.}$

Target conditional on international support: By 2030 22.6 % of GHG emissions have been reduced compared to the BAU scenario, which means reducing emissions by up to 56.6 million tonnes $_{CO2\text{-}eq.}$

The measures prioritised during the NDC update process in 2021 will reduce 6.09 million tonnes of $_{CO2\text{-}eq}$ by 2030, which corresponds to an 8.32 % reduction in projected emissions in the baseline scenario for that year (Figure 5).

In order to reduce the remaining 2.88% of the emissions contemplated in the unconditional target of 11.2%, the MARN, as the lead agency on the issue, assumes the commitment to continue promoting national efforts and will continue working in close coordination with sectoral actors to strengthen national capacities to enable the implementation of other measures identified in the National Strategy for Low Greenhouse Gas Emissions Development and to achieve the proposed target before 2030.

Figure 5 BAU scenario and updated NDC mitigation targets, period 2015-2030



Note: BAU scenario projections (based on 1990-2018 time series data from GHG inventories) and estimated GHG emissions with compliance with the unconditional and conditional target are shown. Finally, the projected GHG emissions with compliance with the measures stipulated in the updated NDC are shown.

The actions outlined for the mitigation component are aligned with 11 of the 17 SDGs: 1 End poverty, 2 Zero hunger, 3 Health and well-being, 5 Gender equality, 6 Water and sanitation, 7 Affordable and clean energy, 9 Industry, innovation and infrastructure, 11 Sustainable cities and communities, 13 Climate action, 14 Undersea life, and 15 Life of terrestrial ecosystems.

These measures were proposed for four sectors. In Table 3 a summary is displayed.

Table 3 Prioritised measures for the updated NDC in the mitigation component

Land use, land-use change and forestry				
Code	**Name of the measure**	**Description**	**Implementer**	**Target 2030**
UTC-1	Conservation, protection and sustainable management of forests	The measure focuses on the administration, conservation and rational use of forest resources from the point of view of the economic, ecological and social benefits that can be obtained. It envisages the implementation of sustainable forest management in natural forests, by promoting the reduction of deforestation, avoiding the loss of soil organic matter and preventing land use change.	CONAP INAB	Reduction of 1.5452 million tonnes CO_{2-eq}
UTC-2	Reducing forest degradation due to forest degradation by fire prevention and control	The measure provides for the development of instruments, means, capacities at local level and institutional strengthening for the prevention, control and combating of forest fires.	CONRED CONAP INAB MAGA	Reduction of 0.12933 million tonnes CO_{2-eq}
UTC-3	Establishment of forest plantations	This measure promotes the increase of biomass available for use in the production of timber, energy (mainly firewood) and seeds, thereby increasing forest productivity through the establishment of forest plantations. These will be subject to sustainable, integrated and efficient forest management and must be established in areas with a productive forestry vocation and areas that are devoid of vegetation cover.	INAB CONAP	Increased absorptions of 0.1773 million tonnes CO_{2-eq}
UTC-4	Restoration of degraded areas	This action promotes the increase of biomass in degraded areas to recover forest cover under a sustainability approach. It is proposed to take actions to restore the natural capital of certain areas, especially river banks and others. The recovery of these areas will allow carbon sequestration with the additional benefits of forests in terms of soil recovery, biological diversity (native species), among others.	CONAP INAB	Increased absorptions of 0.9443 million tonnes CO_{2-eq}
Energy				
Code	**Name of the measure**	**Description**	**Implementer**	**Target 2030**
ENE-1	Prioritise clean energy for power generation	The measure is focused on promoting clean energy sources, such as natural gas, geothermal and non-conventional sources such as wind and solar, in order to diversify the energy matrix.	MEM CNEE AMM INDE EGEE ETCEE GERO-INDE	It is a long term goal that between 2021-2030 will not generate reportable emission reductions

Energy

Code	Name of the measure	Description	Implementer	Target 2030
JAN-2	Sustainable mobility (electro-mobility and biofuels)	This measure seeks to address a programme to renew the private vehicle fleet towards more efficient alternatives. It will combine regulatory measures (vehicle gas regulation) with incentives (tax credits or other fiscal measures) for the purchase and replacement by more efficient vehicles (hybrid and electric), as well as the establishment of the necessary infrastructure for their operation. It also considers the implementation of a programme to promote the use of advanced ethanol in gasoline in Guatemala. This programme will combine regulatory measures such as a new law to reduce emissions from cars using gasoline.	MEM MARN MINFIN MINFIN SAT NCP NNCP NCCRC	2.5 million tonnes of CO_{2-eq}
JAN-3	Change in the matrix energy	In the NDC 2015, the country noted as part of the efforts to reduce the consumption of fossil fuels in electricity generation through the use of clean sources.	MEM AMM INDE EGEE ETCEE GERO-INDE	80 % of electricity generation comes from renewable energies. by 2030

Agriculture

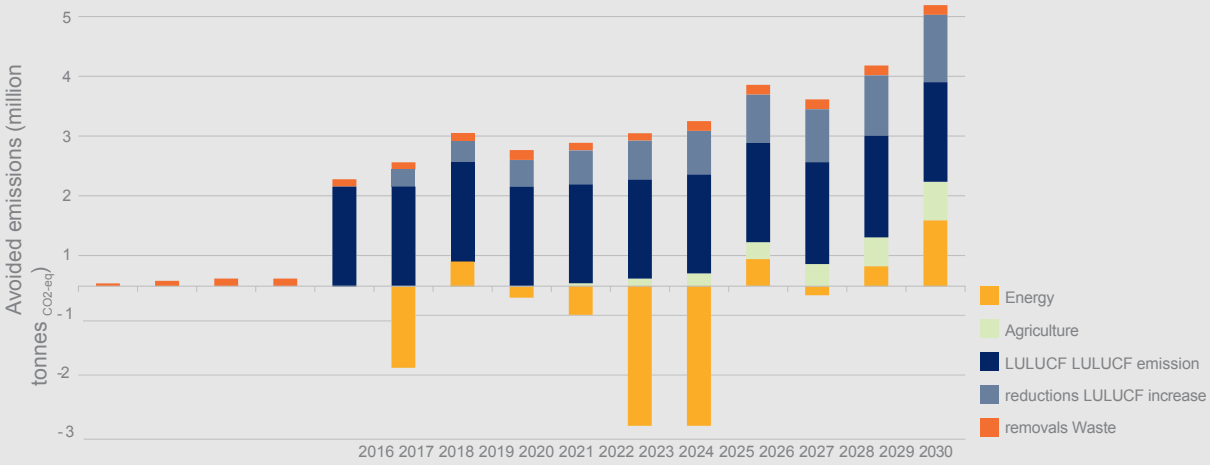
Code	Name of the measure	Description	Implementer	Target 2030
AGR-1	National Strategy of sustainable, low-emission cattle farming	Transform traditional extensive livestock farming into low-carbon livestock production models that can be scaled up nationally. In the first phase, these systems will be adopted on 300 farms that will reduce their GHG emissions and increase CO_2 removal in cattle production, by reducing the carbon footprint of milk and beef production. Intensive rotational grazing practices, improved pastures (at least 40 000 ha), improved nutrition/diets, improved manure management, implementation of silvopastoral practices, more efficient water management systems, improved animal husbandry practices, use of renewable energy at farm level, among others, are expected to be adopted.	MAGA Producer organisations in the meat and milk production chains	Reduction of 0.6370 million tonnes CO_{2-eq}

Waste

Code	Name of the measure	Description	Implementer	Target 2030
RES-1	Methane capture at the zone 3 landfill site and its use for electricity generation	Capture the methane that is generated by the anaerobic decomposition of solid waste at the Guatemala City landfill for use in the generation of electricity to be supplied to the national grid.	Industrias de Biogás, S.A.	Reduction of 0.1539 million tonnes CO_{2-eq}
RES-2	Clean Field Project	This measure has been in place since 1998. Its aim is to remove crop protection packaging from the field as soon as possible and to ensure its proper disposal. This reduces GHG emissions that could be released by burning this type of packaging or preventing its reuse for transport or collection of water for human consumption, which could lead to health problems for the population.	AGREQUIMA	600 tonnes o f empty packaging removed from the field (NON-GHG target).

Figure 6 shows the sectoral contribution of the mitigation identified so far for the updated NDC.

Figure 6 Contribution of the sectoral measures proposed in the NDC update, period 2016-2030



Note: Emission reductions (or avoided emissions) are shown annually and by sector for the period 2016-2030, which corresponds to the implementation time of the updated NDC. The bars below (*Energy* sector) reflect GHG emissions generated in these periods (section 5.2.2).

5.2.1 *Land use, land-use change, land-use change, land-use change, land-use change land and forestry (LULUCF)*

Reforestation and forest conservation is a matter of national urgency and social interest, supported by national legislation (Political Constitution of the Republic of Guatemala. Reformed by Legislative Agreement 18-93, 1993, article 126). On this basis, the country has made great progress in the development of a legal framework.

In addition to these regulatory and policy instruments, there are a variety of mitigation measures implemented in the LULUCF sector, which also provide important benefits for adaptation and, evidently, for compliance with the NDC. Among these measures is the safeguarding of the 349 protected areas legally recognised by SIGAP, which cover 32% of the national territory. There are also incentive programmes for the protection and sustainable management of forests, which promote reforestation and restoration of degraded forests; the establishment of agroforestry systems; and the productive management and conservation of forests inside and outside protected areas (MARN et al., 2021). Guatemala continues to undertake efforts to improve the governance framework for forests and forest lands, so as to reduce the

causes of deforestation and forest degradation, as well as promoting the restoration of degraded lands (MARN et al., 2021). In this regard, the REDD+ Strategy, the Guatemalan National Emission Reduction and Removal Programme (PRE) and an Emission Reduction Payment Agreement (ERPA), which will negotiate the purchase of 10.5 million tonnes of $_{CO2-eq}$ over a period of five years, stand out.

This sector accounted for 54.9% of total emissions nationally in 2018. Given its importance, four mitigation measures have been identified. With their implementation, the LULUCF sector would contribute 45.91 % of the projected reductions with the updated NDC. This is equivalent to 2.79 million tonnes $_{CO2-eq}$ in 2030 (Figure 7).

Four measures derived from the ERP will be implemented for this sector. Two of them are focused on forest conservation, through the reduction of deforestation and degradation; and the others are focused on the increase of carbon stocks, through the establishment of forest plantations and the restoration of degraded areas.

All these measures have synergies with the adaptation measures prioritised in the NDC update and offer co-benefits associated with the improvement of livelihoods, environment and basic conditions for human health; as well as the conservation of biological diversity, regulation of the hydrological cycle and the reduction of soil erosion.

The first measure on conservation, protection and sustainable management of forests (UTC-1) aims at the administration, conservation and rational use of forest resources from the point of view of economic, ecological and social benefits. Focused on the management of natural forests inside and outside protected areas, it is expected to reduce deforestation and avoid the loss of soil organic matter, through fostering increased demand for access to the PINPEP and PROBOSQUE forestry incentive programmes; and promoting the use of regulatory instruments, such as master and management plans, group forest licences and management models. In addition, it will seek to expand and strengthen community forest management, incorporating ancestral knowledge into conventional practices for the management and implementation of timber and non-timber forest management plans.

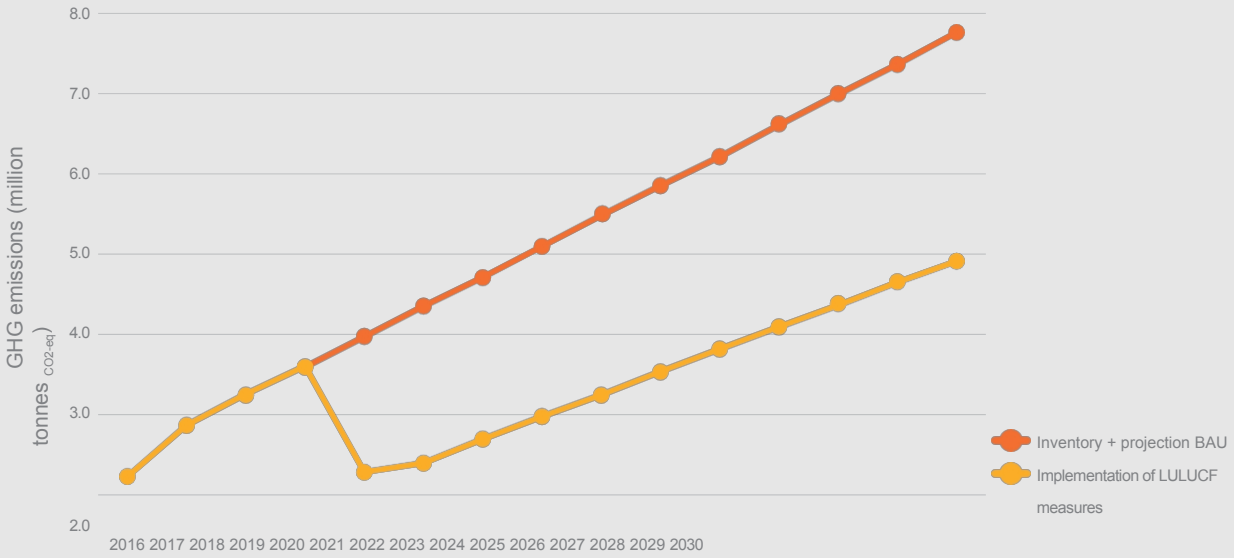
The second measure addresses the reduction of forest degradation through fire prevention and control (LULUCF-2), which provides for the development of instruments and means, as well as capacity building at local and institutional levels for the prevention, control and combating of forest fires. To this end

The institutionalisation and strengthening of fire prevention systems should be promoted, with emphasis on areas with community and private forest management, and improve fire management in the country's agricultural and livestock lands, through the promotion of inter-institutional coordination spaces that guarantee the articulation of actions and relevant actors.

The third measure on the establishment of forest plantations (UTC-3) aims to promote the increase of biomass for uses in the production of wood, energy (mainly firewood) and seeds, which is expected to increase forest productivity. The plantations will be subject to sustainable, integrated and efficient forest management and must be established in areas with a productive forestry vocation and areas that are devoid of vegetation cover. To this end, an increase in the demand for projects under the PINPEP and PROBOSQUE forestry incentives in the modalities of forestry plantations for industrial, energy and latex purposes is envisaged.

Finally, the fourth measure on restoration of degraded areas (UTC-4) aims to promote the increase of biomass in degraded areas to recover forest cover under a sustainability approach. The recovery of these areas seeks to re-establish the functionality and productivity of degraded forests and lands, which will allow carbon sequestration and other benefits of forests in terms of soil recovery, biological diversity (native species), among others. To this end, various sustainable production techniques will be promoted, and the inclusion of land in forestry incentive programmes, productive forestry concessions and the formation of public-private partnerships will be promoted. It will also promote the incorporation of trees into agricultural and livestock production systems. To this end, various forms of agroforestry systems will be promoted and established.

Figure 7 Expected annual emission reduction impact of the LULUCF sector for the period 2021-2030, according to the measures stipulated in the updated NDC



Note: The BAU scenario projection for this sector, analysed with GHG inventory data (dark line) and the projected emissions with the implementation of the measures stipulated for this sector in the updated NDC (light line) are shown.

These measures are underpinned by the ERP, the National REDD+ Strategy and the National Strategy for Low Greenhouse Gas Emissions Development. The country has been preparing on these issues for several years, so it is considered that it has adequate technical and financial capacities for their implementation. Likewise, progress has been made in the monitoring systems, which contributes to the measurement of progress in the fulfilment of the goals associated with each one.

At the institutional level, these measures are led by the two main governing bodies for forests and land use: INAB and CONAP. On the other hand, the Inter-institutional Forest and Land Use Monitoring Group (GIMBUT) and INAB have been defined as responsible for monitoring the progress of the proposed measures, as well as for quality control.

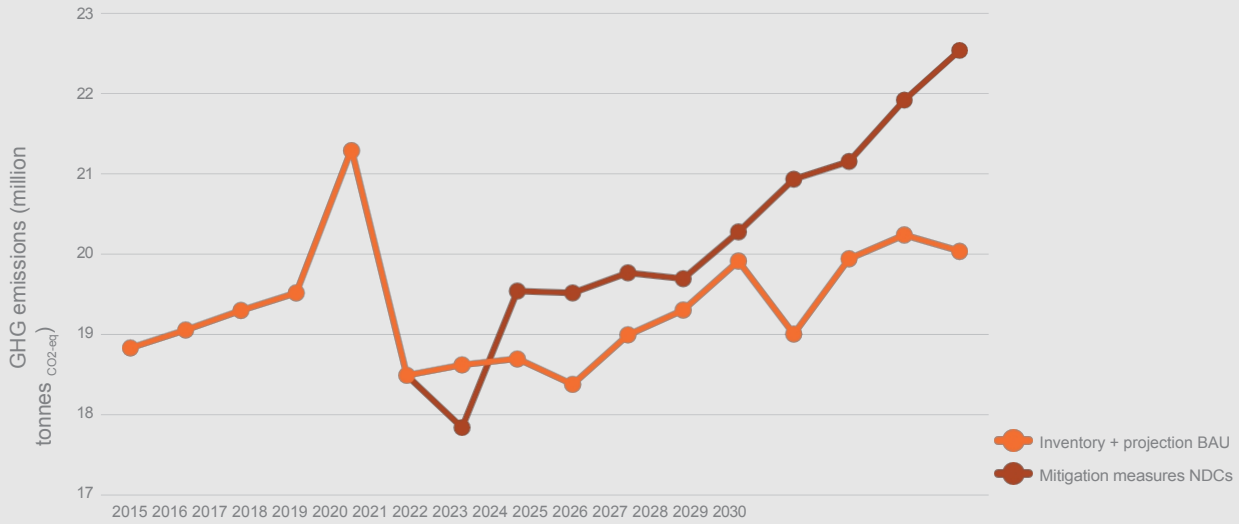
5.2.2 *Energy*

Three measures were proposed for the energy sector. With their implementation, a reduction of 2.5 million tonnes of $_{CO2\text{-}eq}$ is expected by 2030. This figure corresponds to 41.07 % of the reductions projected with the updated NDC.

Implementing measures in Energy is very relevant to meet the mitigation target, as this sector contributes 30.7% of the country's total emissions (2018 data). Within this sector, the categories that contribute the most are: Land transport, with 51 % of the sector's emissions, and Electricity and heat production (electricity generation) with 27.4 % (MARN et al., 2022). Therefore, the country prioritised measures to boost emission reductions in these two categories, as it considers that they could have a high impact.

It is important to note that, due to the adjustments this sector must make in preparation for mitigation, GHG emission reductions will not occur in the first years of implementation, but will be reflected beyond 2030 (Figure 8).

Figure 8 Expected annual emission reduction impact of the Energy sector for the period 2021-2030, according to the measures stipulated in the updated NDC



Note: The BAU scenario projection for this sector is shown, analysed with GHG inventory data (dark line) and projected emissions with the implementation of the measures stipulated for this sector in the updated NDC (light line). Adapted from Henríquez, 2021.

To reduce emissions in the Land Transport category, Guatemala will implement the Sustainable Mobility measure (ENE-2), which is based on promoting the use of electric vehicles (electromobility) and the substitution of fossil fuels with biofuels. To this end, it is proposed to implement a programme to renew the private vehicle fleet in favour of more efficient alternatives, with the aim of replacing 24.3 % of petrol vehicles with electric vehicles by 2032 (Henríquez, 2021). This measure will reduce gasoline consumption and, therefore, GHG emissions derived from this activity. However, it is important to emphasise that the transition to electromobility will increase the demand for electric power generation and, consequently, emissions in this category will increase.

For its part, the partial substitution of gasoline will be promoted through the use of 10% advanced ethanol at the national level.

In the electricity generation category, the country is committed to implementing the measure Prioritise clean energy for electricity generation (ENE-1). This measure focuses on promoting the generation of electricity by sustainable means: solar energy, geothermal energy, natural gas, among others. In addition, the repowering of existing hydroelectric plants will be promoted[28]. According to the implementation scenarios, these actions will begin around 2027. Therefore, in the first years of NDC implementation, emissions will continue with the current trend in the sector. As a result, the use of fossil fuels in electricity generation is expected to be reduced in the long term. In this sense, it is expected that by 2030, clean or renewable energies will account for 80 % of the energy mix (ENE-3).

Finally, it is worth mentioning that the optimisation of transmission grids is indispensable to develop the maximum potential of clean and renewable generation sources. To this end, it is necessary to reduce losses in the transmission system at the different voltage levels (69 kV, 138 kV, 230 kV and 400 kV) due to the fact that transmission is brought closer to the evacuation points of the generation and, in the same way, transport to the consumption centres is made more efficient.

For this reason, the NDC of Guatemala is committed to establishing the premises for the reduction of losses in the transmission of electricity and the extension of the transmission lines of the main system to the potential points of generation with clean energy, as well as to the communities that will soon be electrified. This work will be reflected in the next updates of the Transmission System Expansion Plan.

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[28] Replacement of established hydropower plant equipment to improve its power output.

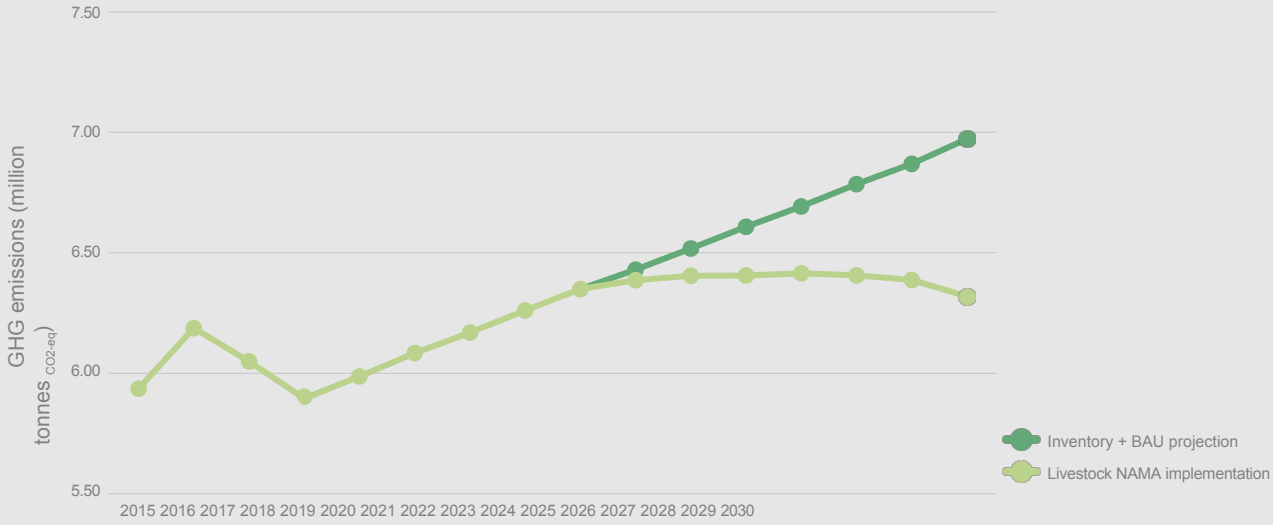
5.2.3 *Agriculture*

The implementation of this measure is planned to start in 2022. By 2030, 0.63 million tonnes $_{CO2\text{-}eq}$ will be reduced (Figure 9)[29]. With this, the agriculture sector will contribute to the 10.46 % of projected reductions with the updated NDC.

The Agriculture sector includes crop and livestock production, as well as agricultural land management. It is a sector of high economic importance, contributing 9.4 per cent of GDP in 2019. % of GDP (Derlagen et al., 2020). It contributed 9.3 % of the country's total emissions in 2018 (MARN et al., 2022).

To contribute to the mitigation target of the updated NDC, the Sustainable Cattle Ranching with Low Emissions (AGR-1) measure is proposed for this sector. This measure is based on the National Strategy for Sustainable Low Emission Cattle Ranching (Government of the Republic of Guatemala, 2018b) and the Nationally Appropriate Mitigation Action (NAMA) for Sustainable Cattle Ranching (MARN, 2018b). It aims to promote the transformation of the livestock sector by increasing productivity and reducing GHG emissions.

Figure 9 Expected annual emission reduction impact of the Agriculture sector for the period 2022-2030, according to the measures stipulated in the updated NDC



Note: The BAU scenario projection for this sector, analysed with GHG inventory data (dark line) and the projected emissions with the implementation of the measure stipulated for this sector in the updated NDC (light line) are shown.

To meet this target, the country is committed to implementing actions to reduce emissions and increase CO_2 removal on 300 cattle farms. This will reduce the carbon footprint of milk and meat production. Among the actions to be carried out by the farms are: adoption of intensive rotational grazing practices, improvement of pastures (at least 40 000 ha), improved nutrition, improved manure management, implementation of silvopastoral practices, more efficient water management systems, better animal husbandry practices, use of renewable energy, among others (MARN, 2018b).

[29] Cumulatively for the period between 2022 and 2030, 2.13 million tonnes of $_{CO2\text{-}eq.}$ are expected to be reduced.

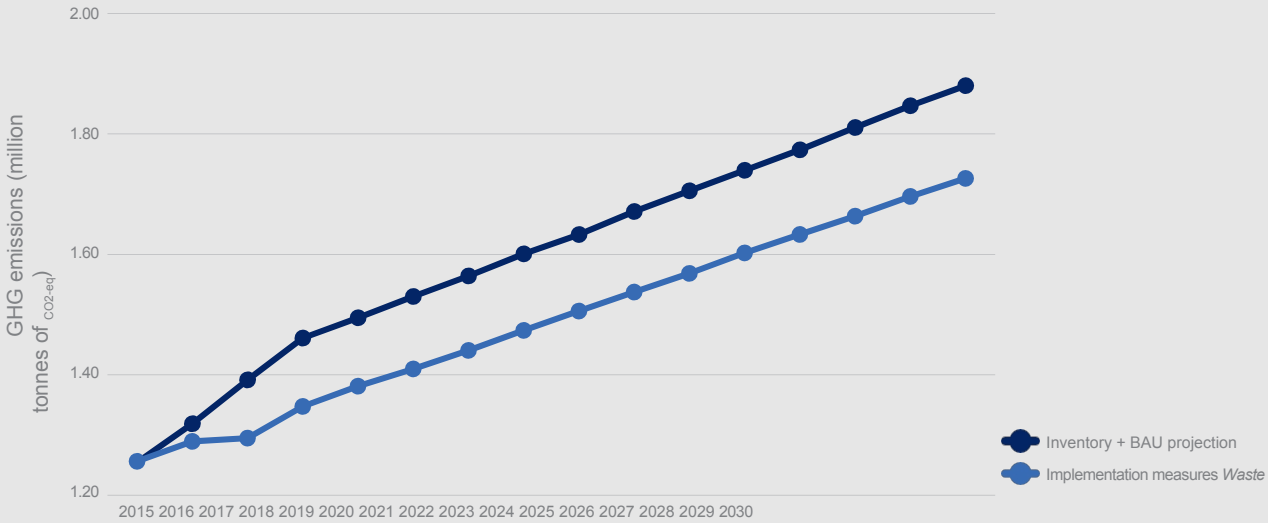
5.2.4 *Waste*

The Waste sector has the lowest impact on national GHG emissions. According to the 2018 inventory data, it contributed 2.3%. The most relevant category in terms of emissions is Solid Waste Disposal (59.7% of the sector), and is mainly derived from the decomposition of organic waste. The second category is Wastewater treatment and disposal (20.6 %). The third category, called Incineration and open burning of waste, accounts for 13.4 %. of the sector's emissions and, in the case of Guatemala, comes almost exclusively from open burning of household waste. Finally, biological treatment represents the
6.3 %, including GHG emissions released in the solid waste composting process (MARN et al., 2022).

For the Waste sector, two mitigation measures have been identified. With their implementation, a reduction in emissions from the sector of 0.15 million tonnes $_{CO2\text{-}eq}$ is expected by 2030. This corresponds to 2.[5%30] of the reductions projected with the updated NDC.

The mitigation measure directly related to emissions proposed for this sector is Methane Capture at the Zone 3 landfill and its use for electricity generation (RES-1). Its implementation started in 2016 and is expected to contribute with a cumulative reduction of 0.19 million tonnes of $_{CO2\text{-}eq}$ until 2030. Figure 10 shows the impact of emission reductions with the proposed measure with respect to the trend to 2030.

Figure 10 Expected annual emissions reduction impact of the Waste sector for the period 2015-2030, as measured in the updated NDC



Note: The BAU scenario projection for this sector, analysed with GHG inventory data (dark line) and the projected emissions with the implementation of the measure stipulated for this sector in the updated NDC (light line) are shown.

[30]Henríquez, W.A. 2021. Data analysis and processing, projections to 2050 and impact estimation. Technical assistance to support the methodological design and prioritisation of strategic goals of the NDC in the energy sector in Guatemala. Euroclima. Report Product 2.

5.3 Monitoring the mitigation component

In order to fulfil the responsibilities assumed under the Framework Under the Paris Agreement's Enhanced Transparency Framework, Guatemala has taken steps to periodically provide information on the progress of its mitigation actions set out in the NDC (UN, 2015, article 13). To this end, the country will monitor and report on progress in meeting the mitigation target through the SNIGT. In turn, as with the adaptation component (section 4.4), progress on the targets will be incorporated into the SNICC, where the country's climate change information and data will be available.

The SNIGT is in a consolidation phase. In a first exercise of this system, national GHG inventories were calculated and published in the Third National Communication on Climate Change of Guatemala (MARN et al., 2021). The inventories published in Guatemala's First Biennial Update Report will also be included shortly. It will soon operate through a virtual platform that will allow for the input of information for the updating of the inventories each year. This will facilitate the reporting of results at the end of the NDC implementation period, and so on with each update.

Depending on the nature of each proposed measure, specific monitoring systems will be in place, as in the case of the Agriculture and LULUCF sectors. Other sectors already have monitoring and reporting systems in place to ensure the collection of activity data, as in the case of Energy.

The lead institutions will be responsible for monitoring and reporting progress in the implementation of the measures in their sector. MARN will then compile the sectoral information for the national NDC report.

It should be noted that the process of developing the most recent national GHG inventories and updating the NDC has served to strengthen the capacities of the MARN and the sectoral lead institutions. As a consequence, coordination and information flow for the implementation, monitoring and reporting of the measures proposed in the NDC will be improved. In this sense, the CBIT project (section 4.4) will improve capacities and inputs for MRV, through its components 1, 2 and 5: 1) MRV system to improve the calculation of greenhouse gas inventories designed and implemented; 2) System to monitor the mitigation component of the NDC, designed and implemented; and 5) Integration of the MRV component in the Sectoral Technical Tables on climate change.

6. GAPS, PROCESS CHALLENGES AND RECOMMENDATIONS

During the process of updating Guatemala's NDC, some limitations and obstacles were encountered. The main gaps encountered are described below, as well as the challenges the country faces in the implementation of the NDC and recommendations derived from the lessons learned from the process.

6.1 Gaps

6.1.1 *Sources of information*

There are important gaps in official or published information that can serve as a reference for targets and indicators. This gap is particularly strong in terms of updated national statistical, financial or similar data.

6.1.2 *Governance in the Management sector integrated water resources management*

In general, there is room for improvement in climate change governance, but the governance gap in the Integrated Water Resources Management sector is particularly relevant. Addressing this issue is of vital importance considering that an adequate and participatory approach to water resources is essential for climate change adaptation. For example, it can help reduce risks from overflowing rivers, floods and landslides, as well as contribute to adaptation in other sectors, such as food security and economic development.

In this sense, in February 2021, the new Vice-Ministry of Water was established in the MARN (Governmental Agreement 18-2021), with which a first step was taken to improve governance in this sector, from an environmental perspective.

6.1.3 *Stakeholder participation*

The involvement of some key actors was limited for a number of reasons. This was mainly due to the limited time to update the targets and the obstacles presented by the COVID-19 pandemic. In addition, the normal delays of a national process such as locating information and data to define targets, the agenda of the lead institutions and the time to decide on which measures to include limited the time and opportunities to extend the participatory process to more actors.

6.1.4 *Systematised monitoring of climate actions*

Despite having planning instruments that directly address climate change such as the National Development Plan K'atun: Our Guatemala 2032 and the PANCC, as well as a climate change financial classifier, the country lacks the scaffolding for the inclusion of specific indicators that reflect results. Since the classifier has not been implemented, the inclusion of concrete results and indicators in institutional strategic and operational plans is limited.

Monitoring and reporting of climate action by non-governmental actors is necessary so that the government can evidence its contributions to the fulfilment of climate commitments. This is supported by Article 9 of Decree 7-2013 of the Congress of the Republic, so it is necessary to develop a legal mechanism to facilitate collaboration between non-governmental actors and the MARN.

6.1.5 *Financial resources*

There is a significant financial gap for the implementation of actions to reduce vulnerability and enable adaptation, as well as the implementation of mitigation measures needed to reduce emissions by the volume set out in the NDC target.

6.2 Challenges

One area for improvement is the timeframe for an NDC update. This process had been conceived in eight months (November 2020 to June 2021) and then extended to 12 months, which represented a considerable challenge. In turn, this process was carried out during the COVID-19 pandemic situation,

This limited the number of meetings and the scope for wider participation by all sectors that was initially planned. Therefore, it is necessary to consider at least 18 months to carry out this process.

Include adaptation or mitigation measures implemented by the private sector and social organisations outside the governmental sphere. This is mainly due to the lack of partnerships or agreements for monitoring these actions. On the other hand, it is necessary to guarantee the reporting of results with the methodological requirements of the NDC by non-governmental actors.

During the process, it was difficult to find information from official sources or scientific publications on the country's vulnerability situation, indicators to measure the results of the implementation of mitigation actions, data to relate the impacts of climate change and mitigation measures in economic terms or social parameters, information disaggregated by gender, among others. For many of these issues, information exists, but it is not up to date.

On the other hand, the most recent inventory data and the recalculation of the 1990-2018 time series worked on for the 1IBA were delayed. This situation meant that preliminary projections were made at the time of defining the mitigation targets and measures, which will have to be updated as soon as the final version is endorsed and made official. Therefore, the goals and measures could be defined in the final months of the project. The consequence of this situation was that the updating processes of the adaptation and mitigation targets had a different timing, which made it difficult to integrate them as synergistic targets. In addition, the time for socialisation with a broad group of stakeholders was limited.

One of the main challenges that the country needs to address to achieve results in complying with the NDC is to effectively integrate climate change into the systemic vision of state management. Although there are advances in the policy framework with the National Climate Change Policy (MARN, 2009a) and the Decree 7-2013 of the Congress of the Republic, the implementation of measures remains a challenge.

In terms of participation, it was difficult to identify and convene youth groups and women's organisations outside the central government. In this sense, it is important that MARN, as the lead agency on the issue, continues to identify stakeholders representing these groups of society, both at national and local level. It is also important that these groups are aware of and participate in these processes.

On the other hand, it is recognised that multiple efforts have been made through projects and initiatives, but the creation and strengthening of technical, financial and information management capacities remains an indispensable challenge to achieve for the collection and analysis of data to feed the SNICC and SNIGT. This has been a central challenge in the process of updating the NDC. For example, it was the case that different actors (sometimes from the same institution) handled different information and it was necessary to hold several meetings with the governing bodies to clarify which was the correct one. On the other hand, in many cases the information needed to formulate targets does not exist, is not in the format needed in terms of emissions, or does not relate to economic parameters. It is also important to increase government understanding of the scope and commitment associated with the NDC.

The development and implementation of monitoring systems is still a pending task. In the adaptation component, only two out of six prioritised sectors have a Monitoring, Evaluation and Reporting (MER) system (section 4.4). The country faces the challenge of developing these systems to promote the reporting of the four missing sectors. In mitigation, the SNIGT is currently in the consolidation phase to start operation. The aim is to update GHG inventories annually. However, there are no mechanisms in place to monitor mitigation measures. This challenge also includes the creation of mechanisms to facilitate quality control and information exchange between actors, as well as the technical and financial strengthening for the monitoring and reporting of targets.

6.3 Lessons learned and recommendations

The **governance** of such a process is of high importance and entails country commitments, starting with strong leadership. The process was led by the MARN, an entity that promoted collaborative work and cross-cutting involvement of several central government entities (MAGA, MEM, CONAP, INAB, INSIVUMEH, among others). This success is a lesson learned, as the joint work allowed for the development of clearer, more robust and transparent goals, strengthening the ambition of the country's commitment.

This shows the importance of **inter-institutional work**, which will be key to the successful implementation of the NDC. Therefore, it is necessary to strengthen governance and dialogue internally in each sector, and externally with the climate change governing body (MARN) or other relevant actors. This recommendation is particularly important in the case of the Integrated Water Resources Management sector, where there is no existing regulation.

The establishment of inter-agency agreements can help to streamline coordination and coordination between the various actors involved in this vital resource, and in the human health and infrastructure sectors, which have had little linkage with climate change. Establishing inter-institutional agreements can help streamline coordination.

Although the process could have been broader, the **participatory construction** of sectoral goals and their **articulation with national planning documents** allows for the efficient implementation of actions, guarantees support for them and their appropriation by the relevant actors. Strengthening the participation of society will make them state goals.

Clear and effective governance is a key condition for the achievement of goals, but not the only one. Equally important is **clear and concrete planning**, with clearly identified objectives, results, activities and outputs, with **responsible persons in charge and budget available**, as well as defined indicators for monitoring and reporting.

Specialised technical capacity with knowledge on climate change both in the technical field of competence of each sector and in relation to international agreements and commitments is of utmost importance to achieve a common understanding and to speed up the identification of targets and measures for each sector.

It will be of vital importance that **constant monitoring** is established **now**, if possible once a year or at least scheduled well in advance to evaluate results based on the targets set per sector, so that based on these results new targets can be set for the next update.

Regarding the **updating process** in general, a lesson learned is that it takes time and should be **scheduled with sufficient time**. This process entails different stages, among which the search, review and analysis of available information, confirmation of sources with governing bodies, as well as the participatory process, are time-consuming steps. It should be scheduled at least two years in advance.

On the other hand, based on the experience of this update, it is necessary to **establish a multidisciplinary team** from the outset. On the basis of general planning, it can be envisaged that certain specialists will be involved at specific times, while others will be needed throughout the process. This team should ideally consist of several specialists (Table 4).

Table 4 Suggested task force for the NDC update processes

Specialists	Remarks
Coordinator or manager;	
9 specialists, one for each priority sector:	This is advisable because of the technical specificity of each sector, but also because of the knowledge of the actors and close work with governing bodies. Other combinations of related sectors could also be made, although this is not ideal.
1. Forests (adaptation and mitigation)	
2. Energy	
3. Agriculture/livestock (adaptation and mitigation)	
4. Waste	
5. PIUP	
6. Integrated water resources management	
7. Marine-coastal zones	
8. Infrastructure	
9. Forests (adaptation and mitigation)	
GHG inventory data management specialist	Projection and quantification of contributions
Specialist in facilitating participatory processes and reaching agreements between actors.	
Environmental or natural resource economist, preferably with specialisation in economic development and/or international trade	
Editor	

Public finance represents only a fraction of the total investment needed to meet climate goals. Therefore, it is necessary that public finance is combined with **private and international finance**, and in this sense, that the MARN continues the dialogue initiated during this update process with the private sector for its involvement in the implementation, monitoring and reporting of measures that contribute to achieving the goals of this NDC.

Based on the above, an **increase in funding** available to all organisations working in the priority sectors will be necessary to achieve the proposed goals. In general, all governmental institutions consulted regretted a lack of funding for their climate change projects. Improving the available national funding is also important to implement **synergistic actions that bring benefits beyond the targets proposed in the updated NDC**, so as to improve people's standard of living and the quality of natural resources in general. In this way, it would contribute to the development that the country has committed to in the National Development Plan K'atun: Our Guatemala 2032. This can be achieved by working in an integrated manner with national climate change planning and institutional strategic and operational plans.

Complementary to the above, it is recommended that government institutions, non-governmental, community and other organisations take the opportunity to **link their plans, programmes and projects within the framework of some of the measures foreseen in the NDC in** order to access international funds and international cooperation programmes that support the achievement of the goals of the updated NDC. To this end, a **closer dialogue** is recommended **between institutions** (at the level of ministries and governing bodies) with associative bodies such as the MICCG, other indigenous representatives, local communities, women's groups and youth. Furthermore, it is recommended that government institutions **keep open the spaces for dialogue and collaboration with different actors**, created during the NDC update, in order to coordinate actions and potential funding that can be developed through civil society, academia, the private sector, cooperation, etc.

Because a long-term vision and goals allow for the planning of climate commitments and institutional plans, it is considered important for **Guatemala** to **develop a long-term vision to guide the country's actions on climate change**. Several countries in the region have initiated such efforts with carbon neutrality targets (Costa Rica by 2021 and Colombia and Chile by 2050). In the case of Guatemala, such a vision could focus on adaptation, which would perfectly complement the declaration of Guatemala as a vulnerable country by the CNCC (2021).

It is recommended that any similar process be based on **published scientific data**. Science-based decision-making is key to a robust and transparent climate change process.

Finally, it is important that MINFIN and SEGEPLAN continue to allocate funds to entities that formulate their plans, programmes and projects in accordance with Article 10 of Congressional Decree 7-2013.

7. BIBLIOGRAPHIC AL REFERENCES

World Bank, MARN, & IUCN (2020). *Prioritisation of adaptation measures to support NDC implementation in Guatemala.*

ClimateWatch (n/d). *Data explorer.* Retrieved on December 3, 2021, from https://www.climatewatchdata.org/data-explorer/historical-emissions?historical-emissions-data-sources=All Selected&historical-emissions-end_year=2016&historical-emissions-gases=&historical-emissions-regions=All Selected&historical-emissions-sectors=&historical-emissions-start_year=1990&page=1

UNFCCC (n/d). *Nationally Determined Contributions (NDCs).* Topics. Retrieved October 1, 2020, from https://unfccc.int/es/process-and-meetings/the-paris-agreement/the- paris-agreement/nationally-determined-contributions-nationally-determined-contributions-ncdc.

CNCC (2016). *National Climate Change Action Plan.* http://sgccc.org.gt/wp-content/uploads/2016/10/Plan-de-Acción-Nacional-de-Cambio-Climático-ver-oct-2016-aprobado-1. pdf.

CNCC (2018). *National Climate Change Action Plan, second edition.* https://www4.unfccc.int/sites/NAPC/Documents/Parties/Guatemala NAP small.pdf.

CNCC (2021). *Ordinary meeting of the National Council on Climate Change, representatives of member institutions. Declaration.*

CONADUR (2014). *Plan nacional de desarrollo K'atun: nuestra Guatemala 2032.*

CONAP. (2020). *National Biodiversity Information System of Guatemala.* https://snib.conap.gob.gt/

Political Constitution of the Republic of Guatemala. Reformed by Legislative Agreement 18-93, (1993).

Framework Law to Regulate Vulnerability Reduction, Mandatory Adaptation to the Effects of Climate Change and Greenhouse Gas Mitigation. Decree 7-2013, (2013).

CONRED. (2020). *Memoria de labores.*

Approves the Paris Agreement, made in Paris on 12 December 2015, (2016).

Derlagen, C., Muñoz, G., & de Salvo, C. P. (2020). *Análisis de políticas agropecuarias de Guatemala. Inter-American Development Bank.* https://publications.iadb.org/publications/spanish/document/Analisis-de-politicas-agropecuarias-en-Guatemala.pdf

Eckstein, D., Künzel, V., & Schäfer, L. (2021). Global climate risk index 2021. *Who suffers most from extreme weather events? Who suffers most from extreme weather events? Whather-related loss events in 2019 and 2000-2019.* https:// germanwatch.org/sites/default/files/Global Climate Risk Index 2021_2.pdf

FAO, & IDFAC. (2021). *Indigenous and tribal peoples and forest governance. An opportunity for climate action in Latin America and the Caribbean.* FAO. https://doi. org/10.4060/cb2953en

GCI (2018a). *Estrategia Nacional para el Abordaje de la Deforestación y Degradación de los Bosques en Guatemala.*

GCI (2018b). *Readiness package for REDD+ in Guatemala.* https://www.forestcarbonpartnership.org/system/files/documents/GUATEMALA_R-Package_v.1finalrev_13feb18_ENG.pdf

GCI (2020). *Estrategia Nacional REDD+ Guatemala (2020-2050)(ENREDD+).*

GIMBUT (2019). *Mesh of sampling points for the elaboration of the Reference Levels for the elaboration of the National Emission Reduction and Removal Programme of Guatemala.*

GIMBUT (2022). *Report of fire scars for the years 2011, 2012, 2013, 2014, 2015, 2016 and uncertainties and estimation of CO2-eq emissions by degradation during the period 2006 to 2016 for the Republic of Guatemala.*

Girardin, C. A. J., Jenkins, S., & Seddon, N. (2021). *Nature-based solutions can help cool the planet - if we act now. Nature, 593*, 191-194. https://doi.org/10.1038/d41586-021-01241-2

GIZ. (2017). *Biennial update report template according to the UNFCCC guidelines for biennial update reporting by Parties not included in Annex I to the Convention (version 2.0).*

Government of the Republic of Guatemala (n/d). *Gran Cruzada Nacional por la Nutrición.*

Governmental Agreement 236-2006, (2006).

Government of the Republic of Guatemala (2015). *Expected and determined contribution at the national level. Ministry of Environment and Natural Resources.*

Government of the Republic of Guatemala (2018a). *Estrategia Nacional de Desarrollo con Bajas Emisiones de Gases de Efecto Invernadero. USAID Development with Bajas Emissions.*

Government of the Republic of Guatemala (2018b). *Estrategia Nacional de Ganadería Bovina Sostenible con Bajas Emisiones.*

Governmental Agreement 19-2021, (2021).

Governmental Agreement 73-2021, (2021).

Government of the Republic of Guatemala (2021). *Guatemala: vulnerable to climate change, contributes to compliance with the Paris Agreement. Country position.*

Henríquez, W. A. (2021). *Output 3 - Proposed Nationally Determined Contribution for Guatemala's energy sector.*

Herr, D., & Landis, E. (2016). *Coastal blue carbon ecosystems. Oppprotunities for Nationally Determined Contributions. Policy brief. In Conservation International*. https://portals.iucn.org/library/node/48422.

INAB. (2017). *Map of forest lands for water catchment, regulation and recharge.*

INE. (2019). *XII National Population Census and VII Housing Census. Main results.* https://www.censopoblacion.gt/documentacion.

National Human Development Report (n/d). *Human development index*. Retrieved 12 of December 2021, from http://desarrollohumano.org.gt/desarrollo-humano/calculo-de-idh/

INSIVUMEH (undated). *Agroclimatic Technical Tables.* Agro-climatic roundtables. Recovered on 12 of February 2021, from https://insivumeh.gob.gt/mesas-agroclimaticas/

IPCC (2021). *Climate change is widespread, rapid and intensifying. Press Release 2021/17/PR.* https://www.ipcc.ch/site/assets/uploads/2021/08/IPCC_WGI-AR6-Press- Release-Final_en.pdf

MAGA, FAO, & UNDP (2019). *Elaboration of the baseline of the Monitoring, Evaluation and Reporting (MER) System of the Agriculture and food security sector oriented to the National Action Plan on Climate Change (PANCC).*

Mapplecroft (2014). *Index of vulnerability to climate change in the Latin American and Caribbean region.* Andean Trade Corporation.

MARN (2009a). *National Climate Change Policy.*

MARN (2009b). *Política para el Manejo Integral de las Zonas Marino-Costeras de Guatemala. Governmental Agreement 328-2009.*

MARN (2015). *Environmental Gender Policy.* https://www.marn.gob.gt/multimedios/2821.pdf

MARN. (2018a). *Propuesta de manual de inclusión de consideraciones de género en*

actividades.
of the preparatory process and in the project cycle of the Green Climate Fund.

MARN (2018b). *Sustainable and low carbon bovine livestock development.* NAMA Facility. https://www4.unfccc.int/sites/PublicNAMA/_layouts/UN/FCCC/NAMA/Download.aspx?ListName=NAMA&Id=202&FileName=Outline template_5th Call_Guatemala Livestock NAMA.vf.pdf

Ministerial Agreement 154-2019, (2019).

MARN (2019). *Analysis of climate finance in Guatemala.*

MARN (2020). *Strategy for Mainstreaming Gender Considerations in Climate Change in Support of the Nationally Determined Contribution (NDC). Ministerial Agreement 11-2020.*

MARN, Rainforest Alliance, NDC Partnership, GIZ, AECID, Federal Ministry of Economic Cooperation and Development of Germany, & UNDP (2020). *Design and development of the Monitoring, Evaluation and Reporting System (MER) for marine-coastal zones for the climate change adaptation component of the SNICC, with the establishment of the baseline and its indicators in areas of biological importance.* https://www.adaptation-undp.org/sites/default/files/resources/1_diseno_del_sistema_mer_zmc.pdf

MARN, & Segeplán (2021). *Informe de pérdidas y daños por efectos del cambio climático en Guatemala.*

NAFC, SGCCC, & UNDP (2021). *Third national communication on climate change in Guatemala.* Editorial Universitaria UVG. https://www.marn.gob.gt/paginas/Direccin_de_Climate_Climate_Change.

NAIROBI, SGCCC, & UNDP (2022). *First biennial update report for Guatemala. Editorial UVG.*

McField, M., Kramer, P., Giró Petersen, A., Soto, M., Drysale, I., Craig, N., & Rueda Flores, M. (2020). *Mesoamerican Reef report card.* https://www.healthyreefs.org/cms/wp-content/uploads/2020/02/SmithReefs_RC19_Pages_BIL_f_E_LO.pdf

Myers, N. (1988). Threatened biotas: Hot spots in tropical forests. *The Environmentalist, 8, 1-2.*

ILO (2018). *Transition ¡usta ¡on to environmentally sustainable economies and societies for all. ILO-ACTRAV Policy Brief.*

Öko-Institut e.V., & GIZ. (2018). *Accounting for Nationally Determined Contributions. Guidance for setting up an accounting with absolute mitigation targets or relative to a baseline.* https://www.international-climate-initiative.com/fileadmin/Dokumente/2018/181004_NDC_Accounting_Rules_EN.pdf

Oldén, A., Peura, M., Saine, S., Kotiaho, J. S., & Halme, P. (2019). The effect of buffer strip width and selective logging on riparian forest microclimate. *Forest, Ecology and Management, 453.*

UN. (1982). *United Nations Convention on the Law of the Sea.*

UN. (2015). *Paris Agreement.*

UNDP (2018a). *Climate finance in Guatemala: describing the process and costing of the National Climate Change Action Plan and estimating the financing gap.* United Nations Development Programme.

UNDP (2018b). *Climate finance in Guatemala: public spending on climate change.*

Seddon, N., Chausson, A., & Berry, P. (2020). Understanding the value and limits of nature-based solutions to climate change and other global challenges. *Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences, 375.* http://doi.org/10.1098/rstb.2019.0120

Segeplan (2018). *Guatemala's National Development Priorities.* https://www.pnd.gt/

Segeplán (2019). *Statistical annex, voluntary national review 2019. The road to sustainable development.* https://www.pnd.gt/PDF/ANEXO_ESTADISTICO_RNV_2019.pdf

SESAN. (2006). *Política Nacional de Seguridad Alimentaria y Nutricional, Ley del Sistema Nacional de Seguridad Alimentaria y Nutricional y su reglamento.* http://www.sesan.gob.gt/wordpress/ wp-content/uploads/2019/02/Politica-Ley-y-Reglamento-SAN.pdf

SIFGUA (2021). *Forest cover.* https://www.sifgua.org.gt/SIFGUAData/PaginasEstadisticas/Recursos-forestales/Cobertura.aspx

UNDP (2020). *The next frontier: Human Development and the Anthropocene. In Human Development Report 2020.* United Nations Development Programme. http://hdr.undp.org/en/2020-report.

UNFCCC (2018). *A new era for global climate action under the Paris Agreement.* UN climate change communiqué. https://unfccc.int/es/news/se-abre-una-nueva-era- for-global-climate-action-under-the-paris-agreement.

European Union (2020). *Involving the private sector in NDC formulation and implementation processes: A good practice guide.* EUROCLIMA+ Programme, Directorate-General for Development and Cooperation - EuropeAid, European Commission.

Williamson Cuthbert, M., Williams Smith, D., Arróliga, O., Mendoza, J., Torres, N., & Flores, O. (2019). Reef health index (RHI) in the coral reefs of Miskito Cays. *Revista Universitaria del Caribe*, 22(1), 16-23. https://doi.org/10.5377/ruc.v22i1.8414

WRI, & UNDP (2020). *Mejorating NDCs: A guide to strengthening national climate plans by 2020.*

Yirigui, Y., Lee, S.-W., Nejadhashemi, A., Herman, M., & Lee, J.-W. (2019). Relationships between riparian forest Fragmentation and biological indicators of streams. *Sustainability, 11(*10), 2870. https://doi.org/10.3390/su11102870. https://doi.org/10.3390/su11102870

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