REPUBLIC OF SURINAME

Third National Communication to the United Nations Framework Convention on Climate Change

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Ministerie van Ruimtelijke Ordening en Milieu

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Republic of Suriname

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Ministerie van
Ruimtelijke Ordening
en Milieu

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Foreword

The Republic of Suriname has ratified the United Nations Framework Convention on Climate Change (UNFCCC), the Kyoto Protocol and the Paris Agreement, respectively in 1997, 2006 and 2019. In accordance with article 4 paragraph 1 and article 12 paragraph 1 of the UNFCCC, Suriname has already submitted its first (2005) and second national communication (2016) and is very honored to have finalized its third. Suriname is mindful of climate change, especially its impact on the socio-economic development of the country.

The country is listed as one of the top ten countries that are most vulnerable to the effects of climate change, due to its low-lying coast. Based on the aforementioned, the Government of Suriname has to increase its focus on adaptation measures. The National Adaptation Plan (2019 – 2029) builds on the climate strategy that is emphasized in the National Climate Change Policy Strategy Action Plan (2014 – 2021), with its focus mainly on integration and mainstreaming of adaptive measures into policies and development planning. Even in this communication to the UNFCCC (NC3), adaptation is affirmed to be a main priority of the country's efforts to minimize the adverse effects of climate change.

Nevertheless, Suriname has been classified as a High Forest Low Deforestation (HFLD) country, with a forest cover of approximately 93%. According to the World Bank, Suriname has been classified as the country with the highest forest cover in the world. The forests of Suriname, which are also biodiversity hotspots, are part of the last pristine tropical forests in the world. The HFLD status fully demonstrates the contribution of Suriname to climate change mitigation–prior to the existence of Climate Change treaties. Crucial to state that Suriname is committed to remain a HLFD country, which was clearly demonstrated in February 2019 when Suriname hosted the High Forest Low Deforestation Conference for HFLD developing countries. This Conference resulted in the "Krutu of Paramaribo" Joint Declaration on HFLD Climate Finance Mobilization, which aims at increasing the access to Finance for HFLD countries like Suriname.

Suriname is the second country in the world to have submitted its Second Nationally determined contribution in December 2019. This contribution emphasizes the county's commitments expressed during COP-23 in 2017 in Bonn and presented its view to maintain its status as a HFLD country and to cap its forest cover of 93% with the condition to receive technical and financial support from the international community.

With the Third National Communication, Suriname builds on the groundwork cemented in the previous National Communications and existing national climate change policies and plans, such as the National Adaptation Plan, The REDD+ Strategy, and the Nationally Appropriate Mitigation Action, of which the latter refers to the off-grid Renewable Energy Solutions in Rural Suriname, the Second Nationally Determined Contribution and the State of the Climate Report.

For Suriname, the compilation of the NC3 is a vital step towards the further implementation of the requirements of the Convention and our country's voluntary effort to address climate change. Based on the presented information, the Government of Suriname is committed to institutionalize the climate change reporting system in Suriname, considering the Enhanced Transparency Framework as an important tool under the Paris Agreement, as well as to improve the implementation of measures in order to adapt to and mitigate the effects of climate change.

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Chapter 6
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Abbreviations and Acronyms

a.k.a	As known as
ABS	General Bureau of Statistics (Algemeen Bureau voor de Statistiek)
ACT	Amazon Conservation Team
AdeKUS	Anton de Kom University of Suriname
AFOLU	Agriculture, Forestry, and Other Land Use
ATM	Ministry of Labour, Technological Development and Environment
BOG	Bureau of Public Health Service (Bureau Openbare Gezondheidszorg)
BTR	Biennial Transparency Report
BUR	Biennial Update Report
CANARI	Caribbean Natural Resources Institute
CBvS	Central Bank of Suriname
CCCCC	Caribbean Community Climate Change Centre
CCD	Climate Compatible Development
CDM	Clean Development Mechanism
CEDAW	Convention on Elimination of all Forms of Discrimination Against Women
CELOS	Center for Agricultural Research in Suriname (Centrum voor Landbouwkundig Onderzoek in Suriname)
CDM	Clean Development Mechanism
CH_4	Methane
CMA	Conference of the Parties serving as the meeting of the Parties to the Paris Agreement
CMIP	Coupled Model Intercomparison Project
CMP	Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol
CP.8	Chapter 8
CLA	Coordinating Lead Author
CO	Carbon monoxide
CO_2	Carbon dioxide

CO_2eq	Carbon dioxide equivalent
COP	Conference of the Parties
COVID-19	Coronavirus disease of 2019
CSO	Civil Society Organization
DBK	Soil Survey Service *(Dienst Bodemkartering)*
DEV	Electification Service *(Dienst Electriciteitsvoorziening)*
DRR	Disaster Risk Reduction
DWV	Water Supply Service *(Dienst Water Voorziening)*
EAS	Energie Autoriteit Suriname
EBS	Energy Company Suriname *(Energy Bedrijven Suriname)*
ECLAC	United Nations Economic Commission for Latin America and the Caribbean
EEZ	Exclusive Economic Zone
EF	Emission factor
EITI	Extractives Industries Transparency Initiative
ENSO	The El Niño southern oscillation
EPAR	Energy Supply Paramaribo *(Energievoorziening Paramaribo)*
ESD	Education for Sustainable Development
ESIA	Environmental and Social Impact Assessment
ESMF	Environmental and Social Management Framework
ESS	Environmental Services & Support NV (consultant)
EST	Environmental Sound Technologies
EU	European Union
EV	Electric Vehicles
EVSE	Electric Vehicle Supply Equipment
EWS	Early Warning System
FAO	Food and Agricultural Organization
FOLU	Forestry and Other Land Use
FNC	Initial National Communication to the UNFCCC
FPIC	Free Prior Informed Consent
FREL	Forest reference emission level
GBB	Ministry of Land Policy and Forest Management *(Ministerie van Grondbeleid en Bosbeheer)*

GCCA	Global Climate Change Alliance
GCF	Green Climate Fund
GDP	Gross domestic product
GEF	Global Environment Facility
GHG	Greenhouse gas
GHGI	Greenhouse gas inventory
GIS	Geographical Information System
GLIS	Institute for management of Land registration and Land information systems *(Instituut beheer van Grondregistratie en Land Informatie systemen)*
GLO	Primary School *(Gewoon Lager Onderwijs)*
GMD	Geological and Mining Service *(Geologische en Mijnbouwkundige Dienst)*
GOS	Government of Suriname
HFLD	High Forest, Low Deforestation
ICZM	Integrated Coastal Zone Management
IDB/IADB	Inter-American Development Bank
IMF	International Monetary Fund
IPCC	Inter-governmental Panel on Climate Change
IPPU	Industrial Processes and Product Use
ITCZ	Intertropical convergence zone
ITP	Indigenous and Tribal Peoples
IWRM	Integrated Water Resources Management
JP	Joint Programme
LCDO	Local Content Development Office
LULC	Land use land cover
LVV	Ministry of Agriculture, Animal Husbandry and Fisheries *(Ministerie van Landbouw, Veeteelt en Visserij)*
MAFOSUR	Mangrove Forum Suriname
MAS	Maritime Authority Suriname
MDS	Meteorological Service Suriname *(Meteorologische Dienst Suriname)*
MEAs	Multilateral Environmental Agreements

MERSD	Master of Science Course Education and Research for Sustainable Development
MINOWC	Ministry of Education, Science and Culture *(Ministerie van Onderwijs, Wetenschap en Cultuur)*
MOGP	Masterplan Urban Drainage Greater Paramaribo *(Masterplan Ontwatering Groot Paramaribo)*
MOU	Memorandum of understanding
MRV	Monitoring Reporting Verification
MSL	Mean sea level
MULO	Lower secundary general education (*Meer Uitgebreid Lager Onderwijs)*
MUMA	Multiple use management area
MZ	Medische Zending
NAMA	Nationally appropriate mitigation action
NAP	National adaptation plan
NC	National Communication
NC1	First National Communication
NC2	Second National Communication
NC3	Third National Communication
NCAP I/II	Netherlands Climate Assistance Program, Phase I/II
NCCPSAP	National climate change policy, strategy, and action plan
NCCR	National Coordination Center for Disaster Management *(Nationaal Coördinatie Centrum voor Rampenbeheersing)*
NDA	National Designated Authority
NDC	Nationally Determined Contribution
NEA	National Executing Agency
NFMS	National Forest Monitoring System
NGO	Non-governmental organization
NH	Ministry of Natural Resources (*Ministerie van Natuurlijke hulpbronnen)*
NIMOS	National Institute for Environment and Development in Suriname *(Nationaal Instituut voor Milieu & Ontwikkeling in Suriname)*

NMA	National Environment Authority *(Nationale Milieu Autoriteit)*
NMS	National mangrove strategy
NMVOC	Non-methane volatile organic compounds
N_2O	Nitrous oxide
NO_x	Nitric oxide (NO) or Nitrogen dioxide
NP	Nature Park
NPC	National Project Coordinator
NR	Nature reserve
NSP	National datum *(Normaal Surinaamse Peil)*
NTFP	Non-timber Forest Products
OAS	Organization of American States
OECD	Organisation for Economic Co-operation and Development
OP	National Development Plan *(Nationaal Ontwikkelingsplan)*
OW	Ministry of Public Works *(Ministerie van Openbare Werken)*
OW/MCP	Overlying Waterboard Multi-Purpose Corantijn Canal
PA	Paris Agreement
PAHO	Pan American Health Organization
para.	paragraph
PC	Project Coordinator
PIP	Project Implementation Plan
PMT	Project Management Team
PSC	Project Steering Committee
QA	Quality assurance
QC	Quality control
RCM	Regional Climate Models
RCP	Representative Concentration Pathways
REDD+	Reducing emissions from deforestation and forest degradation and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries
RGD	Regional Health Services *(Regionale Gezondheidsdienst)*
ROM	Ministry of Spatial Planning and Environment *(Ministerie van Ruimtelijke Ordening en Milieu)*

ROS	Ministry of Regional Development and Sport *(Ministerie van Regionale Ontwikkeling en Sport)*
SBB	Foundation for Forest Management and Production Control *(Stichting Bosbeheer en Bostoezicht)*
SCF	Suriname Conservation Foundation
SDGs	Sustainable Development Goals
SFISS	Sustainable Forestry Information System Suriname
SGP	Small Grants Programme
SIDS	Small Island Developing States
SMNR	Master of Science study in Sustainable Management of Natural Resources
SLR	Sea Level Rise
SOC	State of the Climate report
SO_x	Sulphur Oxides
SPCS	Staatsolie Power Company Suriname
SPS	National Planning Office *(Stichting Planbureau Suriname)*
SRD	Surinamese Dollar
SRES	Special Report in Emission Scenarios
SRI	Stanford Research Institute
SSP	Shared Socioeconomic Paths
SWM	Suriname Water Company *(Surinaamsche Waterleiding Maatschappij)*
SWOT	Strength, Weakness, Opportunity, and Threat
SWRIS	Suriname Water Resources Information System
TCT	Ministry of Transport, Communication and Tourism *(Ministerie van Transport, Communicatie en Toerisme)*
TEG	Technical Expert Group
TNA	Technology Needs Assessment
Toe	Tonne of oil equivalent
UN	United Nations
UNCBD	United Nations Convention on Biological Diversity
UNCCD	United Nations Convention to Combat Climate Change
UNDP	United Nations Development Program

UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFCCC	United Nations Framework Convention on Climate Change
USD	United States Dollar
VAT	Value added tax
VOJ	Lower secondary education *(Voortgezet Onderwijs voor Junioren)*
VOS	Upper secondary education *(Voortgezet Onderwijs voor Senioren)*
vs	versus
WWF	World Wildlife Organization
WFS	Water Forum Suriname
WLA	Hydraulic Research Division *(Waterloopkundige Dienst)*

Executive summary

National Circumstances and Institutional Arrangements

The Republic of Suriname is a country in north-eastern part of South America that borders the Federative Republic of Brazil in the South, the Cooperative Republic of Guyana in the West, French Guiana in the East, and the Atlantic Ocean in the North. With its 163,820 km^2 land area, it is currently home to 598,000 inhabitants, the majority of whom live in the low-lying coastal region. The coastal zone of Suriname is part of the North Brazil Shelf Big Marine Ecosystem, which is productive due to the Amazon River plume. Mud banks can grow up to 20 to 35 km long, which can develop interbank zones as a result of the continuous movement and deposition of mud along Suriname's coastline; although not all mud banks erode at the same rate, erosion has been seen in two locations: near Totness and Weg naar Zee.

In 2013, Suriname's economy experienced a significant fiscal and external current account deficit, as well as an economic recession as a result of the country's reliance on the mining industry. Therefore, the Government of Suriname consulted the IMF for financial support, with the aim to re-establish macro-economic stability and trust. The Suriname recovery plan *(Herstelplan)* calls for the gradual cessation of electricity subsidies, wage restraint, fuel taxes, the implementation of VAT, and the development of effective non-mineral revenue sources.

Suriname was confronted with a second economic crisis in 2020 as a result of unfavourable external factors such as fluctuating commodity prices for gold and oil and COVID-19 containment efforts. The debts rose to elevated levels, and the budgetary situation remained difficult as a result of spending constraints. It is noteworthy to state that between 2017 and 2019, there was an increase in economic growth of 1.9% on average, which was fuelled by rising commodity prices and gold production.

The Constitution of Suriname entered into force in 1987 and provides a legal basis for sustainable environmental policy. There have been developments in terms of legislation, national plans and strategies, policies, and action programs to address climate change issues and UNFCCC commitments. The Environmental Framework Act, which came into effect on May 7, 2020, establishes measures for the protection and sustainable management of the environment and includes regulations and procedures for the implementation of Multilateral Environmental Agreements (MEAs).

Prior to the Parliamentary Election in May 2020, environmental management in Suriname was the core responsibility of the Coordination Environment Office within the Presidency and the National Institute for Development and Environment in Suriname (NIMOS).

Subsequently, the Environmental Framework Act S.B. 2020 no. 97 was enacted and established the National Environment Authority (NMA) as an independent administrative agency with legal personality. The Ministry of Spatial Planning and Environment (ROM) of the Republic of Suriname was established by Presidential proclamation beginning on September 9, 2020, following the Parliamentary Election. The Directorate for the Environment (DE), which falls under the competence of the Ministry of Spatial Planning and Environment, is currently the entity in charge of environmental management. Furthermore, this Directorate plays a crucial role in the creation and monitoring of environmental policy and functions as the focal point for all the secretariats of MEAs as well as national, regional, and international environmental organizations.

The Suriname Environmental Information Network (SMIN) was established in 2016 with the goal of producing official and formal environmental data and information for national policy and planning, creating a standardized reporting process, and disseminating knowledge and recommendations.

In connection to the above-mentioned, reference is made to natural disasters in Suriname that have occurred in the period 2015-2017 and have caused grave destruction to roofs, electricity distribution networks, urban vegetation, and other structures, resulting in the death of one person and left five people badly injured. Moreover, climate-related disasters are expected to rise, due to increased frequency and intensity of extreme weather events.

Measures to Facilitate Adaptation to Climate Change

Suriname is a low-lying coastal state prone to natural disasters and climate change. According to estimates, a 1-meter rise in sea level would have an impact on 5.6% of Suriname's agricultural area, 6.4% of its GDP, and 7% of its population. Moreover, Indigenous and Maroon communities are at risk, considering the economic situation and location in remote areas where extreme droughts and floods have been recorded in the past. The assessments can be viewed as performing a gap analysis, in which the information on vulnerability and adaptation for the sectors contained in the Second National Communication (NC2) is updated using the National Adaptation Plan (NAP) and the State of the Climate Report (SOC) as guidelines in the Third National Communication (NC3). Vulnerability assessment, including impact assessment and climate scenarios, have been conducted, leading to some proposed associated adaptation measures for the following sectors: energy, water resources, agriculture, cross-cutting (including biodiversity and forestry).

The baseline climate conditions for Suriname include precipitation, temperature, and wind. Rainfall is highest in the centre of the country and lowest in the north-western part. Average annual temperatures range between 24.0 and 30.9 °C, and the range in average temperatures between the warmest and the coldest months is 2.4 °C. Winds are light, with annual averages of 1.3-1.6 on the scale of Beaufort. Extreme weather conditions often occur, related to El Niño and La Niña events, and there may be a connection noticeable between extremely dry conditions and strong El Niño events.

Climate projections show a sea-level rise of 1-meter, 10% decrease in rainfall, temperature increase, humidity decrease, and possible changes in wind speeds. A vulnerability and impact assessments were conducted for the sectors energy, water resources and agriculture, together with the cross-cutting sectors (education, health, disaster risk management, spatial planning, and environment). Based on these assessments, adaptation measures were proposed.

Some conclusions derived from the aforementioned assessments are as follow:

- Events caused by climate change are increasing, and lack of appropriate action to address the human factors that causes them, could become alarming;
- The sectors agriculture, health, education and environment are vulnerable to the adverse effects of climate change. These sectors are experiencing increased impact in several parts of Suriname;
- The coastline of Suriname, the production of cash crops, food security, urban migration, the livelihoods of farmers, and the energy system are all expected to experience unimaginable changes as a result of climate change.

National Greenhouse Gas Inventory

Suriname's contribution to global GHG emissions, the driving force for climate change, is miniscule and the country acts as a net sink when absorptions from the sector Forestry and Other Land Use (FOLU) are considered.

The First National Communication (NC1) submitted in 2005 included a GHG inventory with base year 2003. In 2016 the Second National Communication (NC2) was submitted with a GHG inventory with base year 2008. The GHG inventory for the Third National Communication (NC3) refers to the period 2000 up to 2017 and uses 2008 as its base year. It should be accentuated that this inventory has additional categories, particularly for waste and agriculture, forestry, and other land use (AFOLU) sectors, and thus far the same base year (2008) was chosen.

Carbon dioxide accounts for the greatest percentage of emitted GHGs in Suriname. Between 2000-2017, Suriname's total aggregated GHG emissions (excluding removals) increased at an average rate of 2% per year from 2,756.5 Gg CO_2eq in 2000 to 3,591.5 Gg CO_2eq in 2017. The primary emitter of GHGs from 2000-2017, has been the energy sector, which has gradually increased. The next largest emitter is the AFOLU sector, which has modestly increased throughout the entire period. With a forest coverage of 93%, Suriname is one of the most forested countries and has the potential to be a significant sink. As a result, the country has a net negative carbon footprint when considering both GHG emissions and removals. Suriname contributed a total of 3,591.5 Gg CO_2eq of GHGs to the atmosphere in the year 2017.

Measures to Mitigate Climate Change

Based on the GHG inventory, the NC3 is to provide information on national programs containing measures to mitigate GHG emissions by addressing anthropogenic emissions by sources and removals by sinks. The GHG mitigation assessment is providing an analysis of various technologies and practices that have the capacity to affect energy supply, agriculture, forestry, and transport resulting in GHG reductions. The aim of this mitigation assessment is to inform policy selection and design by comparing policy options based on their expected GHG effects.

In line with the GHG inventory, the base year is set at the year 2008. The assessment has been carried out with reference to the Business as Usual (BAU) projections from 2008-2030 focusing on historical development trends for each identified sector. This mitigation assessment included a minimum of two type scenarios for each sector.

Suriname has had a fiscal deficit and a high level of public debt for the past ten years, which has constrained its ability for investments in reducing climate change, boosting resilience, and enhancing national capacity to deal with its effects. Nonetheless, the nation remains dedicated to achieve climate-friendly growth, concentrating on mitigation measures primarily in the area of forest management and renewable energy.

The top polluters in the energy sector are the transportation, industry, and electricity generating sectors. The proposed mitigation measures in the Energy sector include 10% PV, promoting energy efficiency and energy conservation, and improving road conditions and public transport to reduce GHG emissions by 6.23 Gg CO2eq (2018-2030).

Results of the GHG inventory 2000-2017 show that for the base year 2008, rice cultivation, direct emissions from managed soils and enteric fermentation have the biggest share in the total CO_2eq. Improved cultivation practices and water management are being proposed as mitigation measures. The mitigation potential is 184.40 GgCO2eq in 2030, equivalent to 33.23% of the BAU value.
The GHG inventory has been prepared for the period 2000-2017, with the AFOLU sector acting as a net sink throughout that whole period. Settlements (2,059 Gg CO_2eq), Wetlands (54 Gg CO_2eq) and other land (49 Gg CO_2eq) together accounted for 12.07% of the absolute values of emissions/ removals, while Forest land (15,057 Gg CO_2eq), Grassland (687 Gg CO_2eq) and Cropland (5 Gg CO_2eq) functioned as a net sink and accounted together for 87.93%. The category Forest

Land could be characterized as the biggest removal, and the category Settlements as the biggest emitter.

With a total of 2,392.7 Gg CO_2eq in the forest sector, Climate Smart Forestry (CSF) has the greatest potential to reduce emissions. Reduced exports of roundwood and increased sales of items made from processed roundwood may result in an initial drop in emissions. Given that all regulatory mechanisms will be in place and institutions will have been reinforced in the first two years of executing this mitigation step, improved management in protected areas can result in zero deforestation.

Other Information Considered Relevant for the Convention

The following sub-topics have been researched under this component, namely: necessary steps taken to integrate climate change into national policies and priorities; development and transfer of environmentally sound technologies (ESTs); climate change systematic observation and research on effective responses; education, training, and public awareness; capacity building on climate change; information exchange and networking; and gender and climate change.

Some steps have been taken to integrate climate change into national policies and priorities since NC2. One of the important steps is the development of the Nationally Determined Contribution (NDC), a climate action plan to cut emissions and adapt to climate impacts, enhanced the contributions from four of the six emitting sectors, identified in the most recent GHG Inventory: forests, electricity, agriculture, and transport. These four sectors taken together, cover an estimated 70% of GHG emissions. The proposed road map on climate change integrated in policies starting from the 2nd NDC till the 4th NDC (2016-2030) underscores which goals should be realized, how and when.

Suriname participates in several international climate change initiatives and in organizations which aim to enhance knowledge on climate change and ~~to~~ act on climate change issues. There are main academic and research institutions involved in: scientific research in climate change, and some national institutions who also carry out (research) activities and projects related to climate change. The inventory list, made up of climate change related programs and projects within the period of 5-7 years,–portrays the concerns expressed and actions that are being taken on the impact of climate change on diverse levels.

The transfer of technology including know-how, goods and services, equipment, as well as organizational and managerial procedures, is a challenge for the global climate change. The private sector can play an important role in direct technology transfer. In order to evaluate the current status about EST knowledge, use and transfer amongst Surinamese companies, desk research and a survey under a list of pre- identified companies in Suriname was carried out. From the obtained information, the following is concluded:

(i) Limited availability of human resources, lack of facilitation by the Government, lack of institutional support on waste management practices and limited transfer of knowledge on EST, (ii) the technology EST has still to take off in Suriname. Currently the focus on technology transfer is more related to the energy sector.

On the aspect of increasing awareness and improving capacity building, an inventory was produced consisting of all available awareness products in Suriname. Based on this listing, a strategy is drafted, with the main purpose to continue enhancing the awareness on the issue of climate change. It has been recognized and initiated by the relevant stakeholders to implement a multidimensional approach, one that also involves and supports the private sector, civil society, and the public sector. Therefore, the emphasis should be placed on human resources and capacity building, education, and awareness on all levels in the society. Six strategies with prioritized activities were identified with input from stakeholders and incorporated in an Action and training plan.

For Suriname to be able to respond to its international environmental obligations under the UNFCCC, strengthening of the institutional and technical capacity of Government agencies, non-governmental organizations (NGOs) and the private sector is a prerequisite. NC2 included a more comprehensive approach to training and capacity building. A major step taken within the scope of prioritizing climate change related policy making, was the appointment of a taskforce with the focus on a climate compatible development strategy within the Office of the President (now Directorate Environment under the Ministry of Spatial Planning and Environment (ROM)). This has led to a coherent and focused approach in maximizing benefits including on training and capacity building aspects. With expertise gained during the previous national communications, local experts were better equipped to facilitate a more efficient elaboration of subtasks. A stakeholder evaluation on the gap and needs assessment, regarding capacity building on climate change (baseline assessment), was conducted. The gaps and needs assessment showed three gaps: (i) knowledge, (ii) a proper data collection and information network and (iii) creation of techniques and technologies to address climate change mitigation and adaptation. With the collected information a training & capacity building plan has been developed with the aid of the UN Framework, consisting of three levels: individual level, institutional level and systemic level.

The component gender and climate change has been reported for the first time in the National Communication reporting. This component evaluated the vulnerability of women in three sectors in Suriname (Mining, Agriculture and Forestry) and the impact of climate change on their livelihood and their inequality in access to resources. The review concluded that women still have unequal access to resources, opportunities, participation, and decision-making, which prevents them from contributing sufficiently to social, economic and environmental development.

Constraints and Gaps

The most important constraints and gaps experienced during the process was the limited knowledge and expertise on certain themes and subjects. Training and capacity building initiatives have strengthened Suriname's technical, institutional, political, and financial capacities, allowing local experts to contribute towards the drafting of the next National Communication. Having a coordinating system in climate financing will enable Suriname to advance its sustainable development and tackle climate change. The Government of Suriname recognizes the special needs of indigenous and tribal people and marginalized communities and is in urgent need of support to strengthen and increase their awareness on climate change related issues.

Chapter 1

National Circumstances and Institutional Arrangements

1 National Circumstances and Institutional Arrangements

1.1. Geographical Setting

Suriname is located at the northeastern coast of South America, between 2° and 6° north latitude and 54° and 58° west longitude, bordering the Atlantic Ocean in the north, the Cooperative Republic of Guyana in the west, French-Guiana in the east and the Federative Republic of Brazil in the south (see figure 1). These borders are historically established in the east and the west, based on the main course of the Marowijne and Corantijn Rivers, respectively, and in the south by the water divide formed by the mountain ridges of the Acarai, Tumukhumak, and Grensgebergte mountains (Second National Communication (NC2), 2016). According to most recent publication on demographic data Suriname 2017-2019, the land area of Suriname is about 163,820 km^2 with a population of 598,000 inhabitants in July 2019, mainly residing in the low-lying coastal zone (ABS 2021).

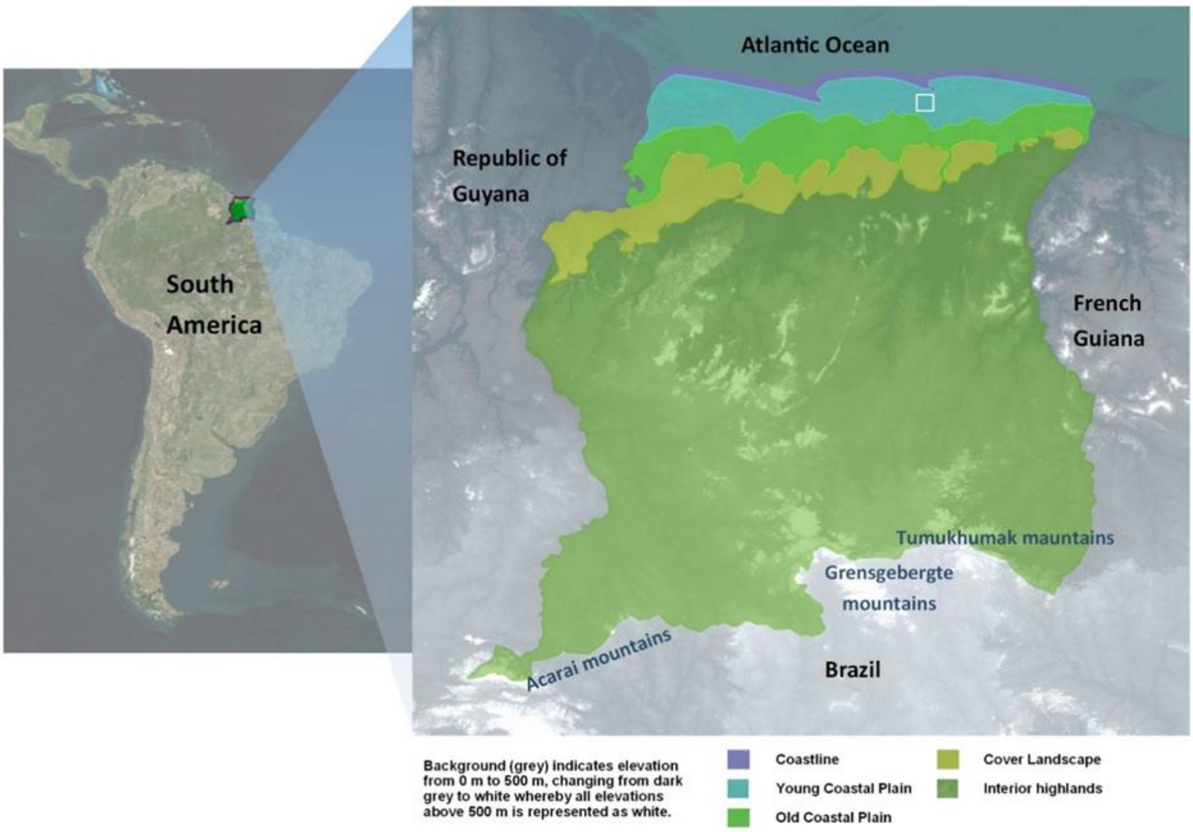

Figure 1 Map of Suriname showing the geographical setting
Source: Figure made by De Dijn, B. (ESS) in partial report National Circumstances and Institutional Arrangements

1.2. Geology and Geography[1]

The land area of Suriname is bordered in the North by the intertidal zone that forms the coastline, and is characterized by extensive mudflats and sandy shell beaches exposed during low tide; the land area is generally divided in four main geographic regions that can be identified from north to south as follows:

- the Young Coastal Plain, with variations in height of 1 (± 0.5) – 3 m above Mean Sea Level (MSL), featuring extensive flat and low-lying formations of clay, interrupted by isolated or bundled sandy ridges (also known as cheniers; see also next section) with admixture of shells;
- the Old Coastal Plain, with variations in heights of 4-11 m above MSL (Veen, 1970), which consists of extensive clay flats and sandy ridges (cheniers), and localized peat and clay deposits in the swampy gullies. The Coastal plain ranges in width from 21 km in the east up to 75 km in the west (De Dyn B., Teunissen P., Mol J., 2018);
- the Cover Landscape (also known as the Zanderij or Savanna belt), ranging from 10-100 m above MSL, consisting of coarse bleached white sand and yellowish-brown sands to sandy clay; and
- the Interior highlands (also known as the Precambrian Basement), with hills in the northern part reaching heights of up to 100 m above MSL, and further south, hills with heights of up to 750 m and some even higher (highest point is 1,230 m). The soil is composed of weathered and eroded Precambrian rocks with a generally thick regolith layer (weathered rock; mostly lateritic). This area is part of the Precambrian Guiana Shield and covers about 80% of the land surface of Suriname.

Coastal Change

Based on above description of the geographic regions, it is apparent that the coastal zone of Suriname is a low-lying area. This area is part of the regional coastal system that extends from the mouth of the Amazon River in Brazil to the mouth of the Orinoco River in Venezuela, also known as the North Brazil Shelf Large Marine Ecosystem. This ecosystem is considered to be very productive, due to the Amazon River plume (i.e., water mass in the ocean that is formed by the Amazon River discharge, consisting largely of mud and mixed with saline water of the ocean) which is considered a source of nutrients (Heileman, 2020). The mud is transported and deposited by the westward-flowing ocean currents, and by waves that are generated by the trade winds.

This constant movement and deposition of mud creates a very dynamic and transient muddy coastline. In areas where mud is deposited, mud banks are formed and can grow up to 20 to 35 km long. These mud banks move with the ocean currents and waves in a westward direction at speeds of 0.5 – 1.5 km/year. Adjacent to the mud banks, where there is no mud deposition, interbank zones

[1] Information extracted from the chapter Geology, Landforms and Soils by Kroonenberg S. & Noordam D. from “Natural History and Ecology of Suriname”, 2018 by De Dyn, B. (ed.)

are formed. In these areas, shoreline erosion can occur but is mitigated in the presence of cheniers. These cheniers are narrow ridges of marine sand deposited by the ocean currents derived from the marine shelf and from sediment transported to the sea by major local rivers.

The aforementioned coastal movement along the coast of Suriname results in a cycle of accretion and erosion. However, it has been reported that not all mud banks move at the same speed. The Coronie mud bank for example, located in the west, seems to move more rapidly compared to the Commewijne mud bank which is located in the west (Gratiot, 2011). This phenomenon can worsen the erosion in the interbank zone, as is currently taking place along the coast near greater Paramaribo (Guzman et al., 2017).

Along the coast of Suriname, two areas have been reported showing a general trend of erosion namely near Totness (Coronie district) and at Weg naar Zee (Wanica district; near greater Paramaribo). Significant coastal erosion has been reported along the Weg naar Zee and nearby Wanica coasts with erosion over some 1200 m of the coastline; here some 140 hectares of mangroves is lost over a period of 34 years between the years 1984 and 2014 (Moe Soe Let, 2016).

1.3. Climate[2]

Suriname is located in the tropical part of South America and is characterized by a large variability in rainfall between years and decades, high average rainfall, high temperatures year-round and high relative atmospheric humidity. The climate is partly regulated by the rainforest through evapotranspiration and partly controlled by the position of the Intertropical Convergence Zone (ITCZ). The ITCZ is a low-pressure region that produces much rain, located where the northeast and southeast trade winds converge. The position of the ITCZ is influenced by oceanic-atmospheric processes. These processes are caused by the variability in sea surface temperatures in the Atlantic and Pacific oceans.

The annual northward and southward displacement of the ITCZ, results in two dry and two wet seasons in Suriname, namely:

- The short rainy season (early December to late January);
- The short dry season (early February to mid-April);
- The long rainy season (mid-April to mid-August); and
- The long dry season (mid-August to early December).

[2] Information extracted from the chapter Climate and Hydrology by Nurmohamed, R., Groen J. & Naipal S. from “Natural History and Ecology of Suriname”, 2018 by De Dyn, B. (ed.), “ABS, 2020”

1.3.1. Precipitation[3]

The months with the lowest amount of precipitation are September and October, while the months with the highest amount are May and June (see figure 2 below). The average yearly precipitation over the period 2013 – 2019 was about 1900 mm, with 20-108 mm on average during the driest months and 202-372 mm during the wettest months (Meteorological Service Suriname, 2022). In addition, an overview is provided of the yearly precipitation in the coastal area (see figure 3) and that of the Interior (see figure 4) from the period 2011 until 2017 per precipitation monitoring station in Suriname (based on data from the Meteorological Service Suriname (MDS)).

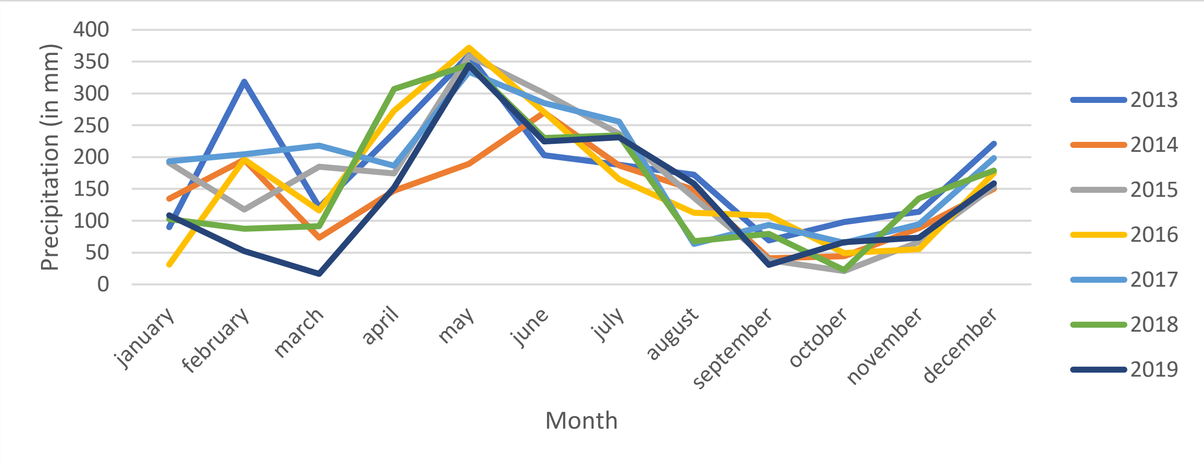

Figure 2 Monthly average precipitation in millimeters (mm), period 2013-2019

Source: Compiled data from the Meteorological Service Suriname (MDS), 2022 processed by ESS in partial report National Circumstances and Institutional Arrangements

[3] Compiled information for subparagraphs 1.3.1 till 1.3.4 is based on data received from the MDS, 2022

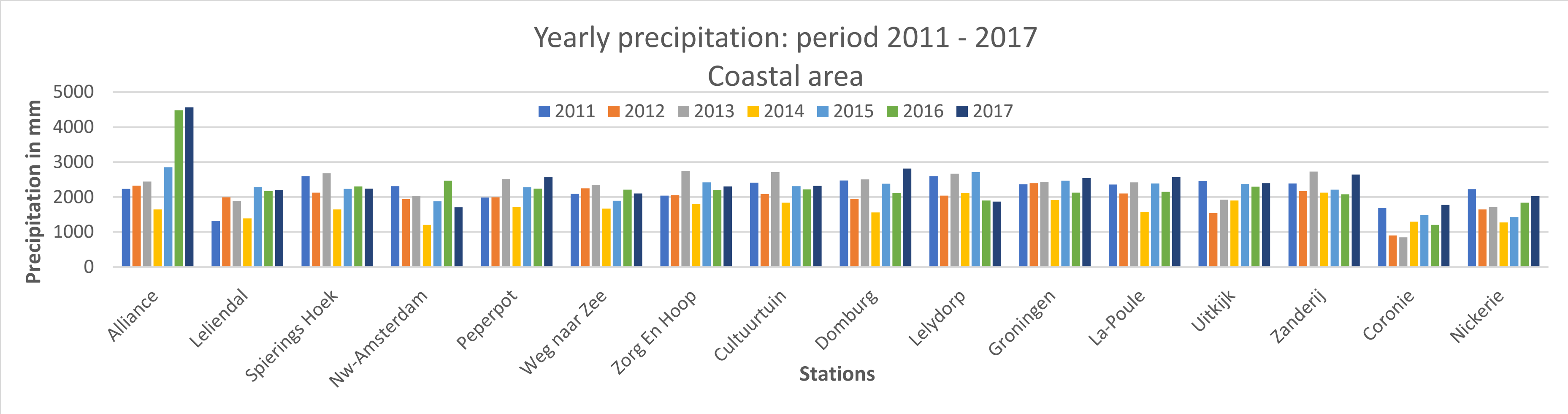

Figure 3 Yearly precipitation in the coastal area of Suriname from 2011 until 2017 per precipitation monitoring station

Source: Compiled data from the Meteorological Service Suriname (MDS), 2022 processed by ESS in partial report National Circumstances and Institutional Arrangements

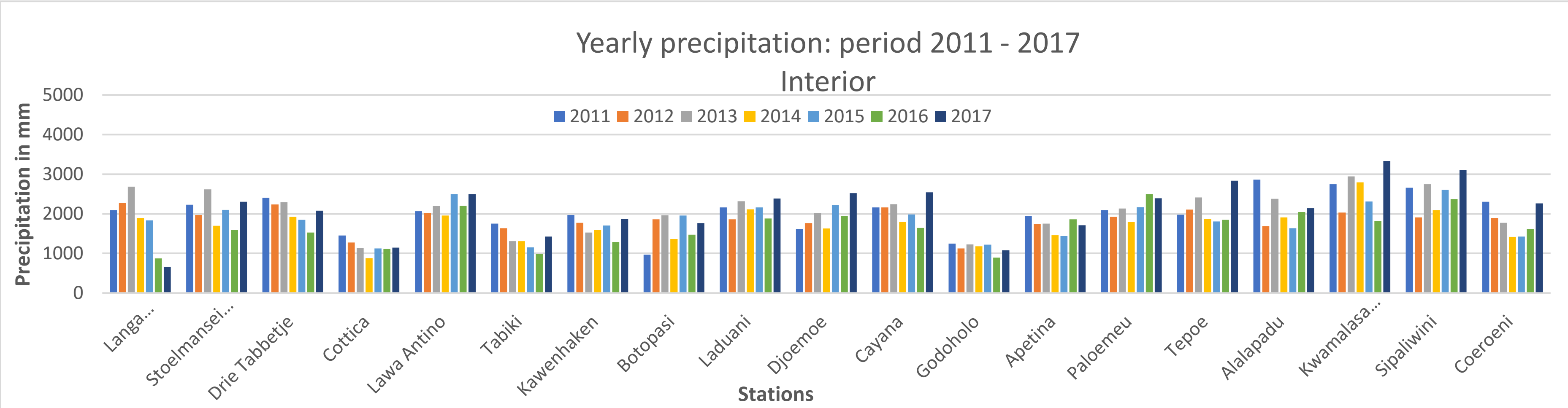

Figure 4 Yearly precipitation in the Interior of Suriname from 2011 until 2017 per precipitation monitoring station

Source: Compiled data from the Meteorological Service Suriname (MDS), 2022 processed by ESS in partial report National Circumstances and Institutional Arrangements

1.3.2. Air temperature

The average temperature at 06:00 a.m. is between 21° and 24°C based on measuring stations at the airstrip in Nickerie and the airport at Zorg and Hoop (Meteorological Service Suriname, 2022). Temperatures around noon are the highest, with an average are between 31° and 34°C. September and October are the months with the highest average temperatures, varying from 28.1˚C to 29.8˚C, while and January and February are the months with the lowest average temperatures varying from 26.5 ˚C to 27.6˚C, based on data from the period 2013 – 2019.

1.3.3. Wind

The trade winds moved in a northeastern and southeastern direction, with an average velocity between 1.3 – 3.2 Beaufort for the period 2013 -2019. An overview of the average wind velocity for the period 2013 - 2019 is presented in figure 5. From north to south, the measuring station in Nickerie is the closest station to the ocean followed by Zorg en Hoop, Zanderij and Kwamalasamoetoe. This station also has the highest recorded values for wind velocity.

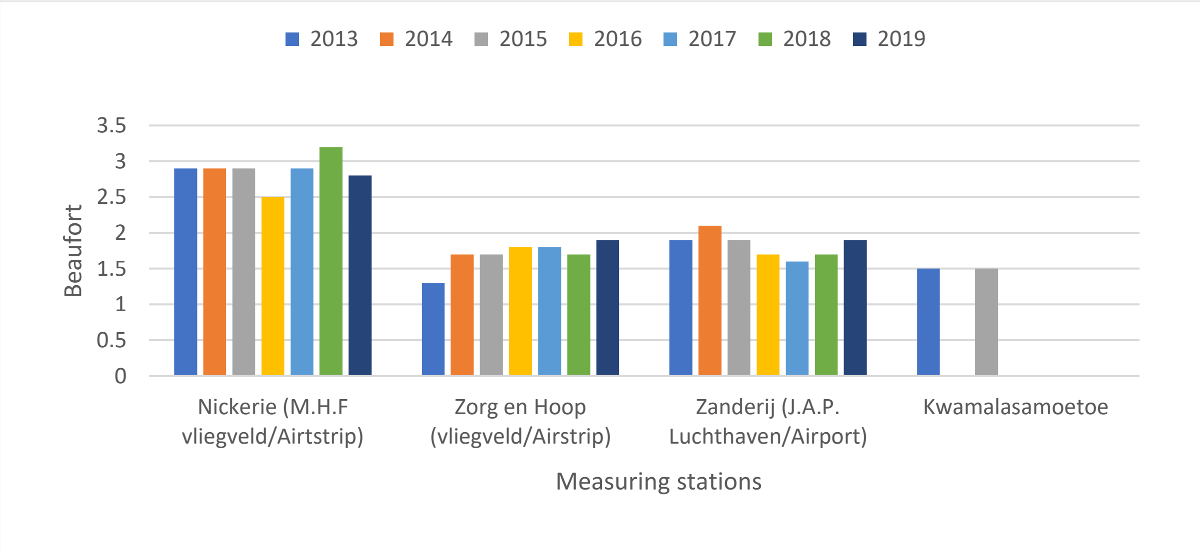

Figure 5 Wind velocity at certain measuring stations in the period 2013-2019

Source: Compiled data from the Meteorological Service Suriname (MDS), 2022 processed by ESS in partial report National Circumstances and Institutional Arrangements

1.3.4. Air humidity

Suriname has a high atmospheric humidity. An ambient relative humidity between 80% to 90% is quite normal in Suriname. The average humidity for the period 2013 – 2019 (see figure 6 below) was between 74% and 80%.

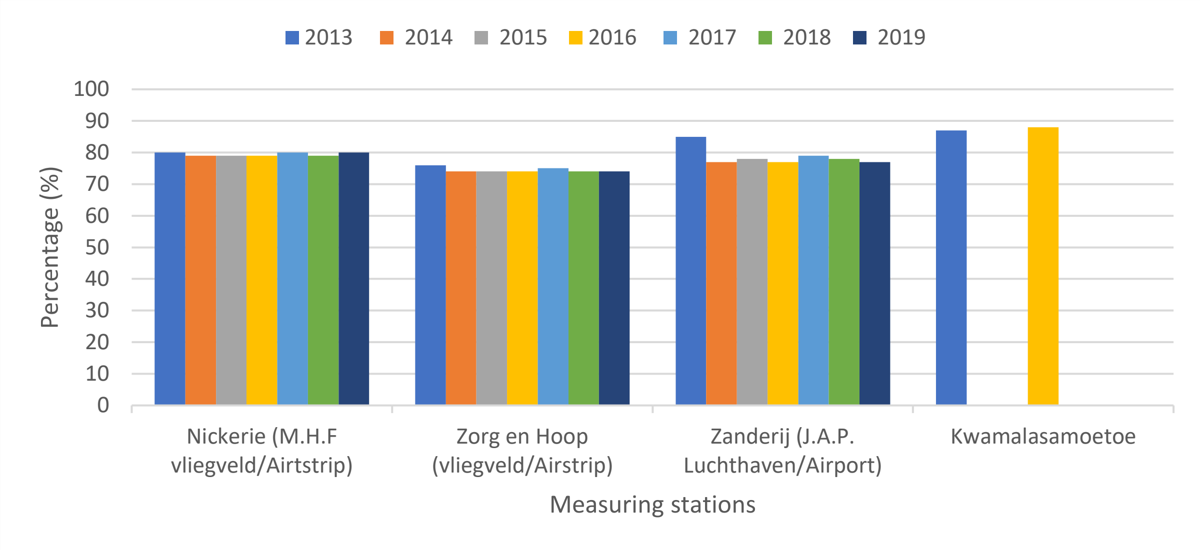

Figure 6 Relative humidity in Suriname at certain measuring stations in the period 2013-2019

Source: Compiled data from the Meteorological Service Suriname (MDS), 2022 processed by ESS in partial report National Circumstances and Institutional Arrangements

1.3.5. El Niño

The El Niño Southern Oscillation (ENSO) also influences the climate in Suriname, especially the rainfall. ENSO is characterized by changes in sea surface temperature and a shift in upper atmosphere wind currents. This occurs periodically and is also a global phenomenon. The shifting of the atmosphere wind currents direct moisture-bearing storms away from Suriname during some years, and causes drought in the country. During other years (La Niña years), the shift direct more intense storms to Suriname which then causes heavy rains and flooding (Nurmohamed, Groen and Naipal, 2018)

1.4. Natural Resources

1.4.1. Agriculture[4]

Agriculture is mostly practiced in the low-laying coastal zone of the country and accounts for 3.2% of the total land area; an estimated 120,000 hectares. This sector is currently threatened by salt intrusion in water and soils by sea level rise, erosion and leaching by extreme rainfall, water scarcity for livestock and crops due to drought, and damage of crops by regular pattern of flooding. As a result of rising temperatures, Suriname’s agricultural sector is experiencing slow overall growth and development of traditional crops, reduction of grain production, heat stress in poultry and cattle, degraded water quality for fish farming, and higher occurrence of pests, diseases and weed.

[4] Information extracted from Foundation for Forest Management and Production Control (SBB) & Ministry of Agriculture, Animal Husbandry and Fisheries (LVV), 2022; Partial reports National GHG Inventory Report for Suriname, Agriculture, Forestry and Other Land Use Sector period 2000-2017

Although agriculture accounts for 7.45% of national employment and is also a large employer in rural areas of Suriname, this sector is considered a key contributor to food security. It is therefore important to indicate that rice is one of the main agricultural products produced and is also the staple food in Suriname.

Rice and Bananas are the main agricultural products produced in the northwestern part of Suriname. The agriculture sector is well developed in that part of the country as opposed to the north central part where other agricultural products and commodities, such as vegetables and fish, are produced.

1.4.2. Forestry

Suriname has a forest cover of 93% of the national territory and is one of the most forested countries on earth with less than 0.1% deforestation (SBB, 2020). This categorizes Suriname as a High Forest and Low Deforestation (HFLD) country. The definition of 'forest' that is used by SBB for the estimation of the forest reference emission level (FREL) in Suriname is: "Land mainly covered by trees which might contain shrubs, palms, bamboo, grass and vines, in which tree cover predominates with a minimum canopy density of 30%, a minimum canopy height (in situ) of 5 meters at the time of identification, and a minimum area of 1.0 ha" (FREL, 2021).

The main driver of deforestation for the period of 2000-2017 is gold mining, being responsible for 69% of the total deforestation. In addition, infrastructure development is responsible for around 18% of the total deforestation, urban development with 2.8% and agriculture with around 5% have are also identified as relevant drivers of deforestation (see figure 7).

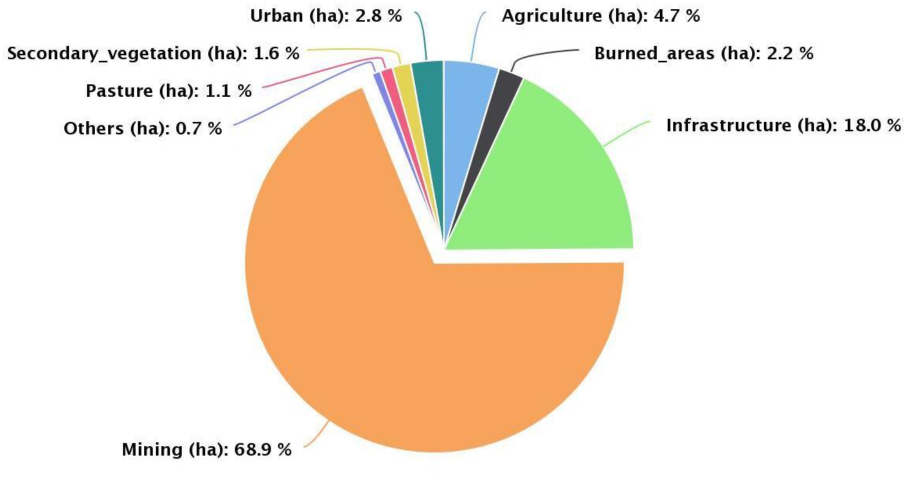

Figure 7 Overview of deforestation land use land cover information in the period 2000-2017

Source: Stichting voor Bosbeheer en Bostoezicht (SBB), 2021: Deforestation Land Use Land Cover (LULC) information. Retrieved from Stichting voor Bosbeheer en Bostoezicht Bosbouw statistische informatie: https://www.gonini.org/SBB/index.php

With regard to the forestry sector, roundwood is one of the main timber assortments which is produced by the timber industry. This includes raw material for semi-processed products and finished products, produced by the timber processing industry. The most produced and well-known commercial timber species are G*ronfolo* (*Ruizterania albiflora*), *Basralocus* (*Dycorinia guianensis*), *Kopi* (*Goupia glabra*) and W*ana* (*Ocotea rubra*). The total roundwood production in 2019 amounted to approximately 925,126 m^3. This is almost twice the amount reported in 2015 of 568,656 m^3. The roundwood export in 2019 amounted to 504,877 m^3 and was more than twice the amount reported in 2015 of 204,793 m^3 based on data from the Foundation for Forest Management and Production Control (SBB) (ABS, 2020). Therefore, the NDC 2020 (2019) includes a target / policy measure to phase out the export of round wood.

Mangrove forests are very important for coastal protection against erosion and sea-level rise, they fulfill the role of a nursery for many coastal and marine fish and shrimp, and they are at the same time important for carbon sequestration. In 2017, mangroves covered approximately 1,100 km^2 of Suriname's coastline and stored about 57.93 Mg Carbon per hectare (aboveground). A National Mangrove Strategy was formulated to fill the gaps in existing policies and legislation for conservation of biodiversity and reduction of the impacts of climate change on the coastal areas. The strategy "*promotes the strengthening of the legal framework (including enforcement) and introduces adaptation technologies to support the sustainable and effective management and monitoring of mangrove ecosystems. Emphasis is placed on building institutional capacities*" (MAFOSUR, 2019).

1.4.3. Mining[5]

Coastal Plain consist of sand, clay and peat and offer good opportunities for
Suriname is highly dependent on the extractive sector, with oil and gold accounting for a large part of the country's export. In 2017, gold accounted for nearly three-quarters of Suriname's exports. Oil is extracted from the Young Coastal Plain, while gold is mined in the hilly Interior.

The soil of the Young Coastal Plain features extensive, flat, and low-lying formations of heavy marine clays, usually overlain by a peat layer (a.k.a. pegasse). Exploitation of crude oil, sand and shells is taking place in the northern part of the Young Coastal Plain. The clay flats are locally interspersed by roughly east-west striking ridges of sand with admixtures of shell. The soils of the Old Coastal Plain consist of sand, clay and peat and offer good opportunities for agricultural development, in particular, horticulture.

[5] Information compiled from the chapter Geology, Landforms and Soils by Kroonenberg S. & Noordam D. from "Natural History and Ecology of Suriname", 2018 by De Dyn, B. (ed.), "NC2, 2016", "National Climate Change Policy, Strategy and Action Plan (NCCPSAP), 2015", "Meerjaren Ontwikkelingsplan 2022-2026 van de Republiek Suriname (a.k.a. MOP 2022-2026), 2021" and "EITI, 2022"

The State Oil Company (Staatsolie Maatschappij N.V.) is involved in oil exploration and exploitation in the Young Coastal Plain since the 1980s. This company keeps flourishing and expanding and has shares in gas stations (GoW2), generation of electricity, and gold exploitation. With the discovery of offshore oil and gas reserves, the production is expected to rise from 16.500 to 650.000 barrels of crude oil per day. In the context of creating value and job opportunities, the Multi-Annual Development Plan (MOP) 2022-2026 identifies the need for the development of local content, i.e., participation of Surinamese companies and citizens in the economic activities associated with the offshore oil and gas sector. For this purpose, the Local Content Development Office (LCDO) should be established to provide an overview of needs and requirements and monitor and evaluate progress on local content in the offshore industry.

The Surinamese Interior is hilly and mountainous and is mainly composed of weathered and eroded Precambrian rocks with a generally moderately thick regolith layer. Important human activities in this part of the country in the period 2015–2019 are gold and gravel mining (Ministry of Natural Resources, Geological Mining Services). Suriname is part of the Extractives Industries Transparency Initiative (EITI) since 2017 and aims "*to mainstream EITI reporting in Government systems, disseminate key information on the sector, strengthen beneficial ownership disclosure and expand EITI reporting to also include construction materials*" (EITI, 2022).

The dependency of mining on hydropower generated electricity and water for processing makes it vulnerable to (seasonal) decreased availability of water as a result of climate change (droughts).

1.4.4. Energy[6]

Electricity is generated by the state-owned Suriname Energy Company (N.V. Energie Bedrijven Suriname; EBS), Staatsolie Maatschappij Suriname (through the State Oil Power Company Suriname (SPCS)) and Suralco LLC[7]. EBS provides energy to the coastal area, while the Electricity Supply Service (Dienst Electriciteitsvoorziening; DEV) of the Ministry of Natural Resources, provides energy to parts of the Interior.

Energy generation is predominantly based on hydropower and diesel. In 2019, electricity production amounted 2,818 KWh per person with a growth of 8-10% in energy consumption per year. It is expected that energy demand will grow from 1,550 GWh in 2019 to 4,000 GWh in 2040 as a result of economic developments related to the mining industry. However, drought and increased temperatures may increase vulnerability of existing hydropower facilities (Afobakadam and small

[6] Information compiled from "ABS, 2018", "MOP 2022-2026, 2021" and "NCCPSAP, 2015"
[7] The Afobaka hydropower plant which was operated by Suralco LLC in the past is owned by the State Oil Power Company Suriname (SPCS) since 2020.

facilities in the Interior) by impacting water availability and therefore electricity generation. In addition, high temperatures cause transmission and distribution losses because of reduced thermal efficiency of overhead lines. Cooking gas is the most important fuel used for cooking by Surinamese households (91% of households in 2016) and its distribution grew by 44% in the years 2013-2017. Other sources of fuel for cooking include wood or charcoal (7%) and electricity (1%).

1.4.5. Water[8]

Suriname is rich in water resources that can be categorized as surface water, ground water and Suriname's part of the Atlantic Ocean. The surface water resources comprise of abundant annual rainfall, which, together with the topography, soil types and land cover has resulted in many streams and large wetlands. Seven main rivers, originating in the Interior of the country, are annually discharging about 4,800 m^3/s of fresh water into the Atlantic Ocean. The Marowijne and the Corantijn Rivers contribute 70% to the total discharge; of the remaining rainfall, the largest part evaporates and only a small part percolates to the aquifers, recharging ground water reserves.

Surface water resources (rivers, creeks and swamps) are mainly used for irrigation (e.g., for rice and banana cultivation) and for the generation of hydropower. Groundwater is mainly used for potable purposes and to lesser extent industry.

The Cover landscape plays an important role in the maintenance of drinking water reserves because the greatest amount of rainfall percolates into the ground, recharging the freshwater aquifers. These aquifers are the main resource for potable water in the coastal areas (mainly around the capital). River water is also processed into drinking water in Eastern Suriname. Approximately 26.3M m^3 of water was consumed in 2016, while production was approximately 46M m^3. The consumption is dominated by households, 70.4% in 2017.

The Exclusive Economic Zone (EEZ) extends the part of the Atlantic Ocean starting from Suriname's coast to 370 km offshore. In total, the EEZ covers an area of 140,000 km^2 which is sub-divided into the Continental Sea, located between the coast and the Continental Slope (65,000 km^2), and the Deep Sea, located between the Continental Slope and the northern border of the EEZ (75,000 km^2).

1.4.6. Tourism[9]

In general, most tourists arrive in Suriname via the Johan Adolf Pengel (JAP) airport; other entry ports are South Drain (Nickerie), Airstrip Zorg en Hoop (Paramaribo), Albina (Marowijne) and the Suriname Harbour. The total number of

[8] Information compiled from "NC2, 2016" and "ABS, 2018"
[9] Information compiled from "ABS, 2018", "NC2, 2016" and "MOP 2022-2026, 2021"

tourist arrivals amounted to 256,951 in 2016. The majority of tourists (>36%) stay for a period exceeding 15 days and visit Suriname for holiday purposes or family visits and make use of hotel facilities or just reside with family. The majority of visitors comes from Europe (mostly the Netherlands), South America (Guyana, French Guyana and Brazil) and Asia (mostly China). Important tourist attractions include natural (e.g., nature reserves, major rivers with waterfalls and rapids) and cultural experiences. Tourism is highly dependent on the existing environment and biodiversity; this will be negatively impacted by climate change as sea level rise and increasing temperatures may cause degradation of natural areas.

1.4.7. Infrastructure[10]

Road transport is dependent on 4,305 km of asphalt, paved, or dirt (sand, shells or laterite) roads. More than 50% of the road network is in Paramaribo and Wanica, while in the hinterlands (Marowijne, Para, Brokopondo and Sipaliwini) a limited number of mostly dirt roads are found (473 km).

Air travel relies on two international airports, Johan Adolf Pengel Airport and Zorg & Hoop Airport; the latter is mostly used for domestic travel. There are 48 airstrips, which are used for domestic travel, mostly to the district of Sipaliwini. Although there are 17 formal harbors in Suriname, the two main ports are the Dr. Jules Sedney Port (Paramaribo) and the port of Nieuw Nickerie.

Infrastructure in coastal and urban areas is expected to become more exposed to flooding as sea level rises, while existing drainage systems remain poor.

Broadband internet subscription is limited to 14% of the inhabitants in 2019. The highest percentage of households with internet access is in urban areas (58%), followed by 42% in rural coastal areas and 22% in rural Interior households.

1.4.8. Housing

According to the inhabitants, 4% of houses were in very good, 36% in good and 2% in very bad condition in 2016. The majority of the dwellings are owner occupies (62%), while 16% are either rented, leased or in the process of purchasing. Most houses are constructed out of bricks (cement) and/or wood.

According to the Multi-Annual Development Plan 2022-2026, there is a visible deterioration of housing conditions, i.e., decreased house availability vs increased number of households, increased dilapidation and vacant homes, and undeveloped plots in the city. There is a structural shortage of adequate and affordable housing as a result of a reduced number of houses built, devaluation of the Surinamese Dollar, reduced purchasing power of households, increasing prices of land and construction materials, and high demand of housing opportunities closer to the

[10] Information compiled from “State of the Climate (SOC), 2021”, “ NCCPSAP, 2015”

city. Houses in low-lying coastal areas are exposed to flooding as a result of sea-level rise, while houses in both the Interior and the coastal area are vulnerable to flooding as a result of heavy rains. In addition, the increased intensity and frequency of *Sibibusi* (strong winds) increases the risks of structural damage to houses, especially roofs.

1.5. Population

In 2019, Suriname had an estimated (mid-year) population of 598,000 inhabitants, largely concentrated in the coastal area. Paramaribo and Wanica are classified as urban coastal areas in the recently published Demographic Data 2017 – 2019 report by the ABS (2021). Both areas are the most densely populated districts, with around 66% of the total population. The rural coastal area, consisting of the districts Nickerie, Coronie, Saramacca, Commewijne and Para, are together inhabited by approximately 19% of the total population. The remaining population lives in the rural Interior/ hinterland districts of Marowijne, Brokopondo and Sipaliwini.

The population of Suriname is made up of various ethnicities, which is due to the colonial history. Figure 8 presents the ethnic diversity of the population in 2012. Census data from August 2012 compared to demographic data of July 2019 from ABS (2012) show a total population growth of 10.41%.

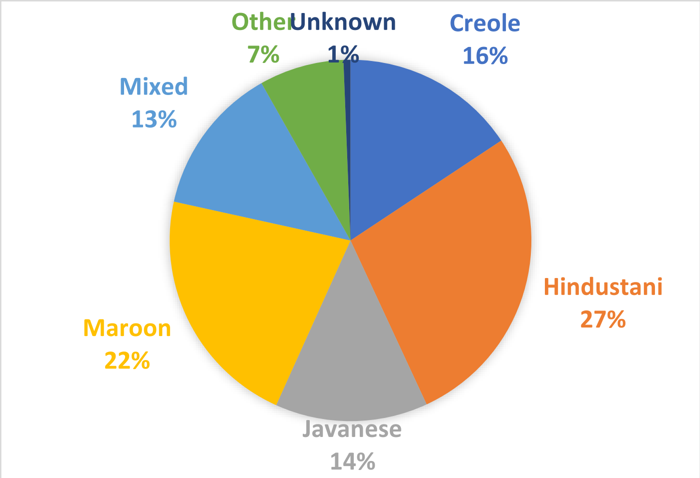

Figure 8 Ethnic diversity of Suriname's population of 2012
Source: Compiled data based on census data of ABS, 2012 processed by ESS in partial report National Circumstances and Institutional Arrangements

The mean age of Suriname’s population was 31.75 years for men and 33.18 years for women as of July 2019 with an age and gender distribution as presented in figure 9 below. The share of the male population was 49.88% and of the female population 50.12%. Published data of ABS for the period 2017–2019 shows that women generally live longer than men in Suriname with a life expectancy at birth of 70.9 years for men and 75.6 years for women.

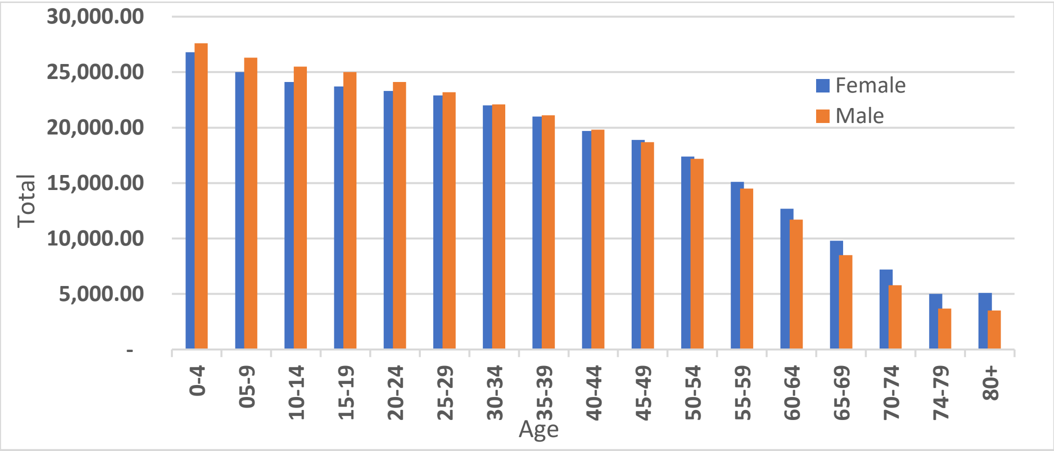

Figure 9 Population characteristics gender and age distribution

Source: Compiled data from ABS, 2021 processed by ESS in partial report National Circumstances and Institutional Arrangements

1.6. Government

Suriname has a Constitutional Democracy with a President being both the Chief of State and the Head of Government. The governing power is divided between the executive authority and the legislative authority.

The legislative authority is formed by the National Assembly (i.e., the Parliament of Suriname) and is represented on a regional level by the District and Local Councils/Resort Councils. These members are elected for a five-year term in the General Elections. The National Assembly subsequently elects the President and Vice- President of the country. The legislative authority has legislative, administrative, and controlling powers.

The executive authority comprises of the central Government and the local Government. The central Government consists of the President, the Vice-President, State Advisory Council, the Auditor's Office, and the Council of

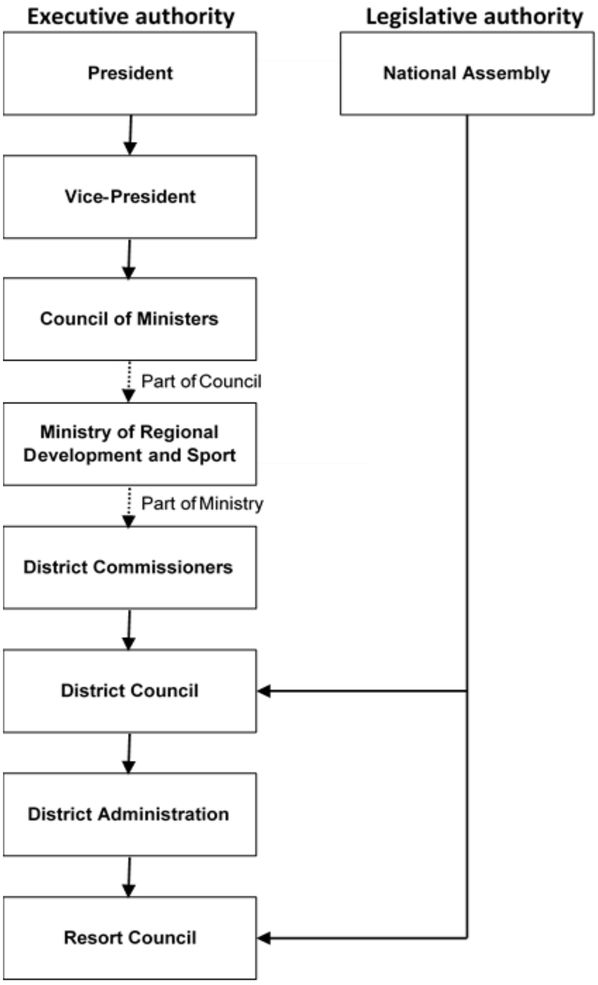

Figure 10 Organizational structure of the local administration
Source: Figure drafted by ESS. 2023. Retrieved from partial report National Circumstances and Institutional Arrangements

Ministers consisting of the 17 Ministers with the Vice-President as Chair.

The State Advisory Council advises the President on general policy matters and on the content of bills and proposed State decrees. The Auditor's Office has the responsibility of supervising and monitoring the Government's expenditures and financial management. The preparation and execution of the Government's policy is the responsibility of the Council of Ministers as well as preparing laws and administrative regulations, and inter-ministerial coordination.

The local Government's responsibility is overseeing activities of central ministries in their districts, and they also have the responsibility of local governance. The ten administrative districts of Suriname are: Brokopondo, Commewijne, Coronie, Marowijne, Nickerie, Para, Paramaribo, Saramacca, Sipaliwini and Wanica. These 10 administrative districts are further divided in 63 resorts. The local Government consists of the District Councils, Resort Councils, District Administration and District Commissioners supported by the District Administration. The first two are elected officials, whereas the District Commissioner is appointed by the President (see organizational structure in figure 10).

1.7. Economy and Development[11]

The economy of Suriname was strongly dependent on the mining sector in 2013. These commodities accounted for almost 90% of export revenues and 30% of Gross Domestic Product (GDP). The subsequent price declines of gold and oil, and the closure of the alumina refinery Suralco have caused substantial fiscal and external current account deficits. The fiscal deficit reached 8.8% of the GDP in 2015, compared with a small surplus in 2011, and the current account has worsened from a surplus of 5.7 percent of the GDP in 2011, to a deficit of 15.6 percent of the GDP in 2015. Due to these negative developments combined with interventions by the Central Bank of Suriname (CBvS), official foreign reserves have declined to very low levels resulting in an economic recession. This has led the Government of Suriname to request financial assistance from the International Monetary Fund (IMF) to support a program that is intended to restore the macro-economic stability and confidence and facilitate economic recovery.

The Suriname recovery program (*Herstelplan*) includes the following key elements:

(i) **Fiscal policy**: fiscal adjustment that is primarily based on phasing out electricity subsidies, wage restraint, an increase in fuel taxes, introducing value added tax (VAT) and to create an efficient source of non-mineral revenue;
(ii) **Social protection**: the program includes measures to strengthen the social safety net to help soften any negative impact of the macro-economic adjustment on the underprivileged;

[11]Information compiled from "International Monetary Fund (IMF), 2016", "IMF, 2019", "Khadan, 2020"

(iii) **Monetary and foreign exchange policy:** auctioning foreign currency and authorization of commercial banks and foreign exchange bureaus to freely determine exchange rates. This facilitated Suriname's transition to a floating market-determined exchange rate, which will strengthen the economy's resilience to commodity price shocks;

(iv) **Structural reforms:** the program also includes substantial structural reforms to promote the economy's diversification and attract foreign direct investment, enhancing the productivity and competitiveness of Suriname's agricultural sector and it also includes legal reforms to improve the business environment.

Between 2017 and 2019, economic growth returned by an average of 1.9%, driven by increased gold production and commodity prices. Mining and oil exports comprised 86% of the total exports of goods and services in 2018, accounting for 36% of Government revenues. Activity growth has been broad based on expansions in the wholesale and retail trade, construction, hotels, restaurants, and manufacturing, while mining has remained stable. The main economic drivers were the increased manufacturing sector, largely driven by higher gold production, along with wholesale and retail trade, although the fiscal situation remained challenging as spending pressures have resulted in a very high central Government deficit, and the national debts have increased to elevated levels.

In 2020, Suriname experienced its second economic crisis in six years due to negative external developments. The first shock resulted from the sharp decline in commodity prices and the second as a result of measures that have been implemented to combat the COVID-19 pandemic. Crude oil prices fell to 50% in March 2020 compared to December 2019, while the prices of gold increased by 8% over the same period. The COVID-19 restrictions slowed down the domestic economy. According to Khadan (2020), these developments will also affect underprivileged and vulnerable groups.

In addition to these economic challenges, the oil and gas sector in Suriname reported four major deep-water offshore oil discoveries in 2020 and one in January of 2021. Future exploitation could increase export revenue, generate new investment and jobs. A cautious estimate suggest tens of billions of US dollars will be generated in the next 25 years from Block 58 alone and that Suriname will start earning income from the offshore discoveries as the first oil flows out in 2026 or 2027 (Staatsolie, 2020).

The strong dependency of the economy on the extractive sector for its export earnings, shows the high vulnerability of the economy of Suriname to commodity price fluctuations. This has prompted the Government of Suriname to focus its investment program on diversification of the economy to non-natural resource-based sectors.

1.8. Other Socioeconomic Factors

1.8.1. Disaster Risk Reduction[12]

Natural disasters most common in Suriname in the period of 2015-2017, include *Sibibusi* (strong winds associated with heavy rains) that usually occur during thunderstorms and flooding of the urban coastal plain, rural coastal area and the rural Interior. These natural disasters caused damage to properties, e.g., houses (roofs) and other buildings (e.g., schools), electricity distribution networks, urban vegetation (trees) and other structures. In the aforementioned period, nine (9) *Sibibusi's* were reported in the coastal area, one of which resulted in flooding of some areas in Paramaribo. In total, five people were badly injured and one person died as a result of these natural disasters. The total number of persons directly affected by these disasters in 2015-2017 was respectively, 210, 69 and 52. The estimated damage amounted to SRD 900,260, SRD221,454 and SRD 191,155 for this specific period. It is expected that climate-related disasters will increase, due to the frequency and intensity of extreme weather events, while the population is concentrated in low-lying coastal areas and defense infrastructure is lacking.

1.8.2. Spatial Planning[13]

A lack of spatial data as well as outdated legal framework poses constraints to proper spatial planning in Suriname. In addition, public spaces like gardens, squares, schoolyards, open-air museums, roadsides, playgrounds, and lots on which state buildings are located are generally free domain, making them prone to potential issuance to private persons or entities. Low-lying areas along the coast and rivers are vulnerable to flooding as a result of sea-level rise, heavy rains, poor drainage and other infrastructural defenses and mangrove deforestation. This poses a threat to both urban (housing, businesses, Government offices, other facilities, etc.) and rural areas (e.g., agricultural areas). Zoning plans are therefore important. This needs to occur based on a pre-determined pattern, which considers, among others, the natural environment, environmental impacts, availability of jobs and livelihoods, transport and climate change.

1.8.3. Education[14]

Education is a crucial factor for climate change adaptation and is essential for resilience building in all other sectors which are identified in the National Climate Change Policy, Strategy and Action Plan (NCCPSAP, published in 2015). Identification of these sectors was based on their climate risk and vulnerability to climate change impacts and whereby such impacts are more likely to impede Suriname's sustainable development. The sectors are categorized in three groups

[12] Information compiled from "ABS, 2018" and "NCCPSAP, 2015"
[13] Information compiled from "MOP 2022-2026, 2021" and "NCCPSAP, 2015"
[14] Information compiled from "NCCPSAP, 2015", "Pool, M. & Dipowirono, V., 2022" and "National Adaptation Plan (NAP), 2019"

i.e. (i) productive sectors, which are the main economic drivers of national development, followed by the (ii) cross-sectoral or supportive sectors group that contributes to, and impacts the functions of the production sector. The third group is referred to as the (iii) foundational sector and includes the education and health sectors. According to the National Adaptation Plan (NAP) for Suriname, these sectors are the foundation of long-term building of national economic wealth, sustainability, resilience and sustained development. The NCCPSAP includes objectives aimed at access to and improving the quality of education in Suriname. The ultimate goal in the field of climate change within the education sector is that all levels of educational institutions in Suriname provide information on climate change response to current and future generations.

Currently, the Advanced Teacher Training Institute (IOL), which is a post-secondary/ tertiary education in Suriname, include climate change aspects in their curricula i.e., Ecology, Environmental Science and Botany and Biodiversity Management. Additionally, external experts provide guest lectures on specific issues of climate change.

With regards to higher education in Suriname, the Anton the Kom University of Suriname (AdeKUS) offers a Master of Science Program on Sustainable Management of Natural Resources (SMNR). The objective of this program is to contribute to the sustainable development and management of natural resources in Suriname in the fields of land management, renewable energy, food security, and water management for the benefit of present and future generations in Suriname. In addition, de AdeKUS also offers a Master program in Education and Research for Sustainable Development (MERSD). This program is designed to produce scientists capable of making significant contributions to Suriname's transformation into a sustainable community. This program stimulates and challenges students to think analytically and to continue to develop a critical attitude towards sustainable development issues at both national and international level.

1.8.4. Health[15]

Healthcare expenditure amounted to 1.9% of the Gross Domestic Product in 2017. Most medical costs (68% in 2016) are allocated for the treatment of illnesses, of which 80% relates to chronic illnesses. In 2015, Suriname had 8 general practitioners and 20 nurses per 10,000 inhabitants. This number increased to 21 nurses per 10,000 inhabitants in 2018.

According to Vos et al. (2020) the top five causes of death include mostly non-communicable diseases and one communicable disease. The primary cause of death in 2019 was ischemic heart diseases followed by stroke, diabetes, chronic

[15] Information compiled from “ABS, 2018”, “MOP 2022-2026, 2021”, “Vos et al. 2020”, “SOC, 2021” and “NCCPSAP, 2015”

kidney disease and lower respiratory infection. The most significant health issues related to the environment include malaria, dengue, and leptospirosis. Based on official numbers (positive tests and hospitalizations) malaria cases drastically decreased from 9 to 3 cases (>66%) between 2013-2017, as did Dengue from 2,334 to 16 cases (> 95%). Leptospirosis cases also decreased during these years from 66 to 38 (42%). Since 2014, there have been Chikungunya and Zika cases as well, with peaks of 830 Chikungunya cases in 2015 and 1,144 Zika cases in 2016, although these have decreased to almost none in 2017.

Health risks are likely to increase as a result of climate change, including new pathogens, respiratory illnesses,–diarrhea and cholera outbreaks which are most likely to impact low-lying communities (coastal and hinterland along rivers) as well as disadvantage and elderly people and infants. The State of the Environment Report (SOC, 2021) also mentions increased heat stress caused by increased temperatures and humidity as a consequence of climate change.

1.9. Perspectives, Rights and Specific Circumstances of Indigenous and Tribal Peoples (ITP)

The rainforest of Suriname is inhabited by many indigenous and tribal communities, who still practice traditional lifestyles in isolated forest villages. These communities possess invaluable knowledge on ways to live in harmony with nature, as their livelihood depends on it. They make use of the forest in their daily lives for, among other things, agriculture, medicinal purposes, fruit, firewood, hunting grounds etc. Their reliance on nature, makes them vulnerable (some of the first people) to experience the impacts of climate change.

In the National Forest Policy of Suriname (2006) a goal was set to raise the minimal subsistence level of the population in general, and in particular ITP, through increasing benefits of forests, giving consideration for their culture, values and traditions. In addition, the National Plan for Forest Cover Monitoring (2014) indicates the need for scientific findings to be merged with traditional knowledge of both men and women (Bhattacharji, 2022).

With regards to the educational level, completion rates among children particularly living in rural areas in the Interior, are below the national average (UNICEF, 2019). This indicates that this group of the population of Suriname will experience additional barriers when it comes to development.

Disaster response in these communities, is the responsibility of the Village Council, Resort Council and/or District Administration. If an event exceeds the capacity of these local first responder agencies, the response will then be escalated to the National Coordination Centre for Disaster Relief.

1.10. Gender and Climate Change

The factor gender and climate change has not been described in previous national communications of Suriname. In the past years, there has been growing awareness of the correlation between gender roles and the vulnerability of men and women to the impact of climate change, in this case with particular focus on communities in the Interior of Suriname i.e., indigenous and tribal communities. The emphasis was set on differences in gender roles and climate change impacts in the forestry, agriculture, and mining sectors.

Gender equality is a right that is recognized by the Government of Suriname (GOS) and is stipulated in the Constitution of the Republic of Suriname S.B. 1987 no.116 as amended by S.B. 1992 no. 38[16] in article 35: "Man and woman are equal before the law".
In addition, the general prohibition of discrimination is enshrined in article 8 paragraph 2 of the Constitution of the Republic of Suriname and read as follows: "No one shall be discriminated against on the basis of birth, sex, race, language, religion, origin, education, political opinion, economic position or social circumstances or any other status." Adherence to these principles can be witnessed through ratification of several international conventions concerning gender equality and supporting policy programs on regional level.

International commitments adopted by Suriname with regards to gender equality are as follows:

- Convention on the Elimination of All Forms of Discrimination Against Women (CEDAW) in 1993. Accordingly, the Government of the Republic of Suriname (GOS) commits itself to the implementation of measures to eradicate discrimination against women in all its forms and manifestations.
- The Beijing Declaration and Platform for Action, 1995,
- The Belem do Para Convention, ratified in 2002 also known as the Inter American Convention on the Prevention, Punishment and Eradication of Violence Against Women.

On the regional level Suriname supports the policy programs of the Organization of American States (OAS), Caribbean Community (CARICOM), Action program of the United Nations Economic Commission for Latin America and the Caribbean (ECLAC), and the Union of South American Nations (USAN/UNASUR).

The Ministry of the Home Affairs of Suriname bears ultimate responsibility for the implementation of the aforementioned conventions, the implementation of which is coordinated by the Bureau Gender Affairs. The Gender Vision – Policy Document 2021 – 2035 and Gender Action Plan 2019 – 2020 were developed to achieve gender equality in the Surinamese society. Environmental and climate change

[16] Grondwet van de Republiek Suriname S.B. 1987 no.116 gelijk zij luidt na de daarin aangebrachte wijziging bij S.B. 1992 no.38

activities have also been incorporated in these documents. The strategic goal of this priority area is to get all women actively involved in decision-making by 2035, and to integrate gender issues and gender perspectives into policy measures and programs for sustainable development. In addition, the goal also focusses on the establishment of mechanisms at the national level to take gender-related policy effects into account (*Gendervisie-Beleidsdocument 2021 – 2035* (GOS, 2019))

1.11. Policy and Legal Framework

National and regional development priorities and objectives

The Constitution of Suriname entered into force in 1987 and is wide-ranging in scope, with the main focus placed on the Government system, the major functions of the entities within the Government, the aspect of sovereignty, economic and social objectives, citizen rights and the economic and social system (Dougal, 2001).

Subsequently, it also provides the legal basis for a sustainable environmental policy in Article 6g: "The social objective of the State is focused towards the establishment and stimulation of conditions required for the preservation of nature and the safeguarding of the ecological balance" (NC2, 2016).

Considerable effort has been made to adhere to these principles. There have been some developments noticeable in terms of legislation, national plans and strategies, policies, and action programs to address the issues related to climate change in general and the UNFCCC commitments in particular.

A recent important development in terms of legislation is the approval of the Environmental Framework Act from 7 May 2020; S.B. 2020 no. 97 (*Milieu Raamwet S.B. 2020 no. 97*). This Act establishes measures for the protection and sustainable management of the environment in Suriname and includes rules and regulations for the implementation of obligations deriving from ratified Multilateral Environmental Agreements (MEAs). Currently, this Act is undergoing revision, and the proposed changes by the designated committee are being reviewed and discussed by the State Advisory Council. Other existing laws that form some basis for climate change-related planning are included in table 1.

Table 1 Existing laws on climate change related planning

Other related laws	Description
Nuisance Act G.B. 1930 no. 64 as amended by S.B. 2001 no. 63 (Hinderwet G.B. 1930 no. 64 z.l.g. bij S.B. 2001 no. 63)	Described as being 'outdated' but certain aspects are still applicable to climate change planning.
Nature Conservation Act G.B. 1954 no. 26 as amended by S.B. 1992 no. 80 (Natuurbeschermingswet G.B. 1954 no. 26 z.l.g. bij S.B. 1992 no. 80)	Putting in place arrangements for the protection and maintenance of nature monuments as well as the Nature Conservation Decrees for establishing nature reserves.
National Planning Act G.B. 1973 no. 89 (Planverordening G.B. 1973 no. 89)	Providing provisions for national and regional planning, e.g., land-use policy issues.
Forest Management Act S.B 1992 no. 80 (Wet Bosbeheer S.B 1992 no. 80)	Providing a framework for forest management, and sustainable utilization of the forest resources.

Source: Table drafted by ESS. 2023. Retrieved from partial report National Circumstances and Institutional Arrangements

Furthermore, significant legislative developments have occurred, since the submission of the Second National Communication to the UNFCCC (NC2); however apart from the Environmental Framework Act, no legally binding products have been established. The following text summarizes these legislative developments:

- The draft Coastal Protection Bill (*Wet Bescherming Kustgebied*), specifically designed to protect the vulnerable coastal ecosystems from anthropogenic pressures such as urban development and climate change;

- Three important Bills relevant to governance of water resources which were submitted to the Parliament in 2018 (NAP, 2019):
    - Conservation and Management of Water Aquifers (*Grondwater Beschermingsgebieden*);
    - Groundwater Management (*Grondwater*);
    - Control of Drinking Water Quality (*Toezicht Drinkwater Kwaliteit*);

- A draft law for the protection of the mangrove forest along the North Atlantic coast of Suriname was prepared and submitted to the Parliament for review in 2015 (Mangrove Forum Suriname (MAFOSUR), 2019);

- The Sustainable Nature Management Act (*Wet Duurzaam Natuurbeheer*). This Act is currently drafted using a participatory process, to enable improved management of protected areas. This is intended to replace the Nature Conservation Act (NDC 2020, 2019).

In addition, national strategies and plans are developed to facilitate the implementation of UNFCCC through national policies, these include the following:

- National Climate Change Policy, Strategy and Action Plan (NCCPSAP) published in 2015. The NCCPSAP aims at reducing the country's vulnerability through the implementation of climate resilience measures in the coastal area, as well as in the Interior while bringing development through sustainable and clean technology. In addition, emphasis will be placed on research to generate data on the vulnerability of Suriname, on cross-sectoral awareness-raising campaigns and on delivering climate resilience measures;

- Draft National Energy Policy (2013-2033), with the objective to increase the efficiency, transparency, sustainability and accountability of the power generation sector;

- National Development Plan 2022-2026, focused on 4 thematic areas. These are economy, social-cultural dimension, spatial planning and environment and management. The goals set forth within this plan are in alignment with the Sustainable Development Goals. Specifically, with regards to climate change, the goal is to take urgent action to combat climate change and its impacts. A strategic action point to reach this goal is to integrate climate change mitigation and adaptation into national policies, strategies and planning;

- Suriname's first Nationally Appropriate Mitigation Action (NAMA) was finalized in 2019. A NAMA is considered to be a tool which is applied to integrate consideration of climate change into a country's development planning. The primary objective of Suriname's NAMA is to facilitate the adoption and provision of reliable access to affordable renewable energy solutions in the Interior. In addition, the NAMA will contribute towards accelerating the reduction in greenhouse gas (GHG) emissions and significantly contribute to strides in sustainable and inclusive growth and development;

- National REDD+ Strategy of Suriname finalized in 2019 outlines Suriname's mitigation actions focused on the forestry sector, formulated in its REDD+ vision and the policies and measures necessary to achieve that. The strategy includes policies and measures for improved forest governance (including sustainable forest management), robust land use planning, forest conservation and rehabilitation of forestland on mined out areas. A crucial measure within the strategy is conservation of the mangrove forest. This should be seen as one of many tools that Suriname will utilize to access climate finance and partnerships in order to remain a HFLD country;

- the Government of Suriname organized the High-Level Conference of High Forest, Low-Deforestation developing countries on Climate Finance Mobilization from 12-14 February 2019. On February 14th 2019, the "Krutu of Paramaribo Joint Declaration" was adopted by the HFLD developing countries present at the meeting;

- Policy Document of the Ministry of Spatial Planning and Environment (ROM) which contains assigned tasks and current capacity of the said Ministry. The policy document also includes the reform policy with regard to the environment and spatial planning in Suriname. The objectives of the Ministry of ROM correspond with the Sustainable Development Goals (SDGs), including SDG goal no. 13, which deals with actions to combat climate change and its impacts. The focus towards this SDG goal is to implement actions and measures contained in the policy documents which were previously finalized and submitted to the UNFCCC. In addition, an overview is provided of sustainable financing mechanisms which offers possibilities for Suriname to finance climate objectives;

- National Adaptation Plan (NAP) finalized in 2019, with the objective to enable Suriname to conduct comprehensive medium and long-term climate adaptation planning. The plan builds on the country's existing adaptation activities and mainstreams climate change into national decision-making, development planning, policies, and programs. The goals of the NAP are to reduce the impact of climate change through adaptation, resiliency building and integration and mainstreaming in a coherent manner, into relevant new and existing policies, programs, activities and development planning processes and strategies, across multiple sectors and levels as appropriate;

- National Mangrove Strategy Suriname (NMS) finalized in 2019, which promotes the strengthening of the legal framework (including enforcement) and introduces adaptation technologies to support the sustainable and effective management and monitoring of mangrove ecosystems. Emphasis is placed on building institutional capacities. The NMS will help the Government of Suriname (GOS) in their ambition regarding mangrove management, rehabilitation, and expansion. In addition, the NMS will support the GOS in their strategic planning for integrated coastal management (ICM) with specific focus on mangrove ecosystems.

Multilateral Environmental Agreements

Suriname has ratified the UN Convention on Biological Diversity (UNCBD; 11 April 1996) and UN Convention to Combat Desertification (UNCCD; 6 January 2000). Furthermore, Suriname ratified the Kyoto Protocol (25 September 2006) and the Paris Agreement (13 February 2019) which are part of the UN Framework Convention on Climate Change (UNFCCC). The Ministry of Spatial Planning and Environment (ROM) is the focal point for these conventions, and among others, the National Designated Authority (NDA) for the Green Climate Fund (GCF), the Global Environment Facility (GEF) focal point and in collaboration with the National

Institute for Environment and Development in Suriname (NIMOS) the focal point for the Clean Development Mechanism (CDM).

1.12. Environmental Management Structure

On 7 May 2020 the Environmental Framework Act S.B. 2020 no. 97 (Milieu Raamwet S.B. 2020 no. 97) was proclaimed. Subsequently the National Environment Authority (NMA) was established as an independent administrative body with legal personality, which for budgetary purposes falls under the competence of the Ministry of Internal Affairs. According to this Act, the NMA would consist of the former Coordination Environment Office[17] and NIMOS, tasked with the responsibility of coordination, implementation, and monitoring of the provisions of this act.

After the General Elections of May 25th, 2020, it was established by Presidential Decree of 9 September 2020 (PB 2020 no. 31) that environmental management in Suriname will fall under the direct competence of the Ministry of Spatial Planning and Environment (ROM). In addition, a transition period of 18 months was taken into account by the Ministry of ROM and NMA for an adequate institutional set - up of the organization, which commenced on August 15, 2020. According to this Decree, NIMOS serves as the technical executive body of ROM and therefore reports to the said Ministry.

The current Government institution in charge of environmental management within ROM is the Directorate for Environment (DE), which practically seen, is just a transformation from the former Coordination Environment Office. The DE plays a pivotal role in the formulation of environmental policy and the monitoring of the implementation of this policy and is also the national focal point for all MEAs as well as national, regional, and international environmental organizations. The latter is conducted in collaboration with the Ministry of Foreign Affairs, International Business, and International Cooperation. The NMA will function as executive and supervisory body and will provide the necessary support to the Minister of ROM. The NMA will be responsible for implementing relevant regulations (state decrees) which are prescribed based on the Environmental Framework Act S.B. 2020 no. 97 (*Milieu Raamwet S.B. 2020 no. 97*) and is yet to be operationalized.

Other stakeholders functioning as key agencies with specific global environmental management mandates relevant to the UNFCCC implementation are set out in Table 2, including companies relevant for data provision.

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[17] Before the parliamentary election in May 2020, environmental management was the responsibility of the Coordination Environment, which resided under the former Cabinet of the President with the National Institute for Environment and Development in Suriname (NIMOS) as the technical executive body.

Table 2 Institutional arrangements for climate change governance in Suriname

Stakeholder name	Climate change related mandates
Ministries	
Ministry of Public Works (OW)	• Planning and implementation of civil engineering and infrastructural works; • Water management and drainage; • Hydrological and meteorological services; and • Waste management and spatial planning.
Ministry of Foreign Affairs, International Business & International Cooperation	The coordination of international cooperation, including technical, financial, economic, and cultural cooperation with foreign countries (bilateral, multilateral, and international NGOs) and relevant ministries.
Ministry of Natural Resources	Ensuring the continued availability of affordable, reliable electrical energy for the total population and for the projected economic growth; securing and guaranteeing sufficient drinking water of reliable quality for the Surinamese population at affordable prices.
Ministry of Land Policy and Forest Management	Responsible for nature management and conservation, checking compliance with rules and regulations related to the production of wood and wood products, flora and fauna.
Ministry of Health	Ensuring the quality, availability, and accessibility of healthcare throughout the country.
Ministry of Finance and Planning	Responsible for general financial, monetary, and fiscal policy, as well as for investment policy, which is drafted in collaboration with relevant Ministries. Ministry of Finance and Planning is responsible for the organization and control of the financial administration of the state.
Ministry of Regional Development and Sports	• Directorate Agricultural Development Inland is responsible

	for developing and promoting the agricultural sector in the Interior; • Directorate Sustainable Development Indigenous People is responsible for developing programs, projects and activities deemed necessary for the systematic improvement of housing and living conditions, and the capacity building of the Indigenous Communities in Suriname; and • Sustainable Development Afro-Surinamese Inland is responsible for developing programs, projects and activities that are deemed necessary for the systematic improvement of the housing and living conditions and the strengthening of the capacity of the Afro-Surinamese who live in tribes in Suriname.
Ministry of Agriculture, Animal Husbandry and Fisheries (LVV)	• Data provider, responsible for estimating the emissions from the agriculture sector; and • technical advisory and awareness roles.
Department / agencies	
The National Coordination Center for Disaster Management (NCCR)	Coordinator and facilitator for crisis and disaster management.
National Institute for Environment and Development (NIMOS)	• environmental management/pollution control • environmental and social impact assessment (ESIA)
The Foundation for Forest Management and Production Control (SBB)	• enforcement of the Forest Management Act • data provider, technical working arm of the Ministry of Land Policy and Forest Management (Ministry of GBB) and is responsible for the calculation of the emissions from the AFOLU sector
Meteorological Service (MDS)	• Responsible for collection, analysis, and distribution of atmospheric information

	• Data provider
Civil aviation department	• Data provider
Maritime Authority in Suriname (MAS)	• International marine legislation and monitoring • Data provider
General Bureau of Statistics (ABS)	• Provider of statistical data, archiving center • Data provider
AdeKUS (including its research institutes)	• Research and education • Data provider, public awareness, and technical advisory roles
Energy Company Suriname (EBS)	• Sole public distributor of electricity • Data provider and technical roles (implementation of measures)
Suriname Water Company (SWM)	• Public supplier of potable water • Data provider and technical roles (implementation of measures)
Planning Office	• Responsible for developing the Annual Plans
Companies / institutions / organizations	
Staatsolie Maatschappij Suriname	Data provider
Mining companies (Newmont, Iamgold etc.)	Data provider
Oil import companies	Data provider
Suriname Business Association (VSB)	Support the mobilization of data provision from their members
Association of Surinamese Manufacturers (ASFA)	Support the mobilization of data provision from their members
NGOs (CI, WWF, Tropenbos, ACT, GHFS etc)	Data providers, public awareness
UNDP Country Office Suriname	Observer, provide overview and ensure synergies with other environmental projects going on in Suriname
IDB Office Suriname	Observer, provide overview and ensure synergies with other environmental projects going on in Suriname

Source: Table drafted by ESS. 2023. Retrieved from partial report National Circumstances and Institutional Arrangements

Several institutions joined forces in 2016 and formed a consortium called Suriname Environmental Information Network (SMIN). The objectives of this network are to produce official and formal environmental data and information for the purpose of national policy and planning, to develop a consistent reporting process and to publish information and advice (NAP, 2019).

A draft terms of reference for the SMIN has been developed along with a number of Memorandum of Understandings (MOU's) with ABS, SBB, CELOS, MDS and Tropenbos International Suriname. The process to develop this and other information systems further has been taken up by the REDD+ readiness project and will be continued by NIMOS. The SMIN will be highly beneficial for forthcoming NCs, and vice versa, considering that the NC projects will also supplement data into the network and promote consistency with other reporting.

A major goal of the NC3 process is to establish structures to facilitate reporting to the UNFCCC on a continual basis. For the preparation of the NC3, a structure (see figure 11) has been established with the aim to remain functional, also with reference to future National reports to the UNFCCC/PA, such as National Communications (NCs) and Biennial Transparency Reports (BTRs) and that the positions will be headed in an increasingly institutionalized manner in support of continual reporting. The recently established Environmental Framework Act makes it legally obliged for national actors to provide data and contribute to the reporting. This development will be a major step forward in future reporting to the UNFCCC/PA. Consultants and others who underwent training in UNFCCC reporting during the NC3 process will be required to share their knowledge by contributing to climate change reporting beyond NC3 and/ or to assist with training institutions in the next reporting period.

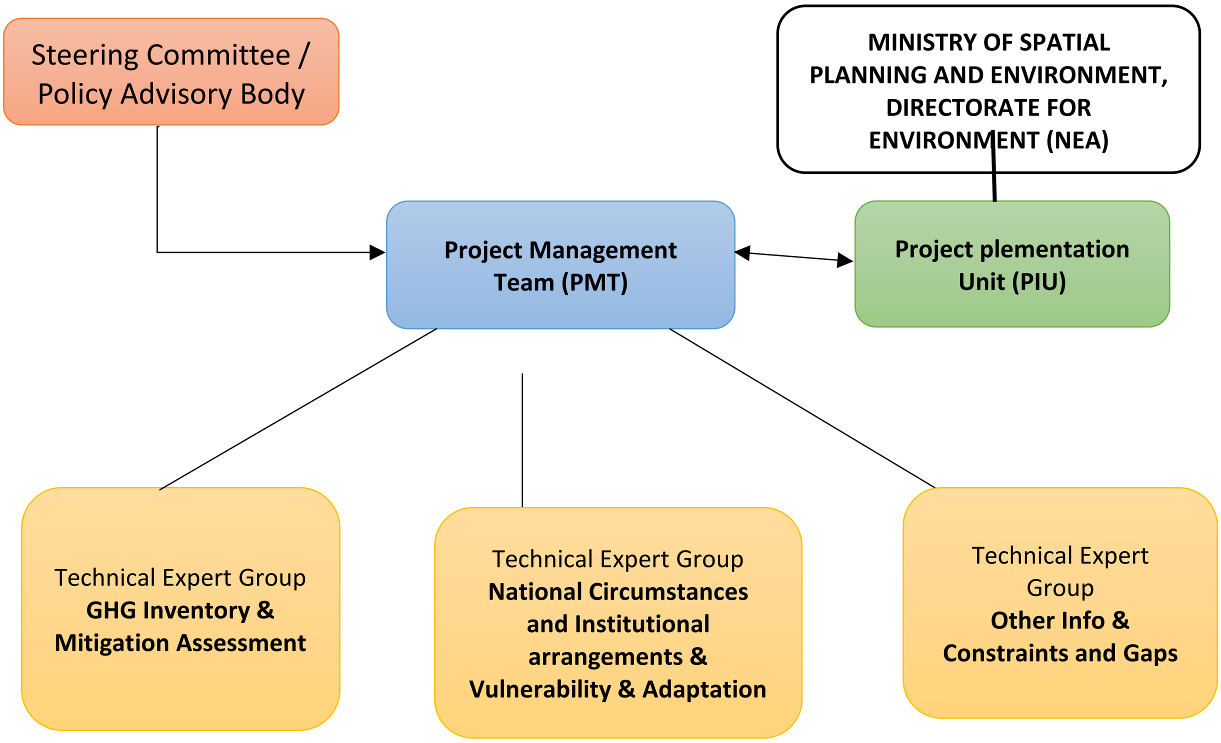

Figure 11 Organogram institutional arrangements for NC3
Source: Figure adapted from the project's Institutional Arrangements

1.12.1. Institutional Arrangements for NC3 Project

Suriname’s Third National Communication (NC3) was prepared by the Directorate for Environment within the Ministry of Spatial Planning and Environment, the National Executing Agency (NEA) for this project, in close collaboration with UN Environment.

The NC3 team consisted mostly of independent experts. The Foundation for Forest Management and Production Control (SBB) and the Ministry of Agriculture, Animal Husbandry and Fisheries (LVV), apart from ROM, were the Government institutions involved in the greenhouse gas (GHG) inventory and mitigation assessment.

The project activities were coordinated by the Project Coordinator (PC) in joint collaboration with the focal point from the NEA and three Coordinating Lead Authors (CLAs), all together forming the Project Management Team (PMT). The CLAs were responsible for their respective components, namely GHG inventory and mitigation assessment; national circumstances and institutional arrangements and vulnerability assessment; as well as other Information, gaps & constraints.

In order to produce and finalize the respective chapters, each CLA had a Technical Expert Group (TEG) who were responsible to, among others, collect and analyze data and provide their input. These TEGs have worked in joint consultation with, and under the guidance and supervision of the CLA.

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Chapter 2

Measures to Facilitate Adaptation to Climate Change

Photo credit: © GCCA+/EU 2020. February 29, 2020

2 Measures to Facilitate Adaptation to Climate Change

2.1. Introduction

This chapter presents a unified consolidation of information on climate scenarios, vulnerability assessment, and adaptation in Suriname. The information for the sectors: energy, water resources, agriculture and cross-cutting have been processed in partial chapters, covering information about their vulnerability and impact on climate change, adaptation measures and analyzed projection scenarios for coping with climate change.

The vulnerability assessment executed for several sectors gives an overview of the status of how vulnerable Suriname is to the adverse effects of climate change. During the execution of the vulnerability assessment various studies were ongoing and/or had recently been completed. The analysis and climate projections made in these studies were thus up-to-date and useful for this vulnerability assessment. Several scenarios have been reviewed and improved where necessary to visualize the knowledge on this topic. Based on these projections, recommendations have been put forward to facilitate adaptation to climate change. To this end, desk research and stakeholder consultations were conducted to improve and update the baseline data of the climate conditions from the Second National Communication (NC2) that was published in 2016 and the National Adaptation Plan of Suriname (NAP) 2019-2029. Based on the improved data, climate projections were made for the different sectors, which form the foundation for the updated vulnerability assessment and adaptation measures presented in this report. The State of Climate Report of Suriname (SOC) published in 2021, was also consulted, in conjunction with results from consultations with key stakeholders and expert knowledge.

2.2. Baseline Climate Conditions and Projections

Establishing national baseline climate conditions not only provides information on the current conditions with regards to the climate, but also serves as the reference period from which the modelled future change in climate is calculated. The latter is indispensable for enabling the vulnerability assessment and recommending sound adaptation measures. This chapter provides an overview of the general methodology used to establish the baseline in Suriname and the actual baseline climate conditions.

2.2.1. Methodology

The methodology used to establish the baseline for this chapter "climate change Vulnerability Assessment and adaptation Strategy" comprised of the following steps:

1. Desk research on baseline climate conditions (at 6 meteorological stations, namely Cultuurtuin (Paramaribo), Zanderij, Coronie, Nieuw Nickerie, Stoelmanseiland and Kwamalasamutu) in the following reports:
   a. Second National Communication (NC2) published in 2016;
   b. National Adaptation Plan of Suriname (NAP) of 2019 – 2029;
   c. State of Climate Report of Suriname (SOC) published in 2021.
2. Comparison and update of the baseline conditions using results from the desk research.
3. The experts reviewed the climate scenarios of previous studies and made updates where applicable. The results of the vulnerability assessment were presented and validated with or by a wide range of stakeholders. This momentum was opportune for stakeholders to present their input on the severity of the impacts of threats and propose the adaptation measures for the various sectors, mainly for the water resources and cross cutting sectors. Through an online survey, the results for the water resources sector were once more verified.

2.2.2. Baseline Climate Conditions

In general, climatic conditions in Suriname have remained consistent throughout the year for decades: the variation of annual temperature is only 2-3 degrees Celsius and there are insignificant changes in rainfall (excluding the extremely dry and wet years). Taking this into consideration, it's clear to state that the climate of Suriname is relatively stable. The current climate condition is presented in the sections below for the most relevant parameters: precipitation, temperature and wind.

2.2.2.1. Precipitation

Based on the available data, the NC2 (2016) and the NAP (2019) both stated that the highest amount of rainfall (about 3,000 mm/yr.) is observed in the center of the country, and the lowest amount in the north-western part of the country (less than 1,750 mm). In the capital Paramaribo and district Wanica, rainfall varies widely, from 1,400 mm/yr. in the North to 2,100 mm/yr. in the South (NC2, 2016). To the South of this zone (except for the central part of the country) yearly rainfall varies on average from 2,000 to 2,350 mm/yr. Examples of exceptionally wet years were 2006 and 2022, when large amounts of rainfall caused significant areas along rivers upstream to be inundated. However, it has been noted that this type of event seems to reoccur every 25-75 years (SOC, 2021).

Recent analysis of data of the period 1990-2014 in the SOC report (2021) has shown that the accumulated yearly precipitation in Suriname is over 1,500 mm for all the regions of Suriname, with a maximum in the southwest receiving more than 3,000 mm/year, and the coastal region with more than 2,500 mm/year. Precipitation during the period 1990-2014 has shown a strong increasing trend in seven points of interest, including up to 546.6 mm/decade in Kwamalasamutu as presented in table 3.

Table 3 Annual average value, decadal rate of change and probability of occurrence for accumulated precipitation in different locations 1990-2014

Location	Average value (mm/y)	Rate of change per decade	Probability of occurrence
Paramaribo	1,756.1	+319.3	extremely likely
Albina	2,469.4	+121.2	likely
Bigi Pan MUMA	1,796.4	+300.9	extremely likely
Brokopondo	1,556.4	+318.3	extremely likely
Kwamalasamutu	2,391.6	+546.6	Extremely likely
Tafelberg	1,851.9	+367.6	extremely likely
Upper Tapanahony	1,926.3	+459.9	extremely likely

Source: SOC Report team elaboration

Source: Table adapted from State of the Climate Report: Suriname (SOC), 2021, listed in the partial report: Vulnerability Assessment and Adaptation Measures for the Water Sector, Amatali, M.A., February 2023

2.2.2.2. Temperature

According to the NAP (2019), the variation of annual temperature is 2-3°C. Average annual temperatures range between a minimum of 24.0 and a maximum of 30.9 °C. The range in average temperatures between the warmest and the coldest month is 2.4 degrees Celsius. During the period 1961-2008 there was a slight increasing trend observed of the mean temperature at station Cultuurtuin with 0.016 °C/year. On the contrary in the Hinterland, at station Zanderij, no significant trends in temperature change were observed.

The more recent SOC report (2021) showed that during 1990 – 2014, the average daily temperature throughout most of the country was similar, which was around 27°C except for the southern border, in which higher elevations lead to slightly lower mean temperatures. Maximum daily temperatures averaged 32°C slightly inland and on the eastern border, around 33°C. Minimum temperatures were higher in the coastal region around 25°C, and decreased constantly going south and towards higher ground, reaching 21°C in the highest point of the country.

At selected locations in seven of the ten districts during the period 1990-2014 the temperature was higher during the long dry season, particularly in October, and had two minimums during the wet seasons.

2.2.2.3. Wind

Winds are generally light, with annual averages of about 1.3-1.6 on the scale of Beaufort (or 1-5 m/s). The daily wind-speed variation is higher, up to 3-4 Beaufort (3-8 m/s). High winds in Suriname correspond with the occurrence of heavy thunder showers at the end of the rainy season, called *Sibibusi*, reaching speeds of up to 20-30 m/s (NAP, 2019).

Extreme weather conditions often occur related to El Niño and La Niña events. There may be a connection between extremely dry conditions and strong El Niño events, as well as between extremely wet conditions in the country with strong La Niña events. Extreme weather conditions are also observed during *Sibibusi* events, when wind speeds of up to 58 knots occur. Such winds can cause significant damage in urban areas (NAP, 2019). According to the SOC report (2021), the maximum wind speed shows a descending trend, ranging from -0.52 km/h per decade in Bigi Pan MUMA to -0.8 km/h per decade in Upper Tapanahony as presented in the table below.

Table 4 Annual average value, decadal rate of change and probability of occurrence for maximum wind 1990-2014

Location	Average value (km/h)	Rate of change per decade	Probability of occurrence
Paramaribo	35.9	-0.5	very likely
Albina	34.25	-0.28	likely
Bigi Pan MUMA	35.85	-0.52	very likely
Brokopondo	29.69	-0.57	extremely likely
Kwamalasamutu	31.15	-0.73	extremely likely
Tafelberg	32.7	-0.66	extremely likely
Upper Tapanahony	33.7	-0.8	extremely likely

Source: SOC Report team elaboration

Source: Table adapted from State of the Climate Report: Suriname (SOC), 2021, listed in the partial report: Vulnerability Assessment and Adaptation Measures for the Water Sector, Amatali, M.A., February 2023

2.3. Expected Climate Change and Sea Level Rise Projections

With reference to the NAP (2019) and SOC (2021), the following projections are taken into account as included in table 5. These projections have been done for the year 2100 for all sectors. It is worth mentioning that the projections for the NAP were adopted from the NC2 (2016), while for the more recent SOC report, climate projections have also been developed.

Table 5 Comparison of climate projections adapted from NAP (2019) and SOC (2021)

Parameters	NAP (2019)	SOC (2021)
Sea-level	Rise of 1.0 m[18]	Increases by 0.25 m in the severe scenario by the end of the century.
Rainfall	Decrease of 10%	• Yearly accumulated rainfall is expected to decrease strongly. In general, the decrease could surpass 20% of the historical average. • The number of rainy days per year decreases, especially on the coastal and South-West part of the country. This leads to a shorter and drier rainy season in these areas, however with more intense precipitation events. The interior will experience heavy precipitation events ('wetter' (more rainfall – more water)), having impacts on the river water level and residential areas (flooding). • Maximum precipitation in 5 days and in 1 day will increase greatly for all locations. This, together with the decrease in the number of rainy days, points to a change of rain regime towards fewer but more intense precipitation events. • The short dry season precipitation, dry season precipitation and short rainy precipitation will become drier throughout the country. • The rainy season becomes drier at the coast but wetter in the interior.
Temperature	Increase (unknown value)	• Daily mean, minimum, and maximum temperatures are projected to increase in the entire country, although less at the coast and more in the southwest. • Frequency of hot days and hot nights will increase throughout the country. • Frequencies of cold days and cold nights will decrease and almost disappear.
Wind	Possible changes in wind speeds	• Maximum daily winds, gale wind days and strong wind days are projected to vary little. The main patterns visible in the historical map change very little in all scenarios and time horizons.
Humidity		• The climate in Suriname is expected to become drier, particularly in the South-West of the country.

Source: Compiled information retrieved from Suriname National Adaptation Plan (NAP), 2019 and State of the Climate Report: Suriname (SOC), 2021, listed in the partial report: Vulnerability Assessment and Adaptation Measures for the Water Sector, Amatali, M.A., February 2023

[18] The 1 m sea level rise projection is based on: 1. analysis of five major projections of sea-level rise; 2. exclusion of the IPCC projection (AR4) sea level rise, because new evidence is available that results in higher predictions than those found there; and 3. a lack of reliable data on sea-level rise in Suriname. In addition, local factors such as storm surge and subsidence should also be considered as important contributors to sea-level rise in Suriname (Amatali, 2023).

The decrease in precipitation is not limited to the southwest of Suriname but is applicable at all 7 stations as presented in table 6. Rainy days will decrease in number in the coast, while in the interior changes are not significant.

Table 6 Mean accumulated precipitation values (MM/y) for each scenario and period in seven locations

Locations	1990-2014	2020-2044		2045-2069		2070-2094	
		SSP2-4.5	SSP5-8.5	SSP2-4.5	SSP5-8.5	SSP2-4.5	SSP5-8.5
Paramaribo	1,756	1,596	1,496	1,493	1,486	1,476	1,350
Albina	2,470	2,270	2,161	2,156	2,160	2,128	1,970
Bigi Pan MUMA	1,796	1,633	1,531	1,525	1,522	1,510	1,379
Brokopondo	1,556	1,457	1,387	1,397	1,387	1,379	1,306
Kwamalasamutu	2,392	2,219	2,166	2,130	2,002	2,108	1,849
Tafelberg	1,852	1,718	1,651	1,667	1,541	1,634	1,458
Tapanahony	1,926	1,782	1,686	1,718	1,588	1,692	1,520

Source: SOC Report team elaboration

Source: Table adapted from State of the Climate Report: Suriname (SOC), 2021, listed in the partial report: Vulnerability Assessment and Adaptation Measures for the Water Sector, Amatali, M.A., February 2023

After comparison of the various studies as mentioned above, the following can be summed up:

- Apart from the 1.0 m sea-level rise and the rainfall decrease of 10% the results included in the SOC report (2021) support the projections included in the NAP (2019);
- In the SOC report the estimation of the sea level rise is 0.25m on the long term;
- Research done by Amatali (2022) on sea level rise, resulted in a sea level rise of 51.3 cm by the year 2100. The 1.0 m projection by the year 2100, as proposed in the NAP (2019) is however, still an acceptable projection when the linear extrapolation is considered, including future declination of the soil surface, storm surges and statistical probability of high water during coming century, and future development of emission of GHGs. This 1.0 m projection by the year 2100, has been adopted for NC3.

Therefor the climate projections calculated based on the A2 and B2 IPCC scenarios for NC3 by the year 2100, are as follows (NAP, 2019):

1. The overall annual mean air temperature in Suriname will increase with 2-3°C by the year 2100;
2. The overall annual mean precipitation will decrease with 10% by the year 2100;
3. While precipitation will decrease, the intensity of rains will increase and become rarer;
4. The duration of the dry seasons will increase;
5. Increase in weather extremes, including high winds;
6. Maximum wind speed is expected to increase moderately;
7. Sea level will rise by 1.0 m by the year 2100.

2.4. Vulnerability and Impact Assessment

In this part reporting is done for the vulnerability and impact assessment for the energy, water resources, agriculture and cross-cutting (education, health, environment, spatial planning, and disaster risk reduction) sectors, based on the climate projections presented in section 2.3. The selection of these sectors was based on the roadmap for implementation of the NAP, whereby the national climate change adaptation is focused primarily on the productive sectors with the most vulnerable risk profiles.

2.4.1. Energy

2.4.1.1. General

An overview of Suriname's main energy suppliers is presented in the table below. Staatsolie Maatschappij Suriname N.V and NV Energie Bedrijven Suriname (NV EBS) provide the coastal zone with electricity, whilst 130 villages in the interior are supplied by DEV with diesel generators for their energy supply (Lachman, 2022).

Table 7 Overview Suriname's main energy suppliers

Producer	Plant	Capacity (MW)
Staatsolie	Thermal power plant	96
	Afobaka Hydropower Plant	189
NV EBS	EPAR thermal power plant	168
	ENIC thermal power plant	25
DEV	Diesel generators in approximately 130 villages	4.5

Source: SOC Report team elaboration

Source: Table adapted from State of the Climate Report: Suriname (SOC), 2021, listed in the partial report: Vulnerability Assessment and Adaptation Measures for the Energy Sector of Suriname, Lachman, D., November 2022

Staatsolie produces 15,000 barrels of oil per day and exports crude oil, diesel oil, fuel oil, and bitumen. Two main production sites of the company are the Tambaredjo and the Calcutta oilfields, which are located in the coastal district Saramacca. Staatsolie runs a thermal power plant with a capacity of 96 MW, from where on average of 35-45 MW of electricity is transferred to NV EBS for distribution. NV EBS also purchases diesel from Staatsolie (Lachman, 2022).

The Afobaka hydropower plant, owned and operated by the Staatsolie Power Company Suriname (SPSC), an independent power producer and subsidiary of Staatsolie, has a capacity of 189 MW. The power generated at Afobaka is transferred to NV EBS for distribution, supplying almost half of the electricity consumption of Paramaribo and its surroundings. Other hydro-systems are a 40kW micro-hydropower plant at Poeketie and 405 kW mini-hydropower plant at Gran Olo in Sipaliwini. The NV EBS provides most of the country with electricity through two centralized large-scale electricity generation systems: Electricity Paramaribo (EPAR), and Electricity Nickerie (ENIC). EPAR and ENIC generate electricity with thermal fuel oil and diesel power plants respectively in Paramaribo and at Clara Polder.

2.4.1.2. Impacts on the Energy Sector

The identified vulnerabilities of the energy sector are presented from a commodity, network, and holistic perspective and well as follow:

1. **Commodity perspective:** Suriname is relatively energy intensive since it depends on energy intensive sectors such as the petrochemical and mining & metals industry. Energy use per capita has been rising during favorable economic times, while usage per unit of Gross Domestic Product (GDP) has been decreasing. This alludes to the notion that more energy is being consumed but less for productive uses. The reasons for this can be found in urban sprawl, energy inefficient housing and buildings, traffic intensity, etc. In other words, interruption of energy services will have relatively large ramifications, because of the specific local characteristics mentioned above.

2. **Network perspective:** divided in
    a. *Transmission & distribution network:*

Suriname has a number of isolated networks, as depicted in figure 12. Apart from the EPAR network, all island systems are fed by a single generating unit from where power is dispatched to users. This inadvertently implies that in the event of extreme weather, such as flooding, high winds, etc. that can adversely impact infrastructure, this dependence on a single dispatch renders high risk for energy insecurity. This risk is about to increase since extreme weather events are likely to rise and might be even more catastrophic in the "tipping point" scenario. Also, in the case of the EPAR network, electricity is dispatched from just three locations, of which the Afobaka hydroplant can supply more than half of the demand. Though spare capacity exists, especially at the EBS power station, it is unlikely that it will be able to fully make up for lost capacity (also considering transmission infrastructure), when dispatch from the hydroplant is rendered impossible. Also, interruptions in supply will affect a relatively large portion of the economy/ population due to the high population density that is served by the EPAR network.

Increased demand for climate control due to elevated temperatures will result in an increase in energy demand to run climate control machinery. The transmission and distribution network (and thus all its separate components) need to be able to carry this extra (peak) demand. If the capacity of just one part of the network is insufficient, the reliability of the entire system can be put into danger, resulting in brownouts and blackouts.

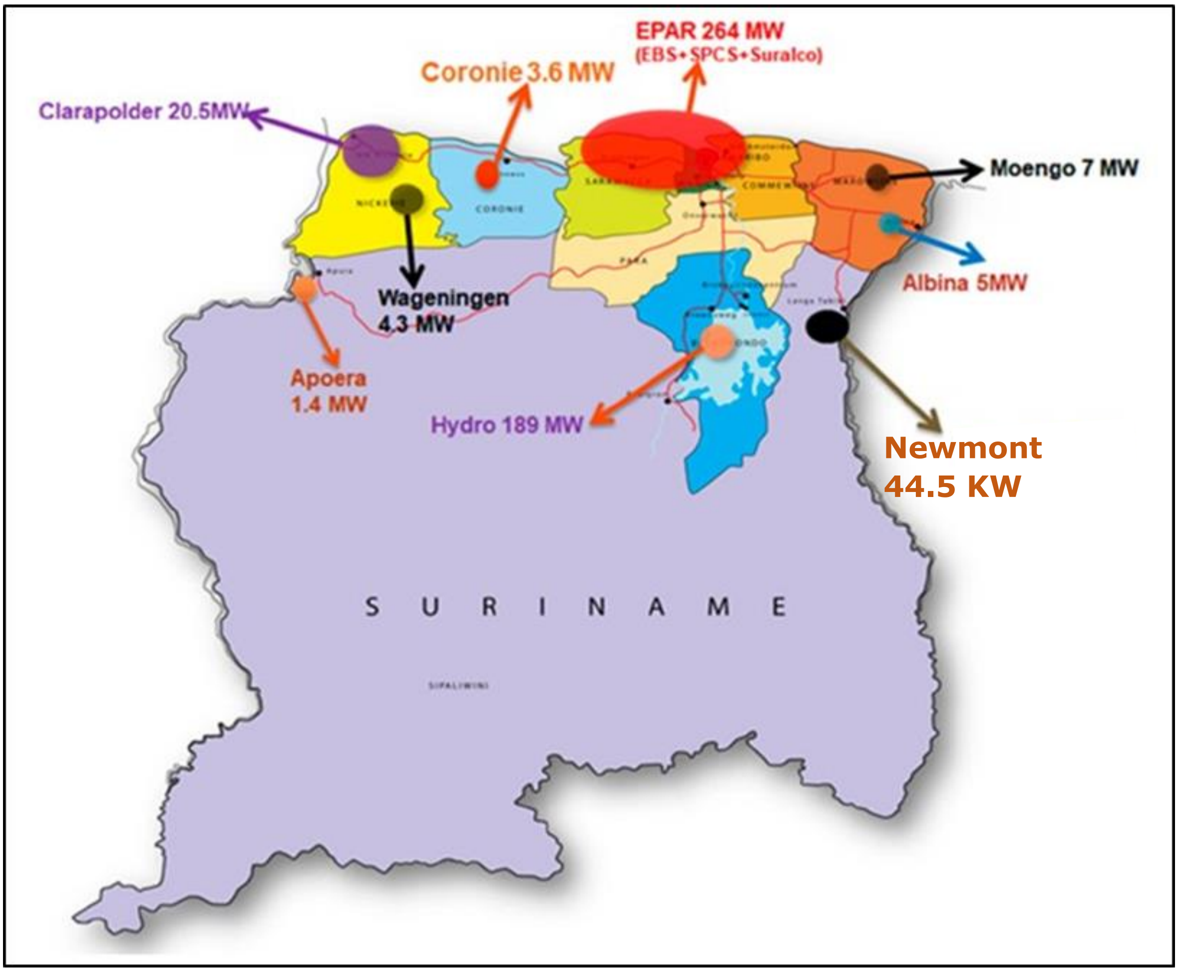


Figure 12 Locations in the coastal area with small and isolated electricity networks
Source: Adapted from the partial report: Vulnerability Assessment and Adaptation Measures for the Energy Sector of Suriname, Lachman, D., November 2022

b. Generating systems:

i. Extended periods of intense drought result in severe water availability reduction for the Afobaka hydropower plant.

ii. Increases in precipitation can lead to more downstream sedimentation, leading to algal blooms in hydroelectric dams and congestion through the blockage of turbines of hydroelectric plants. Both lead to interruptions in energy supply and demand more maintenance of the dam and power plant.

iii. Thermal plants function based on the temperature difference between their combustion products and the ambient environment. Increases in ambient air and water temperatures can reduce the thermal efficiency of thermoelectric power plants, resulting in reduced power output (Sims et al., 2007).

iv. Increased demands for cooling will require more capacity to generate electricity. Which will lead to overwhelming of the available back-up capacity and create less opportunity for (intrusive) maintenance and repairs (Sims et al., 2007).

v. Rising sea levels will lead to an increase in salinity of the water upstream of the Suriname River where two power plants reside that service the EPAR network. This can put an increase in strain on maintenance and also warrant processing water intake first before any cooling, thereby increase the cost of electricity produced (Magrin et al., 2007).

c. Holistic perspective:

Transportation (Margin et al., 2007)

i. Because of the dense built environment and decades of urban sprawl, transportation requires relatively high amounts of energy per unit of distance. This notion is exacerbated by the fact that public transport is arranged through the means of one (1) single wheel-and-spoke system, with the center of the wheel being the center of the capital. In other words, to move from one "spoke" to another, one must first travel to the center of Paramaribo (see figure 13). This renders the use of public transportation, which is very time consuming, and makes many opt for private transportation. Most, if not all, transportation is based on fossil fuels, which combined with the dense urban environment and high travel times, result in not only more exhaust gases per unit of travel distance but also relative more additions to the perceived ambient temperature near urban travel routes. This in turn increases the demand for climate control.

ii. The majority of the fossil fuels used in transportation are imported. Climate change is expected to impact global supply chains (especially considering extreme weather events) and can thus derail a large portion of the domestic transportation sector.

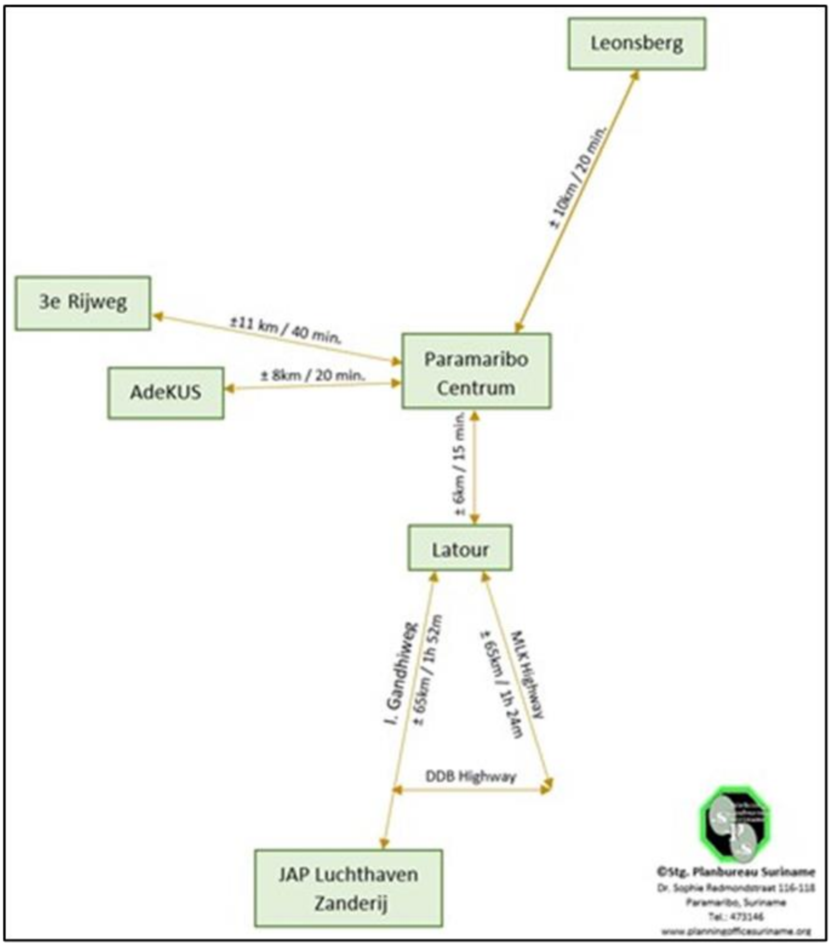


Figure 13 Example of distance and associated time duration related to travel with automobiles

Source: Adapted from the partial report: Vulnerability Assessment and Adaptation Measures for the Energy Sector of Suriname, Lachman, D., November 2022

Urbanisation: more than 90% of the economic activities are located in the coastal zone especially in the Paramaribo and Wanica districts. When jointed together, these activities account for more than 80% of the country's GDP. This indicates the huge importance these coastal areas hold for Suriname's economy as a whole. Due to a lack of spatial planning, urban sprawl has been rampant over the past few decades, resulting in residential, commercial, and industrial areas being intertwined with travel routes cross cutting these areas (see figure 14).

Not only does this lead to a further centralization (and this higher risk) of the EPAR network, but also leads to the heat island effect: concentrated human activities increase ambient temperatures leading to an increase in use of climate control equipment. However, this in turn releases waste heat and thus adds again to the increase in ambient temperatures, thus creating a vicious cycle. Global warming resulting in climate change will further exacerbate this cycle.

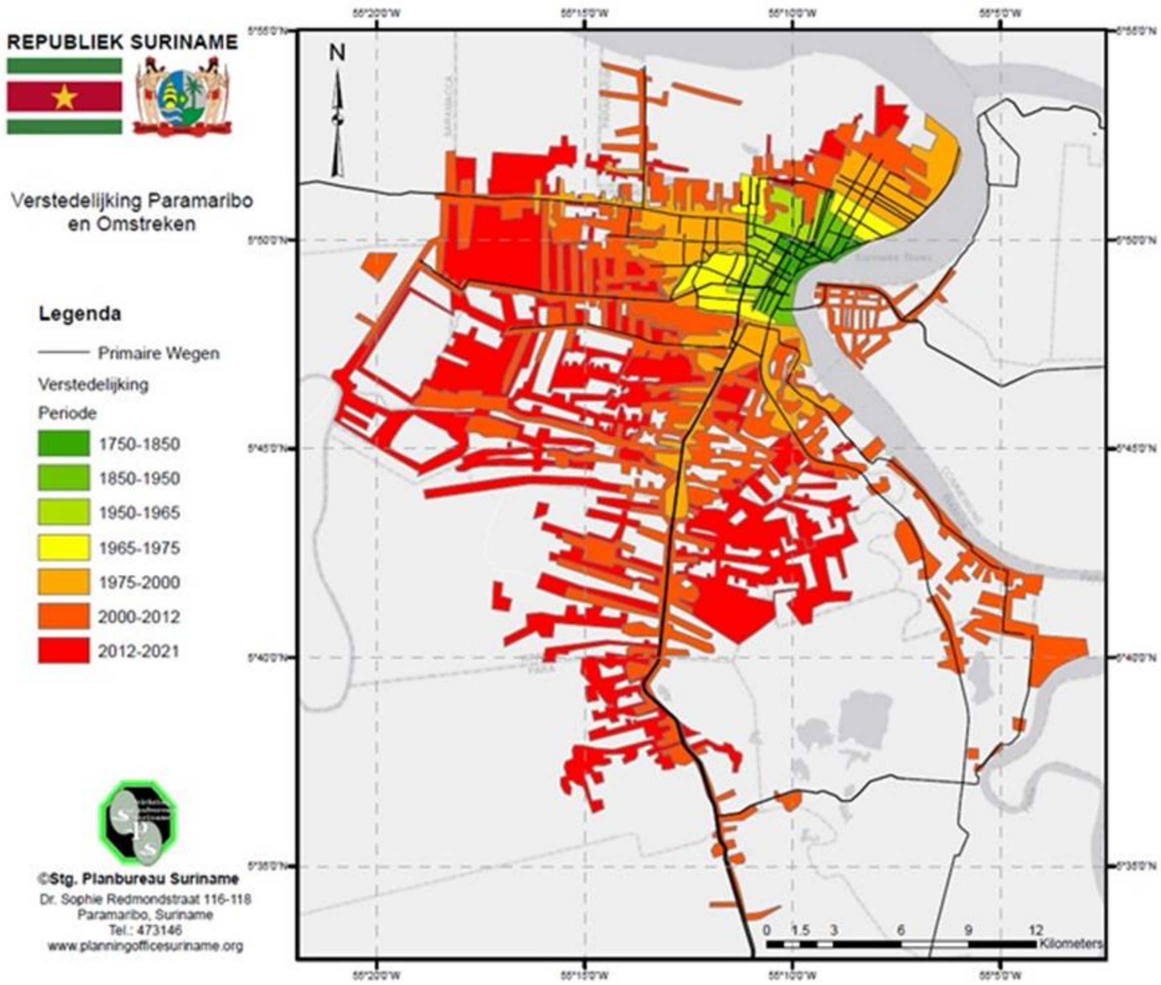


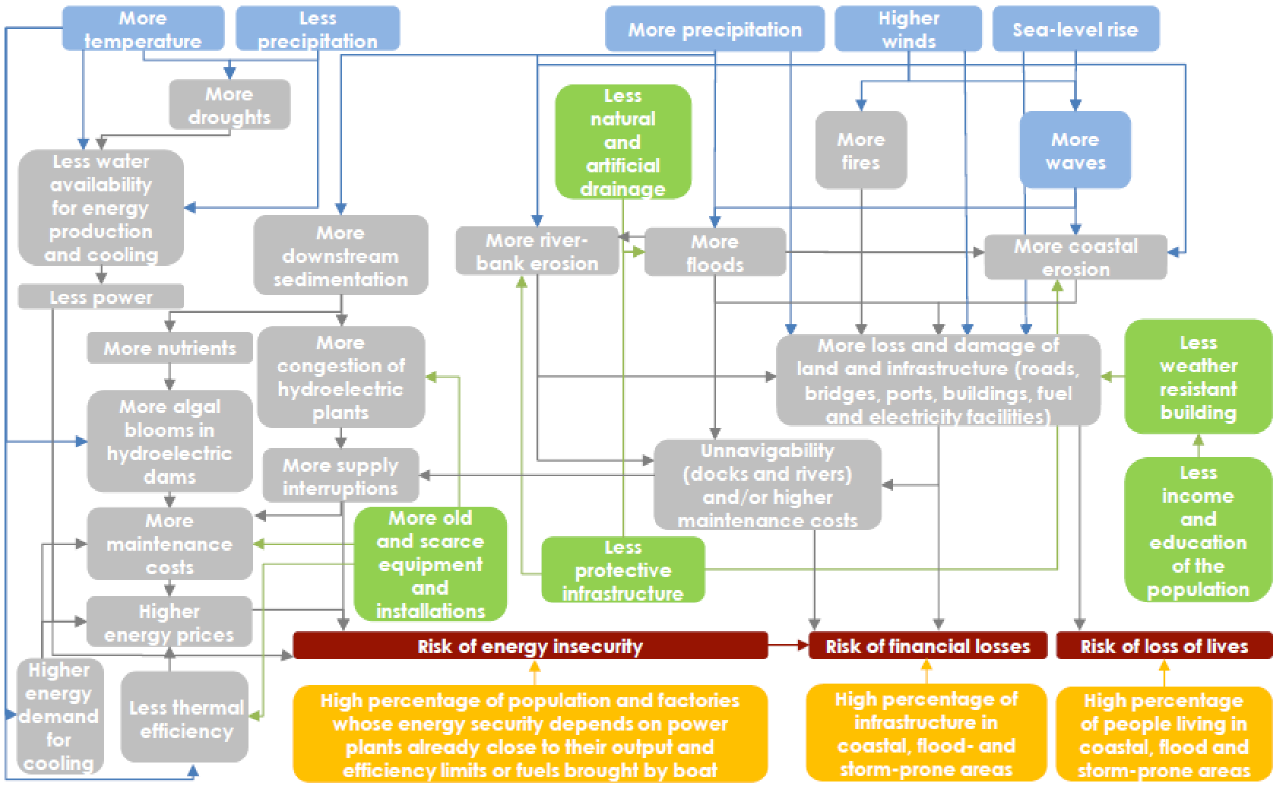
Figure 14 Urban sprawl of Greater-Paramaribo over time
Source: Figure adapted from Stichting Planbureau Suriname, 2021, listed in the partial report: Vulnerability Assessment and Adaptation Measures for the Energy Sector of Suriname, Lachman, D., November 2022

Interior: In the hinterland, electricity provision is poor for reasons of difficult accessibility, poor fuel supply, low population density and high transportation costs of fuel. The total number of people affected by these poor conditions is approximately 30,000, or about 15% of the population. Some specific vulnerabilities related to climate change and the interior are (Georgieva et al., 2021):

a. Flooding and landslides in the interior can disrupt energy systems.
b. Maintaining current operating models where fuel for diesel generators is transported from the capital and then by boat to the villages, will suffer from a reduced or more costly fuel supply due to increased difficulties to navigate rivers.
c. Especially in the interior, women play a pivotal role in natural resources management and in other productive and reproductive activities at the household and community levels. Disruption of failed electricity provision systems will affect them therefore relatively harder.

d. Reduction in precipitation and an increase in ambient temperature with higher evaporation rates in the interior will lead to competition in the use of the water resources between those households, where women collect drinking water, and the electricity generating systems, such as thermal and hydro plants.

The SOC report has produced the overview as shown in Figure 15, which depicts some of the vulnerabilities mentioned in this section. It presents the most important hazards in blue, the intermediate impacts in grey, and final risks in red. These in turn produce the factors, exposure in yellow, and vulnerability in green. It must be noted however that this depiction primarily focuses on the generation aspect of the energy provision.



Source: SOC Report team elaboration

Figure 15 Overview of some of the vulnerabilities, especially related to the energy sector
Source: Figure adapted from the State of the Climate Report: Suriname (SOC), 2021, listed in the partial report: Vulnerability Assessment and Adaptation Measures for the Energy Sector of Suriname, Lachman, D., November 2022

2.4.1.3. Assessing Vulnerability Impact Across Scenarios

The severity of the identified vulnerabilities in section 2.4.1.2 will vary across the three different scenarios. Hence, table 8 is constructed to indicate the impact of each vulnerability per scenario. This is a qualitative exercise, in line with a similar exercise done in the SOC report and indicates if a particular vulnerability has a high (H), medium (M), low (L), or none (0) impact in that particular scenario. The table is constructed using the insights from internationally and nationally published academic, business and policy reports, news articles, peer-reviewed articles, interviews, etc.

Table 8 Impact assessment across scenarios for each of the identified vulnerabilities

No.	Brief Description	SSP2-4.5+	SSP5-8.5+	Tipping Point
1.	Commodity perspective – energy intensive dependence	M	H	H
2.a.i	Limited dispatch options	M	M	H
2.a.ii	Transmission and distribution network capacity	M	H	H
2.b.i	Water availability reduction for hydropower	M	H	M
2.b.ii	Downstream sedimentation: algae bloom and congestion	M	M	M
2.b.iii	Lower thermal efficiency of thermal plants	M	H	M
2.b.iv	Increased peak demand for climate control	M	H	H
2.b.v	Increase in salinity of water intake	L	M	H
2.b.vi	Alteration of historical vegetation behavior	0	M	H
3.a.i	Heat island effect due to inefficient transportation	M	H	H
3.a.ii	Dependency on imported fuels for transportation	L	M	H
3.b	Heat island effect due to urban sprawl	M	H	H
3.c.i	Flooding and landslides in the interior	L	M	H
3.c.ii	Decreased reliability to transport fuels to interior for power	L	H	H
3.c.iii	Impact of power failures on the role of women in the interior	L	H	H
3.c.iv	Competition for water resources in the Interior	M	H	M

Source: Adapted from the partial report: Vulnerability Assessment and Adaptation Measures for the Energy Sector of Suriname, Lachman, D., November 2022

2.4.2. Water Resources[19]

2.4.2.1. General

Suriname's water resources comprise of seven large rivers (Marowijne, Commewijne, Suriname, Saramacca, Coppename, Nickerie and Corantijn) as depicted in Figure 16, lakes, wetlands, and groundwater, all of which are fed by rainwater. Freshwater is amongst others important for drinking water supply, agriculture, industry, and recreation. Freshwater rivers are used for fishing, navigation and transportation.

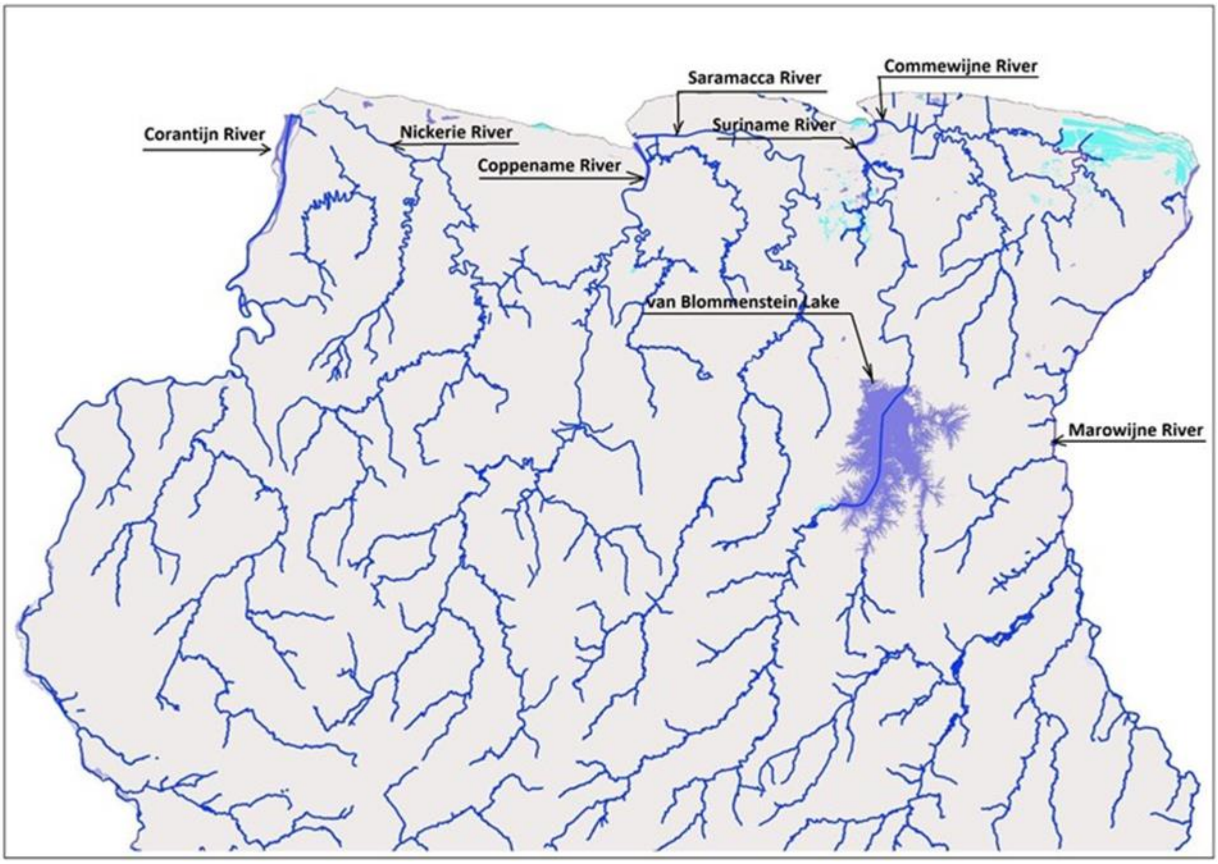


Figure 16 Main rivers of Suriname (NextGIS, 2023)

Source: Figure adapted from NextGIS, 2023, as listed in the partial report: Vulnerability Assessment and Adaptation Measures for the Water Sector, Amatali, M.A., February 2023

According to the World Bank (and as depicted in table 9), Suriname belongs to the top 3 territories with the highest renewable internal freshwater. However, within the period 1961-2019 a decrease of more than 50% in renewable internal freshwater resources per capita has been noted. Taking into consideration that the rainfall will decrease, and the population growth will increase, the renewable internal freshwater resources will further decrease.

[19] Amatali, 2023

Table 9 Top ten territories with the highest renewable internal freshwater resources per capita in 2019[20]

Country	Country Code	Renewable internal freshwater resources per capita (m^3)	Rank no.
Iceland	ISL	471,484.872	1
Guyana	GUY	301,720.307	2
Suriname	SUR	164,917.267	3
Bhutan	BTN	101,634.094	4
Papua New Guinea	PNG	83,940.390	5
Canada	CAN	75,795.392	6
Gabon	GAB	73,123.371	7
Norway	NOR	71,429.960	8
Solomon Islands	SLB	66,222.909	9
New Zealand	NZL	65,673.200	10

Source: Table adapted from the World bank website, and listed in the partial report: Vulnerability Assessment and Adaptation Measures for the Water Sector, Amatali, M.A., February 2023

2.4.2.2. Impacts on the Water Resources

The most important threats related to water resources and climate change are:

- Drying out of the water resources in the dry season;
- Pollution of the water resources;
- Salinization of the water resources in the dry season;
- Flooding.

Through a validation session with a wide range of stakeholders these threats were scored, based on severity in the various districts, to determine their impacts on the sector. Based on this scoring exercise the impacts on the water resources, due to climate change, are as follows:

a. Drying out of the water resources during the dry season

Water resources in Suriname may experience stress as a result of climate change through the combined effects of reduced annual rainfall, increased evapotranspiration and prolonged dry periods. This can result in the decreased availability of freshwater of required quality for drinking water supply, irrigation,

[20] https://data.worldbank.org/indicator/ER.H2O.INTR.PC. The countries were ranked by the hydrologist Mr. A. Amatli, using the website's data on the amount of available Renewable Internal Freshwater Resources per capita.

and fishery/aquaculture. Drinking water is supplied by deep freshwater aquifers, which are mainly found in the coastal plain (A-sand, Coesewijne and Zanderij Aquifers). Reduced annual rainfall and increase of evapotranspiration will decrease recharge of these aquifers and salination may occur, creating shortages of drinking water.

b. Pollution of the water resources

Currently water pollution is already a concern. In general, only wastewater from the toilet is treated by means of septic tanks, which is not always performed efficiently. The remaining wastewater is treated and discharged directly into the public sewer system and natural courses. When the discharge from the rivers and streams decreases, there will be less dilution and the concentration of contaminants in the water courses and resources will increase, which will lead to deterioration of the water quality. Pollution may further increase, if no appropriate measures are taken and the population, and thus wastewater generation, increases

During flooding the water resources may be contaminated by wastewater from septic tanks and other sources, whilst protective infrastructure of freshwater sources, the treatment, storage, and distribution systems of drinking water may be overwhelmed by flooding. Effects of the pollution of water resources, not only affects the water quality, but is especially detrimental to health.

c. Salinization of the water resources during the dry season

Decrease of freshwater discharge will increase saltwater intrusion in the following ways:

(i) The combined effects of reduced annual rainfall, increased evapotranspiration and prolonged dry periods reduce the discharge and increase the saltwater intrusion in the rivers, creeks and streams that flow directly into the Atlantic Ocean;

(ii) The tidal effect of the Atlantic Ocean and saltwater intrusion also affects the water system and the freshwater discharge from upstream.

Saltwater intrusion will impact the availability of irrigation water for the rice and banana sector in the coastal districts Nickerie, Coronie and Sarammacca.

d. Flooding

The likelihood of flooding in Paramaribo as a result of extreme river flows is negligible. However, the low-lying coastal zone is especially threatened by high water levels in the sea and river, and by erosion causing river and coastal flooding. During periods of heavy rainfall, flooding can worsen in the coastal zone when it occurs simultaneously with high water levels in the river or sea. Throughout the two rainy seasons pluvial flooding occurs in Paramaribo frequently, due to heavy rainfall and the relatively flat area with poor drainage.

With regards to coastal flooding, several locations in the coastal zone, among others at Weg naar Zee, Nickerie, Commewijne and Albina, that are inhabited and/or used for agricultural purposes, are severely flooded by high river or sea water due to overtopping or local collapse of the water retention dam and/or combined with coastal erosion, leading to great damages and loss. Protective infrastructure and defense structures built in some places along the coast are not structural, whilst natural and artificial drainage systems in Paramaribo and surroundings are outdated. Furthermore, it can be stated that institutions for water resource management are weak, and there is no close cooperation between institutions specialized in climate change adaptation to contribute to water quality and quantity.

Gender and Indigenous and Tribal Peoples (ITP)

For this vulnerability assessment special emphasis was placed on the impacts of climate change on gender and the Indigenous and Tribal Peoples (ITP) (EnGenDer, 2021). Women are especially vulnerable to climate change in the following ways:

a. Water scarcity

Rural women are the most vulnerable to water scarcity as rural areas have lower access to safe water resources than urban areas. There is a general perception that women, especially in developing countries, are responsible for collecting water to cook, clean and provide care. This responsibility is increased on women and even girls who may be forced to drop out of school to assist in the household.

b. Water contamination

Women living in areas with poor waste management are exposed to a high prevalence of open defecation and low access to basic sanitation. Women, as the caregivers in the household, are more exposed to contaminated water, and are at greater risk of contracting diseases. Girls who assist in the household and pregnant women are also vulnerable to diseases.

Aspects which increase the vulnerability of ITP to the impact of climate change within the water sector are as follows (Tropenbos International Suriname and associated consultants, 2017):

- Traditional livelihood;
- Unemployment or lack of opportunities for income generation;
- Lack of education and training opportunities;
- Lack of recognition of land and ITP rights;
- Lack of health, child and elderly care;
- Expensive travel cost to and from the village;
- Lack of appreciation of culture and tradition and safety;
- Lack of electricity;
- Lack of easy and access to drinking water or water resources;
- Water pollution limiting available potable water.

Figure 17 provides an overview from the SOC report which depicts some of the vulnerabilities mentioned in this section. It presents the most important hazards in blue, the intermediate impacts in grey, and final risks in red. These in turn produce the factors exposure, in yellow, and vulnerability in green.

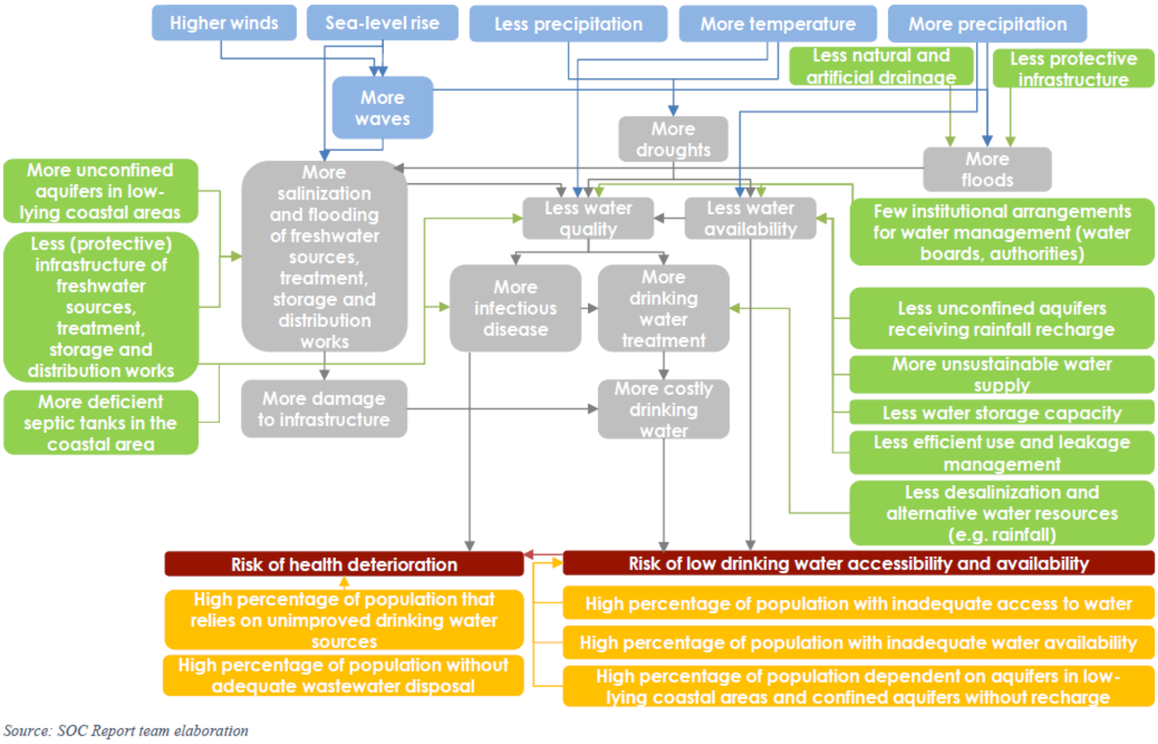


Figure 17 Overview of some of the vulnerabilities related to the water resources sector
Source: Figure adapted from State of the Climate Report: Suriname (SOC),2021, listed in the partial report: Vulnerability Assessment and Adaptation Measures for the Water Sector, Amatali, M.A., February 2023

2.4.2.3. Assessing Vulnerability Impact Across Scenarios

The scenarios from the NAP were updated to enable the impact assessment, by means of desk research and the online stakeholder survey. With stakeholder input on the severity of the impact of threats on water resources, and the prioritization of the proposed adaptation measures, the main threats related to water resources and climate change, identified by the Baseline Study were underscored. These threats are:

- Drying out of the water resources in the dry season
- Pollution of the water resources
- Salinization of the water resources in the dry season
- Flooding

The updated vulnerability impact of the water resources sector across scenarios is presented in the table below (the threats with the highest average scores are presented for the different districts. The table also presents the severity of the abovementioned threats and their influence within the water sector.

Table 10 Results of online stakeholder survey December 2022. Threats with the highest average scores for the different districts

Threats	Average Score	Severity	Location	Sector influence
Drying out of water resources during the dry season	3.1	Severe	Paramaribo & Wanica	Drinking water supply
	3.4	Severe	Commewijne & Marowijne	Drinking water supply
	3.2	Severe	Para	Drinking water supply
	3.2	Severe	Coronie, Saramacca & Nickerie	Drinking water supply
	3.2	Severe		Agricultural sector
	3.1	Severe	Brokopondo & Sipaliwini	Drinking water supply
Salinization of the water resources during the dry season	**Average Score**	**Severity**	**Location**	**Sector influence**
	3.3	Severe	Paramaribo & Wanica	Drinking water supply
	3.4	Severe	Commewijne & Marowijne	Drinking water supply
	3.2	Severe	Para	Drinking water supply
	3.4	Severe	Coronie, Saramacca & Nickerie	Drinking water supply
	3.4	Severe		Agricultural sector
Pollution of the water resources	**Average Score**	**Severity**	**Location**	**Type of waste water**
	3.4	Severe	Paramaribo & Wanica	Domestic waste water
	3.4	Severe		Industrial waste water
	3.2	Severe	Commewijne & Marowijne	Domestic waste water
	2.9	Severe	Para	Domestic waste water
	3.4	Severe	Coronie, Saramacca & Nickerie	Agricultural waste water
	3.2	Severe	Brokopondo & Sipaliwini	Industrial waste water

	3.2	Severe		Waste water from deforestation
Flooding	**Average Score**	**Severity**	**Location**	**Type of flooding**
	3.8	Highly severe	Paramaribo & Wanica	Due to excessive rainfall
	3.2	Severe	Commewijne & Marowijne	Intrusion of ocean water
	3.2	Severe		Combination of excessive rainfall and intrusion of ocean water
	2.9	Severe	Para	Due to excessive rainfall
	2.9	Severe		Intrusion of river water
	3.2	Severe	Coronie, Saramacca & Nickerie	Due to excessive rainfall
	3.2	Severe		Intrusion of ocean water
	3.2	Severe		Combination of excessive rainfall and intrusion of ocean water
	3.4	Severe	Brokopondo & Sipaliwini	Due to excessive rainfall
	3.4	Severe		Intrusion of river water

Source: Table adapted from the partial report: Vulnerability Assessment and Adaptation Measures for the Water Sector, Amatali, M.A., February 2023

2.4.3. Agriculture Sector

2.4.3.1. General

Agriculture, livestock, and fisheries make up the three primary sub-sectors of the agriculture sector, contributing to food security and to the national economy of Suriname (about 8.19% to the GDP, with an export value of USD 84.2 mln. in 2018). The Government of Suriname has designated the agricultural sector as priority area with regard to the aspect of food security. According to the World Bank's collection of development indicators, the employment rate in agriculture (% of total employment) (modeled ILO estimate) in Suriname was reported at 7.9% in 2017 (ILO, 2023). With 1.5 million hectares deemed suitable for agricultural production, there is still sufficient land available for agricultural expansion. Yet just about 120,000 hectares are reportedly being utilized for cultivation purposes in this sector. The agriculture sector is prone to climate change impacts and has suffered damages for decades from heavy rainfall, flooding, higher temperatures during dry seasons, and high winds.

The analysis of the agriculture sector in this part is focused on agricultural crops (rice, bananas, and vegetables), livestock (cattle, sheep, pigs, and poultry), fisheries and aquaculture.

2.4.3.2. Impacts on the Agriculture Sector

Agriculture crops in the coastal zone as well as in the Interior of Suriname are sensitive to the impacts of climate change as described in table 11.

Table 11 Overview of impacts in the agricultural sector based on the identified hazards

Category of hazards	Impacts in the agriculture sector
Sea level rise	Sea level rise has a negative impact on wetland rice production, which is cultivated in the Young Coastal Area. Since agricultural activities are mainly concentrated in the coastal zone there is a threat from saltwater intrusion through inundation.
Drought	• Freshwater availability for irrigation of rice can become a problem in certain areas in the case of unexpected long dry periods. • Lack of forage at the end of the dry season and in the case of unexpected longer droughts, which can result in starvation of cattle.
Flooding	• Inundation of pastures after intense rain, leading to decrease/loss of income. • Increased pressure on poor available drainage systems in the Young and Old Coastal Plain, where most of the vegetable, fruit and cattle production takes place.
Temperature rise	Reduction in productivity: • of dairy and beef cattle if environmental temperature increases • of poultry and increased mortality if environmental temperatures are high • and reproductive efficiency of swine if environmental temperatures are high and increase in swine mortality (Tjien Fooh, 2012 Technical Paper Future Profile Agriculture Suriname NC2)

Source: Table adapted from the partial report: Vulnerability Assessment and Adaptation Measures – Agriculture sector, Tjien Fooh, R, 2023

Prolonged drought, which is often triggered by the presence of a strong El Niño, has negative impacts on the various crop harvests on the shifting cultivation grounds in the Interior, while in the coastal zone prolonged drought promotes penetration of the salt wedge further upstream the rivers, thereby decreasing the availability of freshwater to the agriculture lands in this zone (Tjien Fooh,2012 as cited in NC2, 2016). Often several agricultural areas in the coastal plain are severely flooded by high river or sea water, due to overtopping or local collapse of the water retention dam. In combination with coastal erosion such as at Weg naar Zee, Nickerie, Commewijne and Albina, damages and loss are caused to residential areas and agricultural activities severely affecting many citizens and farmers. Recently, at Johanna Margaretha in the District Commewijne the dam collapsed, and a significant amount of sea water flowed into cultivated and inhabited areas. About 2,000 km^2 of the coastal plain is at risk for annual flooding, since the coastal plain is flat and low elevated, and lacks adequate drainage (Amatali, 2012).

During periods of droughts there is shortage of water for irrigation purposes for rice cultivation. During the second rice crop, which is during the dry season, the rainfall decreases, and the irrigation demand increases. In district Nickerie irrigation water is supplied from water stored in the Nani swamp, and the Nickerie and Corantijn Canal; due to the warm weather, evapotranspiration from the water stored in the Nani Swamp increases, reducing the availability of water. Moreover, due to the low freshwater discharge in the river the salt intrusion increases and the available freshwater for irrigation of cultivating rice is limited, causing loss of crops.

The following table describes the characteristics and respective impacts within the various subsectors.

Table 12 Overview of the impacts on the subsectors within agriculture

Subsector Agriculture	
Rice production sector	
Characteristics sector	Practice: Wet rice cultivation – irrigated culture of rice. Rice production spread over two growing seasons. Farmers struggle with numerous issues such as inefficient irrigation, saltwater intrusion in the coastal rivers especially during the two dry seasons (February-April and September-November), the effects of climate change (shift in seasonal rainfall) and climate variability (e.g. El Niño), poor hydraulic works, weak institutional arrangements at polder level. Observed shifts in the beginning of the seasons, which do not seem to correspond to the planned crop calendar, hamper the planning of the growing seasons of rice.
Climate change impacts	Climate change will have a significant effect on crop growth, development, and yield (productivity) by the increasing temperature and uncertainty in rainfall (Biscay, 1984;). An increase in temperature may shorten the length of the growing period in tropical regions, and thus reduce yield. Intrusion of salt water has been observed in the Nickerie River during the dry season. This poses a challenge in the dry season to the large rice farmers who are located on the right bank of the Nickerie River. These farmers depend on irrigation water from the Nickerie River. The rice farmers, mainly small and medium-sized, on the left bank of the Nickerie River are fed from Wakay via the Nanie Swamp. Further distribution of the irrigation water takes place by means of pumps, which are located at the upper reaches of the Corantijn River. These farmers have a shortage of irrigation water during the dry seasons.
	Expansion of the rice fields in the immediate vicinity of the Corantijn River will exhaust the existing possibilities for irrigation in the coming years. Further expansion of the rice fields to meet the national targets could become problematic, bearing in mind that sea levels will rise and saltwater intrusion will move further up rivers. Strong storm surges and floods can kill the rice plants at the critical stages of their development, while drought and new pests can increase pests and diseases, affecting productivity.
	Flooding of the areas close to the Nickerie River, including the capital New Nickerie, already occurs more frequently than in the past. The coastal part of this district is one of the most vulnerable areas for flooding,

	so the enterprises situated in these areas will have to move or make large investments to be prepared for the effects of sea level rise.
Vegetable production	
Characteristics sector	Even though the area under production per farmer is small, the production and sale of vegetables has an important impact on household income.
Climate change impacts	Part of the area that is used for vegetable cultivation (e.g. Weg naar Zee, Kwatta) can be designated as a high-risk area, taking into account the effects of sea level rise. In the long term (after 2050) the effects of temperature increase, and sea level rise will become more significant.
	The farmers will no longer be able to produce their crops under the current farming systems as their land will be flooded from time to time. Increased soil salinity due to saltwater intrusion and/or flooding will deteriorate soil quality and cause significant reduction in the crop productivity.
	Most small vegetable producers depend on rainfall to irrigate their crops. As a result, they cannot produce in the dry season. Only a small number of farmers use water pumps connected to irrigation pipes to irrigate their crops. These farmers are vulnerable during the rainy season because heavy rainfall and / or flooding can damage their crops.
Bananas and plantain production	
Characteristics of the sector	Large scale banana production is mainly concentrated on two plantations namely the Jarikaba (in district Saramacca) and the Nickerie operations (in district Nickerie), both under the management of FAI (Food and Agriculture Industries N.V.). Plantains are grown on a small scale by small farmers in the coastal area and in the interior for subsistence and for the local market.
Climate change impacts	Heavy winds have impact on the banana trees causing damages to the large leaves or uproot the entire plants. Lighter winds can uproot the plants, if the soil around the plants is sopped by rain. Fallen or leaning plants may experience sunburn and drought stress after a storm.
	Contrary to the large-scale banana production, the production of plantains is very susceptible to the effects of changing weather and climate. In the rainy season and at the end of the dry season the price of plantains on the local market increases due to large losses.
	There will be an increase in climatic zones with higher temperatures and the appearance of areas not suitable due to extended periods of extremely high temperatures.

	This suggests that if temperatures continue to increase beyond 2070, more areas in the tropics may have losses in the banana production due to excessively high temperatures. The increased temperature that is associated with faster leaf emission rate will also be associated with an increased water demand of 10-15 percent across the sites as a result of increasing temperatures for the period through 2070.
	Since it is expected that storm surges will increase in frequency, it is urgently needed that the company starts with the establishment of hedgerows of trees to protect the banana plantations against the damage that strong winds can cause. The vulnerability of the crop to climate change is an important consideration, demanding specific tools suited to banana growth habit and crop cycle.
Fruit production	
Characteristics of the sector	Fruit production will increase in the coming years since there is a growing demand for exotic fruit species with high values of anti-oxidants such as acai (*Euterpe oleraceae*). The plantations for this palm fruit species are established in the waterlogged areas. Recently intensive modern fruit production (pineapple, citrus) has started in the Para district for the local-and export market. The farming systems and techniques which are used to make year-round crop production possible, is less dependent on extreme weather conditions. Fruit species such as papaya, pine-apple, west-Indian cherries, citrus and passion fruit are among the species with potential for large scale production for the export market. Taking the growing demand for fruit on the world market and the governmental plans for diversification of the national economy into consideration it can be foreseen that within 15-20 years fruit production and processing will be much more important than now.
Climate change impacts	Fruit production is impacted by extreme rainfall episodes/events/conditions. Crops such as plantains, bananas, papaya can also be destroyed under circumstances of more frequent storms and more intense rainfall since these crops are very vulnerable for water saturation in the soil. Adaptation efforts should focus on proper drainage of farms and climate smart practices.
	At the State-owned plantation Alliance, situated at the right bank of the Commewijne River, 20 hectare of oranges was lost in March-April 2022 due to flooding.
Subsector Livestock	
Characteristics of the sector	This sub-sector comprises of cattle (beef), dairy cattle, poultry, pigs and small ruminant (sheep and goats).

	It is an important sector in terms of food security, employment and income generation and rural stability. The livestock sector is characterized by mainly small-scale holdings with some medium and large size farms in poultry, beef cattle and dairy. Most of the commercial activities are concentrated in the coastal area. Livestock and dairy products are mainly for the local market (local consumption).
Livestock and dairy production	
Climate change impacts	The potential impacts on livestock include changes in production and quality of feed crop and forage, water availability, animal growth and milk production, increase of diseases, reproduction and biodiversity. Cattle and small ruminant production in Suriname are mainly extensive or semi-extensive. These impacts are primarily due to an increase in temperature and atmospheric carbon dioxide (CO_2) concentration, precipitation variation, and a combination of these factors.
	Temperature affects most of the critical factors for livestock production, such as water availability, animal production, reproduction and health. Forage quantity and quality are affected by a combination of increases in temperature, CO_2 and precipitation variation. Livestock diseases are mainly affected by an increase in temperature and precipitation variation.
	When temperature increases more than the upper critical temperature of the range (varies by species type), the animals begin to suffer heat stress. Heat stress on livestock is dependent on temperature, humidity, species, genetic potential, life stage, and nutritional status. Heat stress decreases forage intake, milk production, the efficiency of feed conversion, and performance. Warm and humid conditions cause heat stress, which affects behavior and metabolic variations on livestock or even mortality.
	For the cattle farms located in areas vulnerable to flooding and salt water intrusion.
Sheep and goat production	
Characteristics of the sector	The sheep and goat herds are very small (about 10.000 animals total). For years one of the main constraints concerning the development of small ruminant production was the availability of good breeding stock. Since sheep and goat do reproduce relatively quickly it can be foreseen that the small ruminant herd will expand significantly in the coming years. Tropical hair sheep and goats are well adapted to the hotter climate regions.
Climate change impacts	Most of the farms are established on well drained soils and young animals are protected against the negative effects of frequent rains. A grazing schedule that minimizes the chance of infestation of small ruminants by internal parasites that have a negative effect on animal productivity and survival rate will be very important since the

	environmental conditions for the development of these parasites will be more suitable under higher temperatures and intense rains.
Poultry	
Characteristics of the sector	The future of poultry production in Suriname will depend on the competitiveness of the poultry sector. If the sector is not able to increase production efficiency it cannot be expected that the market share of locally produced poultry meat will increase. Production efficiency is highly correlated to the price of feed, the food conversion rate and mortality.
Climate change impacts	Heat stress due to temperature rise: Since the comfort zone for poultry is below 26°C, it can be concluded that Suriname will never be able to produce as efficiently as poultry producers located in areas which are more suitable for poultry production in terms of climate. In the hottest months, there is an increase in mortality of heavy broilers since these birds are not able to maintain their body temperature within the safe range. It is already clear that for the realization of more efficient broiler meat and table egg production it is necessary to control the microclimate in the poultry houses. Under current weather conditions, mortality of birds during the hottest months of the year is significant.
Swine production	
Climate change impacts	Higher temperatures result in lower fertility rate, decreased feed intake and reduced growth rate in pigs. In addition, warmer weather enhances survival of insect pests such as flies and lice that can spread diseases. Higher disease incidence in a swine production unit will increase the costs of veterinary service and medicines. Swine are very vulnerable to high temperatures, especially when they cannot access a wallow or watering device. Heat stress can be acute or chronic: Acute heat stress means exposure to high ambient temperatures over a short period of time. Chronic heat stress describes exposure to a high ambient temperature over a long period of time (days to weeks) which allows partial or total acclimatization to the environment. Heat stress results in limited nutrient intake, which in turn reduces production performance and compromises health and welfare. In addition, prenatal heat stress alters the distribution of energy between lean and fat deposition, resulting in fatter carcasses at slaughter.

Fisheries and aquaculture	
Characteristics of the sector	The fishing industry is an important economic sector in Suriname. Over the last decade, the sector has become increasingly important and currently represents 2.3% of the GDP. The sub-sector has always been a major player as domestic food supplier and foreign exchange earner dominated by shrimp exports. The sector is distinguished in artisanal, industrial (shrimp and pelagic fish) and aquaculture fishery. According to the Fisheries Management Plan (VMP) 2021-2025, fish landings increased sharply from 8,871 to 39,993 tons between 2008 and 2017 but fell sharply again in 2018 and 2019 to around 24,000 tons in 2019. The productivity of the fishing waters by 2030 will be dependable on sustainable fisheries management and on recovery of the estuarine zone under climate change conditions. Expansions in fish and shrimp production will mainly come from aquaculture.
Climate change impacts	The decline in fish catch is suspected to be related to climate change. However, no research has yet been done to scientifically support this nor has there been any clear indication so far. The impact of climate change in the Suriname's fishing industries is difficult to determine. By the end of this century the temperature of the water will have increased with at least 2 °C. Such an increase in water temperature will have negative effects on the survival of post larvae from shrimps and other crustacean species. Further on the ongoing increase in atmospheric CO_2 will lead to an increase of the acidity of ocean water. This increase in acidity will affect calcification processes and finally the food web will be disturbed. Care should be taken that the mangrove vegetation in the coastal area will not be destroyed for the establishment of aquaculture farms.

Source: Table compiled with information from the partial report: Vulnerability Assessment and Adaptation Measures – Agriculture sector, Tjien Fooh, R, 2023, and information from Samoender, I.

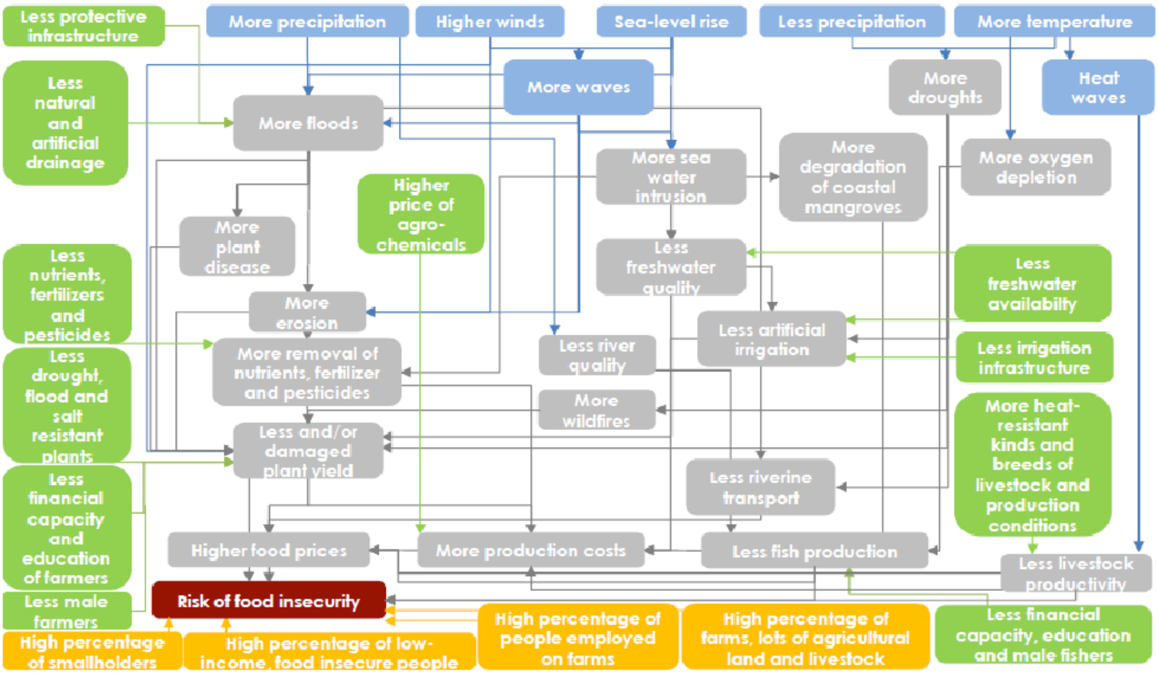
Agriculture in the hinterland

Shifting cultivation is the main farming system practiced by farmers in the hinterland. The seasonal conditions are crucial for the planning and execution of activities regarding crop cultivation. The system is rainfed and land clearing takes place during the dry season. The farmers have already detected that the seasons of the year are disordered, and this affects their common crop calendar. Their main complaints are the untimely start of the rainy seasons and that unexpected longer dry periods have negative effects on their crop production.

The Amazon Conservation Team (ACT) is an NGO that is active in eight indigenous villages (Amotopo, Alalapadoe, Kwamalasemuto, Coeroeni, Sipaliwini, Tepu, Apetina, Palumeu) and in 10 Matawai tribe villages in the Boven Saramacca region. According to ACT agricultural plots close to rivers and creeks in these villages are flooded at least twice a year. This results in temporary shortage of food, due to rotting of the roots of the main food crop cassava caused by water logging. Extreme high-water levels in the rivers and creeks also make agricultural plots inaccessible, due to the strong water current. In case of extreme drought, the yields of the food crops drops significantly and damage to crops caused by leaf cutting ants takes place more frequently.

In the Matawai villages in the Upper Saramacca region wildlife suffer from food shortage during extreme long dry periods and flooding. To survive, these wild animals use the crops on the fields as feed.

Figure 18 provides an overview from the SOC report which depicts some of the vulnerabilities mentioned in this section. It presents the most important hazards in blue, the intermediate impacts in grey, and final risks in red. These in turn produce the factors exposure, in yellow, and vulnerability in green.



Source: SOC Report team elaboration

Figure 18 Overview of some of the vulnerabilities related to the agriculture sector
Source: Figure adapted from State of the Climate Report: Suriname (SOC),2021, listed in the partial report: Vulnerability Assessment and Adaptation Measures – Agriculture sector, Tjien Fooh, R, 2023

2.4.4. Cross-cutting Sectors

The cross-cutting sectors include the sectors education, health (cross foundational sectors), spatial planning, disaster risk reduction and environment (cross integrative sectors). The possible effects and feasibility in the cross foundational and integrative sectors in relation to the productive sectors have been analyzed based on the model presented in the NAP. According to this model the productive sectors are the main economic drivers at the core of national development, starting with the priority sectors of water resources, forestry, agriculture and energy in the immediate term and proceeding to other sectors by priority later on.

The cross-foundational and integrative sectors influence and contribute to the activities of the productive sectors, including their efforts to adapt to and mitigate the effects of climate change. The aforementioned sectors must be resilient foundations, considering the fact that resilience building in all other sectors depends on them. The vulnerability and effects in the various sub-sectors will be discussed in connection to the producing sectors in the sections that follow.

2.4.4.1. Health Sector

Suriname has a fragmented, but coordinated health system that covers the urban, coastal and interior regions of the country. There are 7 hospitals that are currently available in four districts see table 13, while the Interior is covered by the Medical Mission (MZ).

The MZ provides integrated primary healthcare, laboratory services, dentistry, pharmacy and HIV counselling at each of the 51 health clinics over an area of 130,000 square kilometers in the interior, rendering services to approximately 54,000 people, mainly indigenous (Amerindian), tribal (Maroon) and migrant populations (gold miners and forestry workers).

The healthcare facilities in the country are vulnerable to extreme weather and climate events, such as flooding, drought and to climate-related outbreaks of infectious diseases that overwhelm their capacity to provide critical services. There is no decentralized emergency health system and only two emergency departments (SEH) in Paramaribo and Nickerie. In addition, the hospitals and health clinics in the coastal area and to a greater extent in the interior have limited medical staff and are insufficiently prepared in case climate-related calamities occur.

Table 13 Overview of the health facilities in Suriname

District	Health facility
Paramaribo	Academisch Ziekenhuis, 's Lands Hospitaal, Diakonessen Ziekenhuis and Sint Vincentius Ziekenhuis
Wanica	Wanica Hospitaal
Nickerie	Mungra Streekziekenhuis
Marowijne	Ziekenhuis Marwina
Coastal districts	Regional Health Services (RGD)[21]
Brokopondo and Sipaliwini	Medical Mission (MZ) health clinics

Source: Table adapted from the partial report: Vulnerability Assessment and Adaptation Measures – Cross-cutting sectors, Sitaram-Tjin A Soe, F., 2023.

[21] RGD is a state foundation which offers health care via public primary care facilities to the population

In short, the impacts of climate change for the health sector are as follows:

Flooding
As result of heavy rainfall, flooding can lead to:

- Deterioration of human health due to the emergence of water related diseases (malaria, dengue, diarrhea). In the period 2015-2019, the number of reported dengue cases increased by 193.3%. In 2019, the number of cases was high, due to a dengue epidemic (ABS, 2020), while the number of cases in 2020 multiplied five (5) times compared to 2019. Since 2006, malaria is almost completely under control in the village communities, except for communities and gold miners at the French Guiana border and mobile communities where gold miners are active in the interior (ABS, 2020);
- Emergence of diseases such as Leptospirosis, which is related to rat infestation, in (living) conditions with poor sanitation and waste management. The number of reported cases of Leptospirosis (Ziekte van Weil) was reduced by 52.8% in the period 2015-2019;
- The loss of lives;
- Food shortages, due to loss of agricultural land;
- Increase of mental stress of the affected population

Increase of temperature
Foodborne diseases such as Salmonella and Campylobacter, are known to be two of the most common foodborne diseases. The incidence of these diseases shows seasonal trends with more cases when temperatures are warmer. Some foodborne toxins, such as aflatoxin, that could be found in maize and peanuts are also likely to increase with higher temperatures (PAHO, 2017).

Heat waves
Heat waves can lead to heat stress, respiratory allergies and airways diseases, decreased chemical tolerance and fatigue (PAHO, 2017). Specifically elderly, pregnant women, children, persons with pre-existing medical conditions and those with inadequate housing (no air-conditioning) are most vulnerable to heat waves.

Drought
Drought affects the health of the population that do not have easy access to safe drinking water. Consumption of creek water and uncovered water reservoirs increase the risk of all kinds of water-related diseases such as cholera, diarrhea, but also dengue and chikungunya (NCCR, 2017). table 14 gives an overview of the risks, impacts and vulnerability within the health sector.

Table 14 Overview of the vulnerabilities within the health sector

<table>
<tr><th colspan="2">Exposure</th><th>Risk</th></tr>
<tr><td colspan="2">High number of populations living in flood prone coastal area and less in remote areas dependent on health facilities with poor staff and infrastructure.</td><td>- Risk of health deterioration
- Risk of loss of lives
- Risk of malnutrition</td></tr>
<tr><td>Impacts →</td><td colspan="2">• Heat-stress and heat-related illnesses
• Diseases: foodborne (diarrheal); waterborne (malaria, dengue, zika); rodent borne
• Mental stressed people
• Deaths</td></tr>
<tr><td>Sectors impacted →</td><td colspan="2">• All sectors incl. Water, Agriculture, Health, Education etc.</td></tr>
<tr><td>Vulnerability</td><td colspan="2">• Healthcare facilities located in vulnerable food prone coastal area
• Poor functioning health infrastructure (remote areas)
• Health facilities lack adequate energy supplies and water, sanitation and waste management services
• Vulnerable groups: elderly, children, low-income groups, disabled</td></tr>
</table>

Source: Table adapted from the partial report: Vulnerability Assessment and Adaptation Measures – Cross-cutting sectors, Sitaram-Tjin A Soe, F., 2023

2.4.4.2. Education

The education system consists of pre-primary, primary, junior and senior secondary schools, which also includes technical and vocational education as well as higher or tertiary education. Completion rates are 85% at primary education level and progressively decreasing at the junior secondary and senior secondary level to 49% and 24% respectively. Completion rates are higher for children living in urban areas and those from the richest quintiles, compared to their peers from the rural areas and the disadvantage resorts (GOS, 2020).

In addition, Paramaribo and district Wanica, the two most populated districts, have the highest numbers of enrolments for both years 3 – 8 pupils (grades 1 – 6) (figure 19) as well as for secondary education (MULO) pupils (figure 20) from data between 2010-2019. Data from 2019 shows that there are 375 schools in total for primary education (GLO) and 152 schools for secondary education at junior level (VOJ) spread over all districts with most schools located in Paramaribo (146) and Wanica (62) (MinOWC, 2021). Schools for secondary education at senior level (VOS) exist in Commewijne (3), Nickerie (8), Saramacca (3), Wanica (13) and Paramaribo (27).

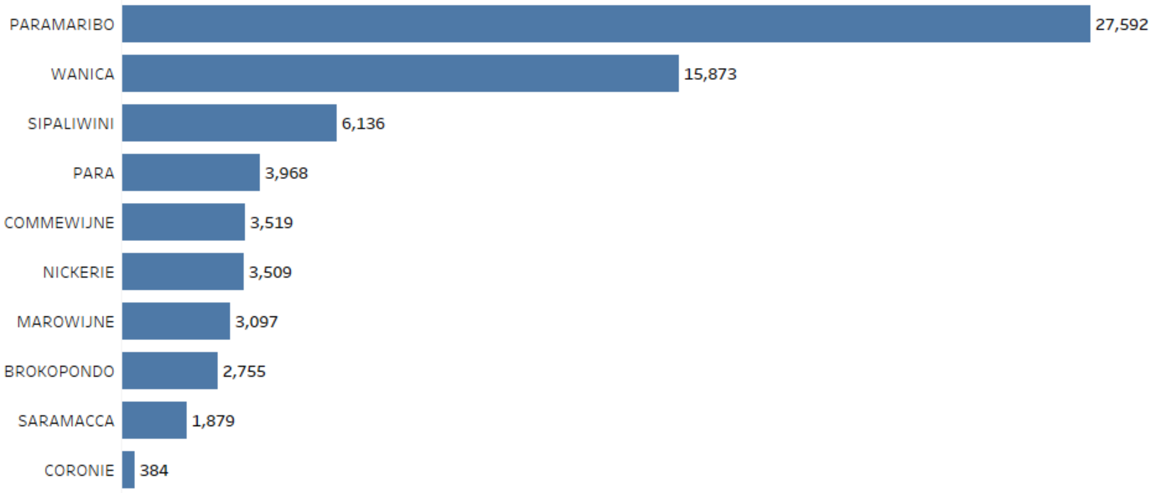


Figure 19 Average number of pupils of year 3-8 per district (2010-2019)

Source: Figure adapted from Education Statistics, Indicators and Trends 2010-2019, as listed in the partial report: Vulnerability Assessment and Adaptation Measures – Cross-cutting sectors, Sitaram-Tjin A Soe, F., 2023.

Inequalities between urban and remote areas in Suriname have been observed at the level of pre-primary schools. As such, many primary schools in the interior are managed by teachers with limited training and experience. Only a third of the children in remote areas attend kindergarten, compared to 50% in urban areas. At primary school level, the gap diminishes; only to broaden during secondary education, with as little as 6% of the interior youth attending senior secondary school, compared to 35% of urban youth.

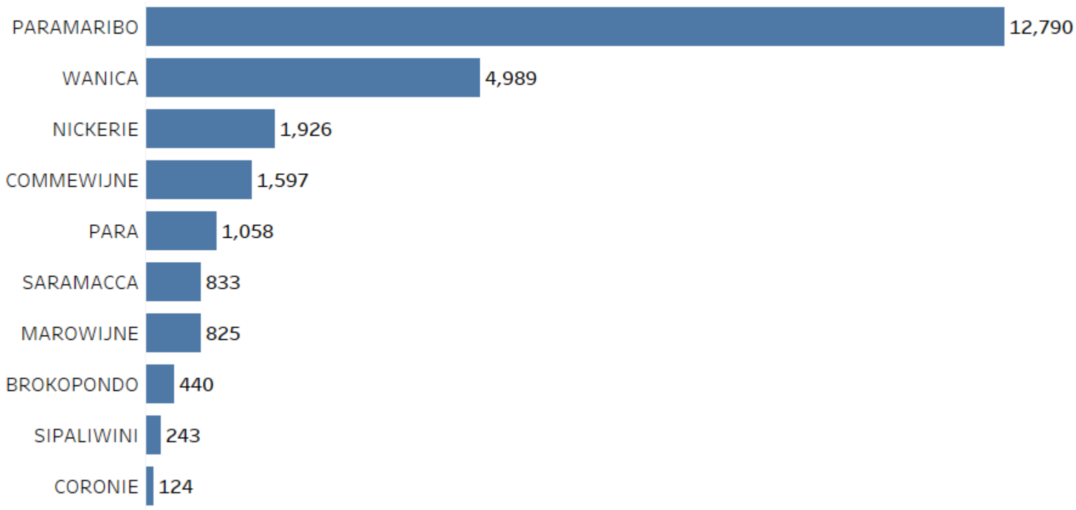


Figure 20 Average number of MULO pupils per district between 2010-2019
Source: Figure adapted from Education Statistics, Indicators and Trends 2010-2019, as listed in the partial report: Vulnerability Assessment and Adaptation Measures – Cross-cutting sectors, Sitaram-Tjin A Soe, F., 2023.

In Sipaliwini, children more frequently fail to promote to the next grades, drop out of school at an earlier stage and score significantly lower than their peers in urban areas on standardized tests. They also take much longer to complete primary school: in 2008, only 1.2% of indigenous and maroon children completed primary school before the age of 12, compared to 24% of urban children. With regards to gender, boys are significantly more at risk of dropping out and repeating classes than girls. This, however, is not exclusive to the interior and can be observed even in the best performing district, Nickerie (Rose-Kambel, 2020).

Table 15 shows the risks, impacts and vulnerability in the education sector. Students depend on schools that are mainly located in the coastal area and to a lesser extent on schools located in remote areas/ interior. In case of flooding and heavy rainfall, the risk of interruption in education occurs. Heavy rainfall and extreme winds accompanied with flooding may result in severe damage to school infrastructure such as buildings, classrooms, toilets, which can result in poor hygiene and sanitation and ultimately affect human health due to water borne diseases.

Moreover, extreme weather events could reduce the access to safe drinking water (refer to the water resources sector within the vulnerability assessment chapter), compromise sanitation and enhance the incidence of weather-related diseases such as malaria and diarrhea (refer to the health sector). Furthermore, it could lead to absenteeism, and the possibility of dropouts. Destruction of school buildings and related infrastructure can disrupt education for days and even weeks, specifically in remote areas such as the districts Brokopondo and Sipaliwini. In the remote areas the schools have limited alternative education modalities which could ultimately result in the absence of classes and have a mere impact on the academic performances.

In Paramaribo and other districts, many schools frequently have to deal with the aspect of flooded schoolyards and classrooms, causing grave educational disruption.

Extreme periods of drought, particularly in October, also have an impact on education. In general, most schools do not have air conditioning in the classrooms. In the past years, the Ministry of Education, Science and Culture (MinOWC) has introduced modified school hours, mostly applicable to primary schools, due to the extreme heat that is unbearable for children and school staff, such schools closed an hour earlier.

In general, most school infrastructure are not resilient to flooding and are located in flood prone areas with poor drainage. In addition, most school buildings are constructed, without deeply considering rising temperatures, the installation of air conditioners and access to adequate ventilation.

Table 15 Overview of the risks, impacts and vulnerabilities in the education sector

Exposure	**Risk**
High number of students/pupils dependent on schools located in coastal flood prone areas and isolated remote areas (interior)	• Risk of disruption in education
Impacts →	• Loss/damage school infrastructure (building sanitary facilities, septic tank etc.) • Loss of textbooks and school material (chairs, desks etc.) • Absenteeism (missed classes), low school performance (dropouts, repeats) • Increase in weather related diseases (malaria, diarrhea)
Sectors impacted →	• All sectors incl. Health, Water, Agriculture, Energy, etc.
Vulnerability	• Less climate proof school infrastructure (remote areas) • Most schools located in low lying coastal area (prone to flooding) • Limited alternative education modalities (specifically remote areas) • Less protective infrastructure (heat stress) • Most schools located in coastal flood prone area

Source: Table adapted from the partial report: Vulnerability Assessment and Adaptation Measures – Cross-cutting sectors, Sitaram-Tjin A Soe, F., 2023.

Moreover, drought and increasing temperatures can also lead to poor harvests and food scarcity (refer to the agriculture sector) which have negative impacts on educational attainment. This causes malnutrition, specifically among school-going children, which impairs their retention and learning performance. Lack of food also increases absenteeism from school.

2.4.4.3. Spatial Planning

Suriname is hardly urbanized; not more than 2% of the entire territory is built-up and just approximately half of this is urban. Not more than 3% is rural-agricultural, while the remaining 95% of the territory is, composed of natural landscapes with a variety of characteristics, each with their own possibilities and limitations to land use planning (Dodman, et al.; 2022). Land use planning in Suriname is characterized by the issuance of overlapping mining and forestry concessions; double issuance of domain land; lack of structure, planning and zoning plans; and even land degradation in protected areas. The most severe environmental issues related to inadequate land use planning in Suriname are the penetration of seawater and the destruction of beaches, local flooding due to sea level rise as a result of global climate change, as well as severe damage to biodiversity and the functioning of natural ecological systems, due to quarrying and mining which leads to the contamination of rivers and lakes.

Current legislation related to spatial planning is scattered across various laws and regulations administered by different Ministries and Government agencies. Planning legislation dates to 1973, while legislation relating to the use and management of land and natural resources was adopted after the independence of Suriname in 1975. Legislative and institutional framework regarding spatial planning is provided in Annex I.

Currently, there are no designated areas for production, industries, and residential areas. As such, development takes place in an uncoordinated way, often resulting in the incorrect use of land, contrary to its intended allocation, which can also cause damage to the environment. There is a risk that more land and/ or areas will become unsuitable for development and other purposes. The majority (about 87%) of the population lives in the flood prone coastal area and some in the more remote unplanned areas. The absence of zoning plans, outdated mapping records of land use conditions and vulnerable areas have resulted in unplanned and chaotic settlements in areas prone to climate change impacts. Due to regular inundating of some areas and sea level rise (saltwater intrusion), some areas may or will no longer be suitable for land use including the production sectors (water extraction & production, energy production, agriculture land). These risks and impacts, also have impact on other sectors such as education, health, housing, industry, and tourism and ultimately result in the relocation of development, including people and related infrastructure to elevated grounds and low risk areas. Table 16 gives an overview of the vulnerabilities and associated risk and impacts in the cross-cutting sector spatial planning.

Table 16 Vulnerability of the Spatial Planning sector

Exposure	**Risk**
High number of the population living (building) in flood prone coastal area and some remote areas in already unplanned zones/areas	• Risk of areas/zones become unsuitable for development
Impacts →	• Unsuitable zones/areas for developing/planning • Relocation/displacement of current development (utility infrastructure, health & school facilities, agricultural areas) to higher elevation/suitable/low risk areas
Sectors impacted →	• All sectors incl. Water, Agriculture, Energy, Education, Health & others
Vulnerability	• No zoning plans → unplanned settlement (poor utility infrastructure works) and conflicting land uses in flood prone areas (sea level rise) administered

	• Uncontrolled/poor coordination of spatial/land use planning (no implementation of Planning act/ Urban planning act) • Outdated mapping records of land use conditions and vulnerable areas • Dispersion of spatial planning responsibilities (several institutions/ministries) • Poor enforcement of Building act

Source: Table adapted from the partial report: Vulnerability Assessment and Adaptation Measures – Cross-cutting sectors, Sitaram-Tjin A Soe, F., 2023.

2.4.4.4. Disaster Risk Reduction

The Constitution of the Republic of Suriname has no specific provisions for disasters, although it mandates the President to declare a state of emergency to maintain external and domestic security in case of danger or threat in any part of Suriname, subject to previous consent of the National Assembly.

Disaster Risk Management (DRM) has risen as a concern in Suriname during the heavy rains and floods in 2006 whereby nearly 30,000 people in more than 150 remote villages along the Saramacca, Upper Suriname and Tapanahony river were affected. Unfortunately, there are still no specific regulations that establish a responsibility framework on all DRM processes for all Government levels, even though the National Coordination Centre for Disaster Management (NCCR) is functional. In the same way, Suriname lacks other key complementary DRM regulations such as climate change adaptation, integrated water resource management, territorial planning and land use.

The lack of regulations on DRM and disaster preparedness and response in the country, does not allow for the verification of basic conditions for disaster preparedness, such as:

- the existence of an inter-institutional organization at the national level for disaster preparedness and response;
- tools to establish a platform or mechanisms for crisis management at the highest national political level, formulation of emergency or contingency plans at the national level; and
- processes that state that the emergency response must be based on damage assessment.

The lack of a national disaster plan affects the disaster risk reduction sector. In addition, the national health disaster plan is still under construction. Thus, there is no structured coordination and/or guidance for victims affected by climate disasters. Table 17 provides an overview of the vulnerabilities of the DRR sector.

Table 17 Vulnerability of the Disaster Risk Reduction sector

<table>
<tr><td colspan="3">Disaster Risk Reduction (DRR) refers to "Build resilience of nations and communities to <u>climate related</u> disasters</td></tr>
<tr><td colspan="2">Exposure</td><td>Risk</td></tr>
<tr><td colspan="2">• High number of the population living, building in flood prone coastal areas and isolated remote areas
• All sectors located in areas where people live</td><td>• Risk of no/insufficient preparedness & responsiveness when climate related disasters occur</td></tr>
<tr><td>Impacts →</td><td colspan="2">• No preparedness when climate related disaster occurs
• Destruction and loss od livelihoods (traumatized victims) and homes
• Loss of agricultural land
• Contaminated/poor water availability
• Impact on schools, health clinics, other infrastructure (roads, bridges)
• Power outage/energy supply</td></tr>
<tr><td>sectors impacted →</td><td colspan="2">• All sectors incl. Water, Agriculture, Energy, Health, etc.</td></tr>
<tr><td>Vulnerability</td><td colspan="2">• Absence of national disaster plan
• Draft national health disaster plan
• No coordination/ unit/ shelter for victims (psychological/ physical relief)</td></tr>
</table>

Source: Table adapted from the partial report: Vulnerability Assessment and Adaptation Measures – Cross-cutting sectors, Sitaram-Tjin A Soe, F., 2023.

2.4.4.5. Environment

Environment is a cross-cutting integrative sector because it overarches the functioning of the productive sectors and affects multiple productive sectors at the same time. This sector undertakes climate change resilience building intrinsic and plays an undeniable and essential role in the building of climate resilience. The environmental sector is cross-sectorial, and therefore climate change adaptation is also cross-sectorial, earmarking that adaptation is linked to various sectors. The environmental sector, therefore, has a more coordinating and facilitating role when it comes to adaptation actions.

Key sector elements of this coordinating role are:

- National Focal Point to UNFCCC, Kyoto Protocol and Paris Agreement
- Reporting to UNFCCC (National Communications, Biennial Update Reports, Biennial Transparency Reports)
- Responsible for overall environmental policy in Suriname
- Signing of Paris Agreement (April 2016)
- Process of development and (re)formulation of NDC.

Global population growth increases demand for resources, whether it be land for agriculture, water for food production, fossil fuels for transportation, or rare earth metals for renewable energy devices. From a supply perspective, the effects of

climate change, such as extreme weather events and global warming, are already endangering resource security (availability, affordability and reliability of quality and supply).
Suriname as one of the greenest countries in the world has a vast natural tropical forest and a high diversity of species. However, over the past decades, economic developments have created a proliferation of competing demands on natural resources. The country retains 93% of its original forest cover, the highest percentage in the world, and houses vast ecosystems and rich biodiversity. These precious forests allow Suriname to be a carbon-negative country, meaning that the country removes more greenhouse gases from the atmosphere than it emits. In addition to a high forest cover, Suriname has an abundance of water and mineral resources. However, the country faces undeniable challenges that threaten the country's forest cover and water resources (del Prado, N. et.al, 2015). Gold mining and infrastructure, mainly road construction, are the main drivers of deforestation, habitat destruction and water resources deterioration (Conservation International Suriname (CIS), 2021). Not only deforestation but also GHG emissions, use of mercury in the small-scale gold mining, use of pesticides in agriculture and inadequate waste management in Suriname contribute to a greater impact on the livelihoods of thousands of people and wildlife due to climate change.

Increased frequency of natural disasters and climate change also pose threats to biodiversity. In 2016, the following endangered species have been reported: mammals (9 species), birds (9 species), reptiles (6 species), amphibians (1 specie), fish (30 species), other invertebrates (1 specie) and plants (27 species) (SBB, 2017). Prolonged drought as well as increased deforestation has led to the rescue of more than 800 animals by Green Heritage Fund Suriname since 2015 and this number has been increasing since 2018.

Estimations indicate that a 1-meter sea level rise would affect over 6.4% of Suriname's GDP, 7% of its population, and 5.6% of agricultural land. Moreover, Indigenous and Maroon communities are at risk, as a result of their economic situation and location in remote areas where extreme droughts and floods have been recorded in the past. Neglecting this reality could result in severe human and economic casualties (SOC, 2021).

Suriname has sixteen (16) protected areas namely eleven (11) nature reserves, four (4) Multiple Use Management Area's (MUMA's) and one (1) nature park. Five (5) nature reserves (Hertenrits, Peruvia, Coppename, Galibi and Wia Wia) are located in the coastal region. Another three (3) nature reserves (Brinckheuvel, Central Suriname, Sipaliwini) and one (1) nature park (Brownsberg) are located in the interior. At the border area between the savannah region and the old coastal area there are another three nature reserves (Wanekreek, Copi and Boven-Coesewijne). Total of natural areas with a legally protected status–amounts to 14.6% (approximately 21,470 km²) of Suriname's land area. There are four areas in Nickerie and Sipaliwini which have been identified and proposed as nature reserves with legal protection: Nani and Kaboeri Kreek as nature reserves, and Snake Kreek and Mac Clemen as forest reserves. The Coppename nature reserve, which plays an important role as a resting and foraging area for water birds, was recognized as a Ramsar area in 1985. The Central Suriname nature reserve was recognized by UNESCO as a World Heritage Site in 2000. Table 18 provides an overview of the protected areas and the proposed protected areas and figure 22 shows a map of the protected areas in Suriname.

Table 18 Protected areas in Suriname

Protected areas			
Name	**Year**	**Surface area (km^2)**	**Type**
Upper-Coesewijne	1986	270	Nature Reserve
Brinckheuvel	1961	60	Nature Reserve
Brownsberg	1969	122	Nature Park
Central Suriname	1998	16000	Nature Reserve
Copi	1986	280	Nature Reserve
Coppename Mouth	1961	120	Nature Reserve
Galibi	1969	40	Nature Reserve
Hertenrits	1972	1	Nature Reserve
Peruvia	1986	310	Nature Reserve
Sipaliwini	1972	1000	Nature Reserve
Peperpot	2009	7	Private protected area
Wanekreek	1986	450	Nature Reserve
Wia Wia	1961	360	Nature Reserve
Bigi Pan	1987	679	MUMA
North Commewijne-Marowijne	2002	615	MUMA
North-Coronie	2001	272	MUMA
North-Saramacca	2001	884	MUMA
Proposed protected areas			
Nani		540	Proposed nature reserve
Forest reserve Mac Clemen		120	Proposed forest reserve
Forest reserve Snake creek		30	Proposed forest reserve
Kaboeri creek		680	Proposed nature reserve

Source: Table adapted from the partial report: Vulnerability Assessment and Adaptation Measures – Cross-cutting sectors, Sitaram-Tjin A Soe, F., 2023.

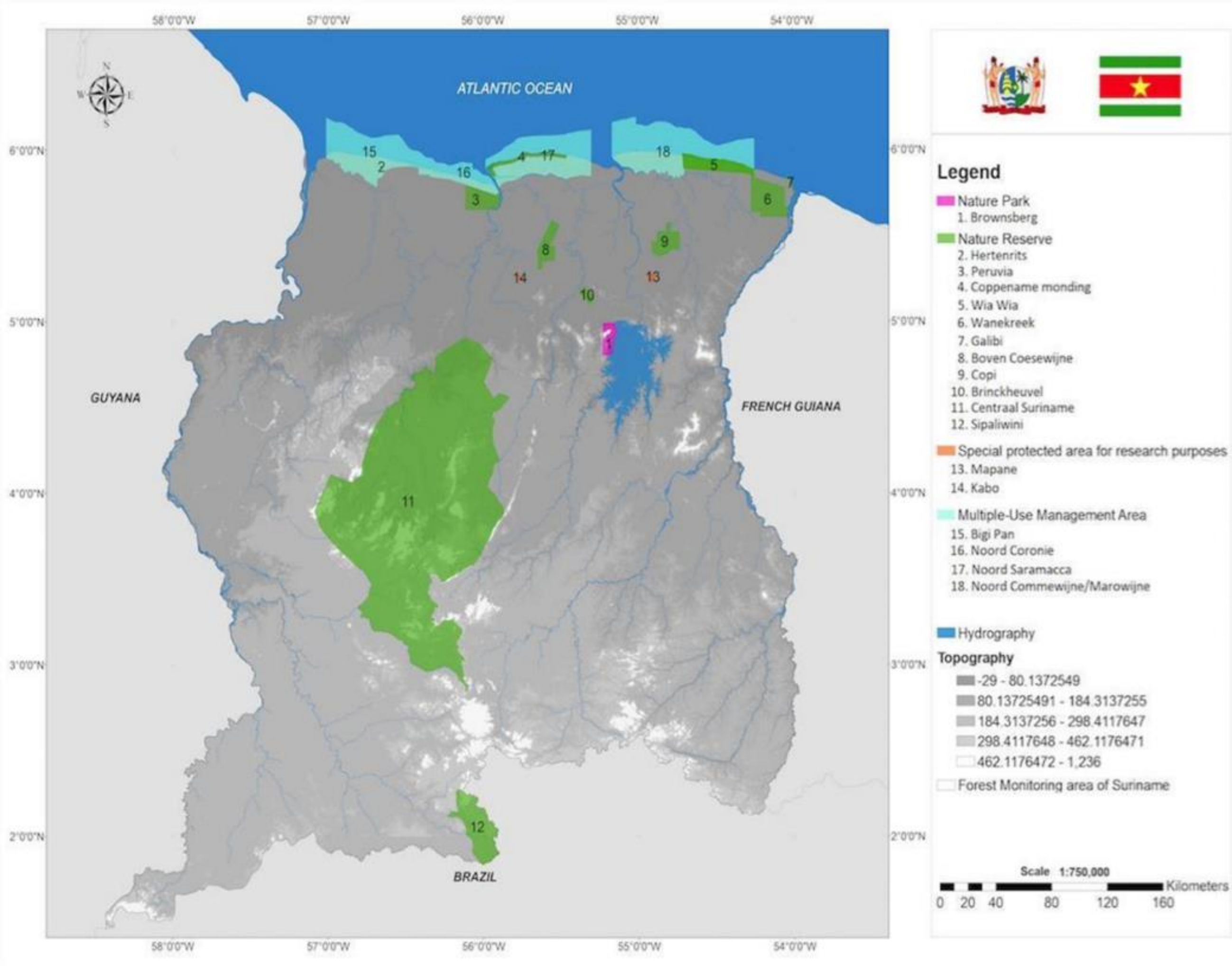


Figure 21 Map showing the protected areas in Suriname
Source: Table adapted from the partial report: Vulnerability Assessment and Adaptation Measures – Cross-cutting sectors, Sitaram-Tjin A Soe, F., 2023.

Use of mercury

The use of mercury in small-scale gold mining activities has increased exponentially in the last decades. Mercury is added to a mixture of ore and other materials and then heated to extract the gold easier. By doing this, almost 70% of the mercury will be released by vapor and 20% is discharged with the tailing to creeks and rivers. This leads to enormous discharge of mercury into the environment. According to the "Suriname Minamata Initial assessment" report from 2022, the estimated total amount of anthropogenic emissions and releases of mercury correspond to 88,864 kg Hg/year. From the total estimated emissions and releases of mercury from anthropogenic sources, 97% was estimated to originate from gold mining activities, corresponding to 86,225 kg Hg/year. The remainder of mercury emissions and releases (3%) corresponds to mercury emissions and releases from waste incineration (informal waste burning); waste dumping/landfilling (informal dumping of general waste) and consumer products containing mercury (thermometers and batteries containing mercury) (Republic of Suriname, 2020).

Waste management
The Ministry of Public Works is in charge of managing the solid waste collection services in the districts of Paramaribo, Wanica, Para, Saramacca, and Commewijne. Trucks gather waste, that is then dumped in the open landfill Ornamibo, which is situated in the Wanica district. The environment and general public health are at risk since this key dumpsite lacks any surface liner or other sanitary facilities. An estimated 200,000 m^3 of solid trash are deposited at Ornamibo each year, primarily from homes, businesses, markets, offices, industries, and hospitals in the servicing regions (Royal Haskoning DHV & Ilaco, 2018). Due to this landfill's closeness to inhabited areas, there is a major risk to both human health and the environment. For example, natural vegetation is deteriorating, water supplies are being contaminated, and air quality is being negatively impacted. Uncontrolled exposure to waste streams throughout the waste cycle, including exposure to waste along the streets, at the temporary storage sites and at the central dump sites, as well as exposure to hazardous waste, which is mixed largely with the domestic waste streams leads to impacts on health and the environment. In 2018, a feasibility study was done for a new sanitary landfill at Ornamibo starting with the closure of the existing dumpsite. Landfill gas inside the new dump site will be collected with horizontal gas wells. As such the gas will be incinerated (flared) to reduce methane emissions and related climate impacts and will later be used to generate electricity.

Institutional framework
Lacking the necessary institutions and absence of legislation or poor functioning of institutions will put coordination and facilitation of climate change adaptation at risk. The institutional and legal framework that should coordinate and facilitate climate change adaptation is crucial for all sectors. Besides the production sectors (water, energy and agriculture), also forestry, tourism, infrastructure, among others, are interlinked to this framework to regulate climate change adaptation. The Ministry of Spatial Planning and Environment (ROM) is responsible for the overall coordination of environmental issues and monitoring of the implementation of environmental policy. NIMOS is a statutory body functioning as the technical working arm of this Ministry and is in transition to become the National Environment Authority (NMA). It is crucial that all Government institutions, with climate change responsibilities, maintain good collaboration and establish a dedicated unit within their organization responsible for climate change related activities.

Table 19 gives an overview of the vulnerabilities and associated risk and impacts in the cross-cutting sector: environment.

Table 19 Vulnerability of the Environment sector

Exposure	**Risk**
All sectors governed by the institutional and legislative framework	• Risk of not having the framework in place to guide institutions and legislation concerning climate change
Impacts →	• Insufficient/ineffective implementation of climate change policies, plans, etc. • Weak enforcement of climate change related laws
sectors impacted →	• All sectors incl. Water, Agriculture, Energy, Health, Education & others (forestry, tourism, infrastructure, etc.)
Vulnerability	• Weak collaboration between coordinating ministries and government agencies with climate change mandate • Leadership role shared between Directorate of Environment and NIMOS

Source: Table adapted from the partial report: Vulnerability Assessment and Adaptation Measures – Cross-cutting sectors, Sitaram-Tjin A Soe, F., 2023

The following table provides a summary of the vulnerability and impact assessment of the various sectors.

Table 20 Summary of impacts, vulnerabilities and risks per sector

Sec-tor	Impacts	Vulnerabilities	Risks:
Energy	a) Interruption (burnouts, blackouts etc.) of energy services/supply affecting a large portion of the economy/ population, due to: - Insufficient capacity and outdated infrastructure - Increase in energy demands due to increased temperature. - Less water availability at the Afobaka Hydroplant for energy generation. - Increased maintenance and downtime because of damage by algal bloom and saltwater intrusion. b) Increased air pollution caused to exhaust gases and increased ambient temperature near urban travel routes due to urban sprawl. c) Shortages of fossil fuels for transportation due to global impacts of climate change. d) Disrupted energy systems caused by flooding and landslides. e) Competition for water resources in the interior (impacts especially women) due to shortages.	The coastal zone, where 87% of the population resides and most economic activities take place are especially vulnerable to the impacts of energy interruptions such as burnouts and blackouts. ITP in the hinterland dependent on fossil fuels for energy generation are also vulnerable to shortages of fuels.	Disruptions in economic activities and transportation, due to pressure on current energy supply systems.

Sec -tor	Impacts	Vulnerabilities	Risks:
Water resources	a) Drying out of the water resources in the dry season, resulting in the decreased availability of freshwater of required quality for drinking water supply, irrigation, and fishery/aquaculture. b) Pollution of the water resources in both coastal zone and the rural areas, caused by discharge of untreated domestic, industrial, and agricultural wastewater for into sewer systems and natural courses. c) Increase in health issues, due to water contamination and scarcity of quality water. d) Reduced availability of irrigation water for the rice and banana sector in the coastal districts Nickerie, Coronie and Saramacca, caused by salinization of the water resources in the dry season. e) Flooding. During periods of heavy rainfall, flooding can worsen in the coastal zone when accompanied by high river of sea water levels, leading to great damages and loss. f) Water scarcity and pollution due to prolonged drought and poor waste management practices, in especially the hinterland where ITP reside and access to water is limited.	Coastal zones such as Paramaribo, Wanica, Nickerie, Commewijne, Saramacca, Coronie and Albina, that are inhabited and/or used for agricultural purposes are vulnerable to the impacts of flooding, water shortages, prolonged drought, polluted water, saltwater intrusion, and reduced availability of irrigation water. All districts are rendered vulnerable to the scarcity of drinking water supply caused by dried out water resources. Farmers that do not have irrigation systems are more vulnerable to these impacts related to water. ITP in general and Indigenous and Tribal women especially are more exposed to contaminated water and are at greater risk of contracting diseases because of poor waste management practices and lack of sanitation. Girls helping in the home and pregnant women are also vulnerable to diseases.	Decreased agricultural production, drinking water scarcity and increase in water pollutions and related diseases.

Sec-tor	Impacts	Vulnerabilities	Risks:
Agriculture	a) Sea level rise and saltwater incursions will have a negative impact on wetland rice production which takes place in the young coastal area. A significant part of the low laying geologically young coastal plain is expected to be inundated if sea level rises. b) Freshwater availability for irrigation of rice can become a problem in certain areas in the case of unexpected long dry periods. c) Lack of forage at the end of the dry season and in the case of unexpected longer droughts. This can result in starvation of cattle. d) Flooding of pastures in the case of intense rains. e) Reduction in productivity of dairy and beef cattle, poultry, and swine due to increased temperatures and prolonged drought. f) Reduction of crop growth, development, and yield of rice due to increased temperatures. g) Irregulated crop calendar of the farmers in the hinterland due to seasonal changes and prolonged dry periods.	Vulnerable crops are especially rice, banana and fruit, which are mostly produced in the coastal zone. The coastal part of Nickerie where rice is cultivated is most vulnerable to flooding as a result of sea level rise and rainfall. Sipaliwini and Brokopondo are the most vulnerable districts due to their vulnerable agriculture and infrastructure sectors. Coronie is the least vulnerable due to its less vulnerable forestry and infrastructure sector. In the Matawai villages in the Upper Saramacca region, flooding of agricultural plots close to rivers and creeks flood twice a year. Wildlife in this region suffer from food shortage during extreme long dry periods and flooding. To survive these wild animals, use the crops on the fields as feed. Livestock, sheeps/goats, poultry and swines are especially vulnerable to increased temperatures throughout the country.	• Food scarcity and insecurity. • Loss of agricultural land and livelihoods.

Sec -tor	Impacts	Vulnerabilities	Risks:
Cross-cutting and cross- foundational sectors	Health sector: a) Increased foodborne (diarrhea), waterborne (malaria, dengue) and rodent borne diseases because of flooding by heavy rainfall. b) Increased heat-stress and heat related illnesses (Salmonella and Campylobacter) due to increase of temperature. c) Food shortages due to flooded agricultural land. d) Increased mental stress, induced by loss of relatives, property, and food amongst others. e) Deaths caused by flooding, landslides, diseases and illnesses, heat-stress amongst others.	Health care facilities located in the coastal zone and hinterland are vulnerable to the impacts of flooding. Poorly developed healthcare facilities with poorly trained staff, inadequate energy, supplies, water, sanitation and waste management are impacted more thoroughly. Vulnerable groups are considered elderly, children, low-income groups and disabled.	Health deterioration, loss of lives and malnutrition.
	Education: a) Loss and damage of school infrastructure, textbooks, and other school material due to flooding. b) Absenteeism (missed classes) and low school performance. c) Increase in weather related diseases.	Schools in the low-lying coastal area and the hinterland alongside rivers are susceptible to flooding. Schools are not equipped with climate proof infrastructure or means to	Disruptions in education.
	Spatial planning: a) Unsuitable zones/areas for development planning. b) Relocation/displacement of current development (utilities, health, school facilities, agricultural areas) to higher elevated / low risk areas. c) Penetration of seawater and the destruction of beaches. d) Local flooding due to sea level rise as well as severe damage to biodiversity.	Absence of zoning plans, leading to unplanned settlements and conflicting land uses in flood prone areas. Mapping records and land use conditions are outdated for vulnerable areas. Absence of a building act.	Areas/zones become unsuitable for development.
	Disaster risk reduction: a) Destruction and loss of livelihoods and homes. b) Loss of agricultural land. c) Water pollution: contamination and scarcity of water. d) Disruptions in essential services due to damaged infrastructure: schools, health	Absence of a national disaster plan. Absence of coordination units/shelters for victims of disasters.	Insufficient or no preparedness and response capacity when climate related disasters occur.

Sec-tor	Impacts	Vulnerabilities	Risks:
	care facilities, roads and bridges amongst others. e) Disruptions in energy supply.		
	Environment: a) Loss of biodiversity and spread contamination due to flooding. b) Insufficient/ineffective implementation of climate change policies and plans. c) Weak enforcement of climate related laws.	Weak collaboration between coordinating ministries and government agencies with climate change mandate. Shared leadership role between governmental agencies responsible for environment.	• No framework in place to guide institutions and legislation related to climate change. • Environmental pollution.

Source: Table compiled with information from the partial reports: Vulnerability Assessment and Adaptation Measures for the energy, agriculture, water resources and cross-cutting sectors, 2023

2.5. Proposed Adaptation Measures

Suriname, with its low-lying 386 km long coastal plain which holds 87% of its population, and its densely forested and secluded Interior, is inevitably vulnerable to the impacts of climate change. Given these circumstances, it is important to prepare for and adapt timely to climate change.

This part of the reporting presents an overview of the current projects and policy supporting adaptation in Suriname and the proposed adaptation measures for the energy, water resources, agriculture and cross-cutting (education, health, environment, spatial planning, and disaster risk reduction) sectors, based on the identified impacts resulting from the vulnerability assessment in section 2.4.

2.5.1. Methodology

An overview of current projects and policy documents supporting adaptation in Suriname was established by means of a desktop study and as provided in the sectoral technical reports from the different experts. The following general methodology was used to formulate adaptation measures for the different sectors:

(i) Update of adaptation measures of the NAP based on the updated vulnerability assessment in the previous chapter, experts' knowledge, and judgement;
(ii) Prioritizing adaptation measures during validation workshops and or online survey with relevant stakeholders.

2.5.2. National Projects and Supporting Policies

Since the submission of the NC2 in 2016, different policy documents have been drafted for climate change mitigation and adaptation. Following is a summary of relevant climate change policy documents regarding adaptation developed in the past five years (2018-Present). A more detailed overview is presented in chapter 5 entitled: Other Information.

- **National Climate Change Policy, Strategy and Action Plan for Suriname (NCCPSAP) 2014-2021.** The objective of the NCCPSAP is to provide a policy statement on Suriname's response to climate change and commitment and consists of a National Climate Change Policy, Strategy and Action Plan. The NCCPSAP is currently being updated;
- **Suriname National Adaptation Plan (NAP 2019-2029).** The objective of the National Adaptation Plan is to enable Suriname to conduct comprehensive medium and long-term climate adaptation planning. It is a flexible approach that builds on the country's existing adaptation activities and mainstreams climate change into national decision-making, development planning, policies, and programs.;
- **National Mangrove Strategy Suriname 2019 (NMS).** The NMS promotes the strengthening of the legal framework (including enforcement)

and introduces adaptation technologies to support the sustainable and effective management and monitoring of mangrove ecosystems;

- **The Nationally Determined Contributions NDC 2020 (2019).** The objective of this second NDC is to outline a cost-effective pathway to decarbonization of sustainable economic development, maintaining the integrity of natural forest acting as a carbon sink, and strengthening resilience to enable adaptation and mitigation action;
- **Sector adaptation strategy and action plan (SASAP) for water resources in Suriname.** The SASAP provides actors in the water resources sector, including Government bodies as well as non-governmental stakeholders, with a structured plan for integrating adaptation in the sector, as well as a set of concept notes to be elaborated to enable funds to be secured for implementation of priority actions;
- **Multi Year Development plan (2022 – 2026).** This plan acknowledges the climate issue and is being considered in various (economic) development plans and strategies, including the number of uncertainties that come with climate change. Adaptation to climate change was also a part of the approach to prepare the plan;
- **State of the Climate Report (SOC) (2021)**, which was one of the products from the project to facilitate Mainstreaming Climate Change in Sustainable Decision-Making Tools.

2.5.3. Proposed Adaptation Measures

The following section an overview is presented of the proposed adaptation measures per subsector.

2.5.3.1. Proposed Adaptation Measures Energy Sector

Adaptation measures have been identified along with different aspects of the energy sector, i.e., consumption, policy, institutions & legislation, generation, transmission and distribution networks, urban development, and transportation. To this end, use has been made of the National Adaptation Plan, State of the Climate report, the Suriname Nationally Determined Contribution (NDC) 2020 (2019), reports and insights from other countries and regions (Lachman, 2014) and interviews with relevant stakeholders among others.

The proposed adaptation measures for the energy sector are presented in the table below.

Table 21 Proposed adaptation measures and measures related to mitigation or sustainable development with adaptation co-benefits for the energy sector

Proposed adaptation measures for the Energy sector	
Area of intervention	**Adaptation measures**
Generation:	
Distributed energy	Coinciding with renewable energy, to avert too much concentration of assets, generation options need to be realized in a distributed manner in order to spread risks.
Reserve margin	Increase reserve margin
Redundancy	a. Having multiple production facilities provides flexibility in the event that one facility is shut down. b. Install backup generation (many facilities, ranging from refineries to hospitals, and data centers, already have standby generation systems).
Transmission & Distribution Networks:	
Intelligence	Enhancing resilience through better intelligence is required. This involves using information technology to harness big data, advanced analytics, and more sophisticated monitoring and automation (RMI, 2014, 2018b).
Network Coupling and Decoupling	Enhance resilience by expanding the number and type of generation units available for dispatch. Likewise, when a network fails, users may need the ability to 'decouple' and operate without the support of the central system. This is particularly true for critical facilities such as hospitals, water treatment facilities and communication systems (RMI, 2014, 2015a, 2015b).
Transnational connections	Explore possibilities for joint investments with neighboring countries in cross-border transmission and distribution networks to further spread risks.
Proposed measures related to mitigation or sustainable development with adaptation co-benefits	
Area of intervention	**Measures**
Consumption:	
Energy saving business models (ACEEE, 2015)	Introduction of incentive programs from the Government and/or utility companies for alternate bus models that save energy (carpooling, distance working, cloud computing).
Energy building code	Introduction of energy efficient buildings and houses. The design of energy efficient buildings relies on a selection of appropriate techniques that are suitable for the local tropical climate, such as natural ventilation, no escape routes for air, shading devices, thermal insulation (to minimize direct solar gain), zoning to avoid cooling, and ceiling fans where possible with minimal dependency on heating-cooling devices. An energy building code provides this selection as guidelines to embed energy efficiency and savings into residential and commercial building construction.
Equipment labeling and performance	a. Promotion of energy efficiency is household appliances and industrial equipment. Labeling provides consumers with information, which enables them to compare the energy efficiency of the different appliances available for purchase

standards (Alam et al., 2012)	b. Adopting international minimum performance standards and enforce those at the port of entry. Performance standards steer suppliers towards removing less efficient appliances from the market (Chen at al., 2012)
Rebates and tax incentives	Deployment of rebates and tax incentive instruments to render energy efficient appliances and equipment more attractive (Yungrae, 2007, Bowers et al., 2018).
Public procurement	Promote procurement of energy efficient goods and services by the public sector to scale up demand and set an example (Brichetti, 2022, Energy Center, 2006).
Policy, Institutions & Legislation:	
Climate change in all policies	Development of laws, policies (in particular the Energy Sector Plan), and regulations considering climate change in the planning of public investments (Bowers et al., 2018).
Net metering	Adjust Electricity Act, to enable/allow small-scale electricity consumers to generate their own electricity and to feed it into the grid, creating a two-way flow of electricity whereby the customer is billed or credited/paid based on the ratio of power consumed to power generated (DOE, 2010).
Market-based electricity tariffs	Create incentives via subsidy reform to encourage more energy efficient consumption. This will have positive impacts on energy security and make renewable energy and technologies more competitive (Nagayama, 2008).
De-risking projects	Bundling a larger number of small projects into one. This would diversify the risks and bring the transaction costs to a reasonable level (White et al., 2013, Gokhale-Welch and Watson, 2019).
Granular tariffs	Introduce tariff differentiation (granularity), whereby units of electricity can reflect the real costs associated with the generation of that particular unit (Lachman, 2011, 2014). This granularity can occur alongside parameters such as temporality, location, and attribute.
New utility business models	Reforming business model and hereby supporting multiple attractive characteristics, such as creating business opportunities, investments in clean energy services and products, value creations for customers amongst others.
Performance-Based Regulation	Establish performance standards for electricity generators and network companies (Beder, 2007, Sovacool, 2009).
Mini-grid business model	Developing sustainable and scalable (innovative) business model for installing, operating and maintaining mini grids, including a payment system.
Energy Efficiency audits	Executing energy efficiency audits. Under the Electricity Act of 2016 (though it requires a revision), the Energy Authority Suriname should establish an auditing function to properly implement carrots and sticks for energy efficiency performance of buildings, industrial equipment, and residential housing (White et al., 2013).
Awareness programs	Develop and implement awareness raising programs to promote energy conservation and efficiency for domestic and commercial users (Apergis and Tang, 2013).
Research	Conducting research to gather data that are relevant to proper functioning of assets in the energy sector (Bointner, 2014, Bouncken and Kraus, 2014). This regards the systematic collection and analysis of data, including – but not limited to – salinization, erosion, water levels, river dynamics, natural ecosystems, etc.

Educational programs	Development of new and enhanced vocational and degree programs in conjunction with regional and international expert education partners (Mulder et al., 2007).
Carbon-tax	Introduction of a carbon tax on emissions from thermal power generation in (especially) extractive industries.
Co-investment fund:	Enable and utilize the co-investment fund mentioned in the Savings and Stabilization Fund Act for Suriname to be able to finance needed transitions in the sector.
Generation:	
Renewable energy	Assessment of the feasibility of the utilization of new energy sources, such as wind, solar, biomass and hydropower, as well as other electricity generation methods.
Renewable energy incentives	Introduction of exemption from import duties, tax holidays, feed-in tariffs, production tax credits, etc. need to be deployed to attract investment (Lovins, 2011, WWF, 2020)
Transmission & distribution networks:	
Hardening existing networks	Strengthening transmission towers, building seawalls around power plants, reducing the need for power plant cooling water, storing larger amounts of fuel at plants, and other measures that mainly treat the large-scale system.
Demand flexibility	Allow demand to respond continuously to changing market conditions through price signals or other mechanisms.
Bidirectionality	The utility (grid operator) needs to add in communications capabilities and gain more granular control options, because the influx of intermittent renewable power demands much more rapid and accurate responses.
Urban Development:	
Zonal planning and regulation	Improved enforcement of zonal planning and regulation to stimulate efficient city design (smart cities), infrastructure and housing development. For instance, stimulate building flats instead of individual houses (NEA, 2010, Lachman et al., 2018).
Decentralize urban development	Establish/ignite new centers of urban development (separate from Greater-Paramaribo).
Transportation:	
Subsidies	Remove fossil fuel object subsidies and introduce subject subsidies (NEA, 2010, European Institute for Sustainable Transport, 2011).
Electric vehicles	Introduction of electric vehicles (EVs)

Source: Table adapted from the partial report: Vulnerability Assessment and Adaptation Measures for the Energy sector of Suriname, Lachman, D., November 2022

2.5.3.2. Proposed Adaptation Measures Water Resources Sector

The evaluation and update of the Adaptation Measures for Water Resources from the NAP (2019) are based on the technical report "Water Sector Baseline and Climate Projections for Water Resources" (Amatali, 2023), the Updated SWOT analysis, collected data and information from stakeholders and fieldtrips, relevant information from documents, and expert judgement.

In addition, seven (7) concept notes have been developed to elaborate on the adaptive measures identified as priorities during the stakeholder consultation. The concept notes have been designed to align with the specific strategic objectives for adaptation in the water resources sector, as well as the core strategic objectives identified in the NAP. They have been developed with inputs from affected stakeholders, including on budgets and timelines, through the consultation and validation meetings. The developed concept notes are presented in the table below.

Table 22 List of concept notes as part of the SASAP for the water resources sector in Suriname (GOS, 2022)

Concept note no.	Project name	Project duration	NAP Strategic Objectives
1	Vulnerability and risk assessments for different water uses	3 years	• Establish a comprehensive national research programme on social, environmental, and economic baselines, climate science, climate vulnerability, impacts, and risk management (NAP Water Resources [WR] Strategic Objective 1). • Incorporation of local knowledge, experiences, and practices in climate actions (NAP Strategic Objective 5.2).
2	Establishment of systems for managing climate change data and information in the water resources sector	3.5 years	• Comprehensive national research programme on social, environmental, and economic baselines, climate science, vulnerability, impacts and risk management (NAP WR Strategic Objective 1). • Provide the necessary resources to ministries to modernize and expand facilities, tools, and equipment to facilitate achievement of their climate related mandates (NAP Strategic Objective 2.2). • Increase the capacity for wider partnership involvement in collecting and using national data and information (NAP Strategic Objective 2.4).

3	Establishment of institutional structures for integrated, climate-resilient and gender-responsive management of water resources	3.5 years	• Develop and implement law, policy, and regulation to ensure sustainable exploitation and use of drinking water resources and wastewater management (NAP WR Strategic Objective 2). • Design, implement, and enforce suitable governance procedures and processes to forward the national climate change adaptation agenda (NAP Strategic Objective 1.3).
4	Implementation of land management solutions to protect water resources	4 years	• Water management programme to increase resilience of water supply (WR Strategic Objective 3).
5	Development of infrastructure for flood protection and drainage	4 years	• Climate-resilient infrastructure development to ensure availability of drinking water and other uses of water (NAP WR Strategic Objective 4).
6	Improvement and rehabilitation of infrastructure for better water management	4 years	• Climate-resilient infrastructure development to ensure availability of drinking water and other uses of water (NAP WR Strategic Objective 4).
7	Establishment of water storage mechanisms to build resilience to drought and flooding	4 years	• Water management programme to increase resilience of water supply (NAP WR Strategic Objective 3).

Source: Table compiled by Amatali, M.A. from SASAP, as listed in the partial report: Vulnerability Assessment and Adaptation Measures for the Water resources sector, February 2023

The proposed adaptation measures for the water resources sector are presented in the table below.

Table 23 Proposed adaptation measures for the water resources sector

Proposed adaptation measures for the Water Resources sector	
Area of intervention	**Adaptation measures**
Data Collection, processing, management, and research:	a. Undertake in-depth studies and establish an observation network and monitoring system, in order to enhance water management and sustainable use of water resources. More specifically: – Optimize climate change related data collection, capacity building, institutional strengthening, data processing and analysis and data management. Additionally, improve financial valuation for the relevant specialists. – Assess vulnerabilities and risk from climate change to drinking water and other uses e.g., irrigation, fisheries, etc. Including gender responsive assessment on water management, including survey on unpaid time spent by individual household members in supplying water, making it safe for use, and managing it. – Undertake an assessment of water needs (for example, irrigation, drinking, waste treatment, industrial) and sources, identify and appraise options for new sources (including water balance and aquifer replenishment studies). – Conduct feasibility studies to explore the possibility of additional groundwater projects, as well as alternative freshwater resources, to buffer the effects of saltwater intrusion. – Explore the development of mechanisms to facilitate Integrated Water Resources Management (IWRM), including appropriate institutional and legislative frameworks at all stages of water planning and management. – Awareness raising program on the impacts of climate change on water resources and management of these impacts, including from gender perspectives. – Nurture and maintain the SWRIS (Suriname Water Resources Information

	System) web-based platform and appoint formally or give the responsibility to maintain and regularly update its information to an institution. Upload research papers (or at least a summary) on this website for knowledge management and sharing – Introduce and maintain Water Resource Mapping. Assess the quantity and quality of available water resources, including groundwater, surface water and subsurface water, to observe trends and to support long term planning and strategy development in relation to climate change. – Establish an observatory of the coast of Suriname, to collect data and develop knowledge on the coastal processes and ecosystems needed for coastal zone management and coastal protection. – Implementation of concept note "Vulnerability and risk assessments for different water uses". – Implementation of concept note "Establishment of systems for managing climate change data and information in the water resources sector".
Related to law, policy and regulation	a. Addition of the climate change aspect including the law on meteorological services after formal approval of the water law; and development of surface water law. Include provision for the protection of water resources, promotion of their sustainable use and for water quality standards and wastewater discharge. More specifically: - Assess options for the establishment of an institutional organization for the enhancement of water management. – Initiate study to indicate the required water resource governance and administration system best suited to Suriname. – Establish more water boards and a national water authority. c. Develop robust land management and waste management policies: – Establishment of water quality standards for each wastewater type.

	– Treatment so as to reduce discharge of pollutants including sediments, sewage, agrochemicals and mining pollutants into water systems and protect aquifers from surface contamination. d. Develop policy, regulations, standards, and best practice guidance to support national water resource management that is adaptive to climate change: – Construct water storage mechanisms for use of water in times of drought; possibilities include artificial controlled ground reservoirs, water towers, or bottled water reserves in strategic locations throughout the country – Develop policies to increase efficiency of drinking water use and supply mechanisms (for example improving infrastructure, capacity building and raising awareness. – Develop policies to increase efficiency of other water type use and supply mechanisms (for example improving infrastructure).
Resilient water management programs	a. Consider current integrated water resource management approaches and future proposals with an intent of mainstreaming climate change adaptation processes into these frameworks. More specifically: – Develop and implement land and waste management solutions to reduce discharge of pollutants into water resources. Implementation of concept note for "Implementation of land management solutions to protect water resources". – Develop, implement and monitor drinking water storage mechanisms for use in times of drought and flooding. Concept note is ready for "Establishment of water storage mechanisms to build resilience to drought and flooding". Continue to Continue the process to implement this activity – Develop, implement and monitor other water types storage mechanisms for use in times of drought and flooding.

	Concept note ready for "Improvement and rehabilitation of infrastructure for better water management". Continue the process to implement this activity – Minimize loss in water production, storage and distribution systems. Concept note ready for "Improvement and rehabilitation of infrastructure for better water management". Continue the process to implement this activity – Introduce and apply water modelling, to develop and implement an Early Warning and seasonal forecasting system, based on climate forecasting and hydro modeling to be able to predict real-time seasonal flooding and/or severe droughts – Concept note is ready for "Establishment of institutional structures for integrated, climate-resilient and gender-responsive management of water resources". Continue the process to implement this activity b. Identify and implement wastewater recycling schemes, including domestic, industrial, agricultural, mining and forestry sector. – Re-use wastewater from domestic, tourism, industrial and agricultural, for example for agricultural irrigation, reducing demand for drinking water.
Resilient infrastructure	a. Develop and upgrade infrastructure for water supply, irrigation. More specifically: – Construct an emergency network of agricultural irrigation pipes and pumps connected to reliable water sources, such as nearby larger freshwater rivers or controlled reservoirs. – Increase efficiency of water use, including storage and distribution, without compromising sanitation systems. – Construct facilities for using of surface water for drinking water supply. – Upgrade the storage capacity of water reservoirs for irrigation – Introduce Rainwater & surface water harvesting and storage, to create natural

	and artificial reservoirs to harvest and store excess rainwater to be able to use in periods of water shortages in the sector b. Develop and upgrade infrastructure to cope with the effects of climate change and sea level rise e.g. drainage and flood protection: – Develop mechanisms to reduce intrusion of river and sea water – Develop a leakage management program including mains rehabilitation, to reduce water leakage from distribution and supply networks – Implement the existing Integrated Coastal Zone Management plan – Adequate zoning in land-uses to prevent river and coastal flooding of inhabited and cultivated areas beyond the coastal area, including the establishment of a minimum development setback of 1.5 km from the coastline to support the floodplain restoration – Improve existing infrastructure and establish new sustainable measures against river, pluvial and coastal flooding – Develop and implement emergency management systems in areas prone to flood hazard including forecasting, warning, and evacuation. Introduce the use of flood proofing buildings – Concept note is ready for "Development of infrastructure for flood protection and drainage".

Source: Table adapted from the partial report: Vulnerability Assessment and Adaptation Measures for the Water resources sector, Amatali, M.A., February 2023

2.5.3.3. Proposed Adaptation Measures Agriculture Sector

The agriculture sector is ranked as vulnerable to highly vulnerable, due to the effects of climate change. The vulnerability assessment has identified appropriate adaptation strategies and measures, which have been divided into two groups: (i) general strategies and (ii) specific measures. The proposed general adaptation strategy for agriculture is the development and implementation of appropriate research programs and capacity-building activities focused on animal husbandry (raising water buffalo), crops (the introduction of new, resistant varieties, including salt-tolerant and upland rice; integrated pest management) and fisheries (improving competitiveness). Specific measures for the agriculture subsectors are presented in the table below.

Table 24 Proposed adaptation measures for the agriculture sector

Proposed adaptation measures for the agriculture sector	
Subsectors	**Adaptation measures**
Rice	a. Construction of dikes in low-lying areas b. Establishment of necessary infrastructure for improved rice irrigation c. Creation of agro-ecological research programs focused on integrated pest management and disease control d. Establishment of an insurance fund to compensate farmers whose crop production suffers damage from erratic weather events e. Research on crop rotation to investigate alternatives for rotating in drought resistant crops during periods of water constraint such as the long dry season.
Bananas	Planting of arboreal hedgerows to protect crops from strong winds
Fruits and vegetables	a. Implementation of alternative growing systems such as greenhouses and hydroponic gardens in order to cope with changing climatic conditions b. Improvement of drainage systems to guarantee efficient production and quality products c. Implementation of crop diversification to guarantee food security under changing climate conditions
Livestock (poultry, dairy production, sheep, goats and pigs)	a. Rehabilitation of abandoned farms in order to guarantee food security (for example, moving cattle from vulnerable coastal areas to higher ground) b. Establishment of measures that prevent further decline in the numbers of productive animals (for example, regulating the slaughter of female animals and the import of beef cattle for a certain period c. Import of climate resilient dairy cattle breeds d. Introduction/improvement of climate-control systems on livestock farms. Introduction/implementation of measures to prevent especially heat stress.

Aquaculture and fisheries	a. Creation of measures to improve sustainable aquaculture and fisheries management b. Protection of fish breeding waters (salt pans, mangrove vegetation, coastal wetlands) and c. Establishment of funding that provides incentives for fishermen to engage in aquaculture.

Source: Table adapted from the partial report: Vulnerability Assessment and Adaptation Measures for the Agriculture sector, Tjien Fooh, R., 2023

2.5.3.4. Proposed Adaptation Measures Health Sector

The objective of adaptation in the public health context is to reduce disease burdens, injuries, disabilities, suffering and deaths. The following adaptation measures are proposed for the health sector. These measures are familiar to the public health community and are needed regardless of whether or not climate changes occur they constitute the basis of a "no-regrets" adaptation strategy (WHO, 2003). Proposed adaptation measures for the health sector are presented in the table below.

Table 25 Proposed adaptation measures for the health sector

Proposed adaptation measures for the health sector	
Area of intervention	**Adaptation measures**
Develop early warning and response systems	Develop early warning and response systems for climate-sensitive health risks such as injuries/ deaths, infectious diseases, and food and water insecurity resulting from extreme climate events**.**
Reduce heat stress	Installation of air conditioners in medical health care facilities**.** Disease such as **are prevented:** respiratory allergies and airways diseases, decreased chemical tolerance and fatigue.
Training facilities and plan for health practitioners	Provide training on climate awareness and action, disaster response and recovery.
Resilient infrastructure/ policy related	Promote climate proof and safe health clinics and hospitals by incorporating flood resistance and, adequate ventilation amongst others into the design and planning phase through building codes and guidelines**.**
Waste management	Improve waste management, adequate water supply, sanitation, and energy supply in all health facilities.
Data collection and sharing	Improve climate change and health related data collection methods, research, training, and monitoring of climate change related diseases.

Source: Table adapted from the partial report: Vulnerability Assessment and Adaptation Measures for the Cross-cutting sectors, Sitaram-Tjin A Soe, F., February 2023

2.5.3.5. Proposed Adaptation Measures Education Sector

The proposed adaptation measures for the education sector are presented in the table below.

Table 26 Proposed adaptation measures for the education sector

Proposed adaptation measures for the Education sector	
Area of intervention	**Adaptation measures**
Awareness activities	Increase public awareness on relevant topics such as climate change causes, impacts and effects (water related diseases, nutrition, losses etc.) and advise on how to prevent/prepare for climate change impacts amongs~~t~~ others. The youth, communities, social media, and the commercial media can be included to advance climate~~s~~ awareness. The university, NGO's -and private sector can play a significant role as support mechanisms.
Education/innovation	Improve development of critical educational resources and innovative communication methods based on climate policies and related action plans, hereby creating an enabling and empowering environment to gain necessary knowledge, skills and attitudes needed to enable climate action. Information on how to adapt to climate change and climate smart education should be included in current curriculum, to support informed decision-making.
Training plan for education sector staff	Training of education sector staff on climate awareness and action, disaster response and recovery.
Resilient infrastructure / policy related	Promote climate proof and safe schools and educational facilities by incorporating flood resistance and, adequate ventilation among others into the design and planning phase through building codes and guidelines.
Improve access to basic services/ facilities	Improve waste management, adequate water supply, sanitation and energy supply at schools and educational facilities.
Data collection and sharing	Improve research and data collection on the impacts of climate change on the education system in the different vulnerable urban and rural areas and in the Interior. This data can be used to develop more specific and custom-made measures/action plans to address these impacts and disaster response plans.

Source: Table adapted from the partial report: Vulnerability Assessment and Adaptation Measures for the Cross-cutting sectors, Sitaram-Tjin A Soe, F., February 2023

2.5.3.6. Spatial Planning

The proposed adaptation measures for the spatial planning sector are presented in the table below.

Table 27 Proposed adaptation measures for Spatial Planning

Proposed adaptation measures for Spatial Planning	
Area of intervention	**Adaptation measures**
Relocate	Relocate utility infrastructure and production facilities, including health and educational facilities, to higher elevations and less flood prone areas.
Isolate and protect	Implement operational measures and isolate/ protect vulnerable assets/ facilities.
Develop and implement zoning plans	a. Develop and implement zoning plans for agricultural zones e.g., Nickerie and Commewijne that are likely to be most affected by the impacts of climate change, including building codes for water and energy utilities and infrastructure works. b. Determine buffer zones along the coastline and along other water bodies such as rivers and lakes. c. Preserve coastal land and development through Integrated Coastal zone management (ICZM). d. Prohibit new infrastructure works in vulnerable zones and gradually reduce existing activities in vulnerable zones.
Energy resources	Expand sustainable energy sources and decentralize transmission in order to reduce vulnerability of energy infrastructure to climate impacts.
Community involvement	Cooperation and involvement of the community by engaging in climate change planning efforts with Government and other local organizations.
Capacity building	Build staff capacity by publishing a list of certified/ qualified green infrastructure contractors/ engineers.
Resilient infrastructure / policy related	a. Require incorporation of climate change aspects into planning new infrastructure (ESIA). b. Integrate flood management and modeling into land use planning when building future utility infrastructure.
Training	Provide training for ministerial staff on how to assess green infrastructure proposals.
Legislation and policy	Update existing legislation and regulations relevant to land-use planning

Source: Table adapted from the partial report: Vulnerability Assessment and Adaptation Measures for the Cross-cutting sectors, Sitaram-Tjin A Soe, F., February 2023

2.5.3.7. Disaster Risk Reduction

The following adaption measures are in accordance with the Index of Government and Public Policy (iGOPP) in the Disaster Risk Management report (Lacambra, S. et. Al, 2021) and expert's judgement.

Table 28 Proposed adaptation measures for Disaster Risk Reduction

Proposed adaptation measures for Disaster Risk Reduction	
Area of intervention	**Adaptation measures**
Short term (1-4 years)	
Infrastructure	**a.** Officially define the essential buildings, indispensable or critical infrastructure in Suriname. **b.** Complement Suriname's Building Code with regulations to incorporate disaster risk reduction measures in public and private infrastructure.
Regulations	Promote the inclusion of disaster risk reduction in sectorial and public services regulations, duties, and activities. Encourage regulations that mandate public entities to reduce the vulnerability of essential buildings, indispensable or critical infrastructure.
Resources allocation	Prioritize sectors to allocate resources to disaster risk reduction activities that can be specifically identified through budgetary instruments/tools.
Awareness	Increase awareness within the community and provide training on how to respond to climate related disasters.
Legislation	Develop specific legislation with regards to disaster management, incorporating climate change. (Develop linkages between draft legislation and the National Road Safety Plan and a National Health Disaster Plan).
Research	Conduct research into past hurricane trends and potential links to climate change.
Climate financing	Establish a disaster relief fund.
Long term (4 -8 years)	
Regulations	a. Promote the inclusion of disaster risk reduction roles and responsibilities in the new DRM regulations detailing the responsibility of Districts and Resorts, Sectors and Utilities. b. Promote the identification of risk areas in development planning and land use regulations. c. Include disaster risk analysis and climate change studies in all phases of public pre-investment processes.
Legislation	Develop legislation to make climate change studies a requirement for the approval of public investments.

Source: Table adapted from the partial report: Vulnerability Assessment and Adaptation Measures for the Cross-cutting sectors, Sitaram-Tjin A Soe, F., February 2023

2.5.3.8. Environment

The proposed adaptation measures for the environment sector are presented in the table below.

Table 29 adaptation measures for Environment

Proposed adaptation measures for Environment	
Area of intervention	**Adaptation measures**
Policy/legislation	Review and update Forest Management Act to include climate change considerations.
Programs/strategies	a. Develop conservation strategies/programs for sectors such as mangrove planting, nature-based solutions along coastal areas and restoration for wetland protection. b. Implementation of conservation strategies designed to protect marine- and wildlife that are threatened in the face of climate change. c. Continue analysis on past climate impacts on forests and sustainable forest management with emphasis on mangroves. d. Identification, analysis, and implementation of sustainable forestry options in Suriname, including but not limited to soil degradation and nourishment, reforestation planning, irrigation, protected areas, agro-forestry, buffer zones, production and harvesting, natural stands and participatory management. e. Further strengthen National Forest Management System (NFMS). f. Include mangrove conservation and afforestation in REDD+ strategy and identify REDD+ readiness actions needed for mangrove carbon sequestration including through mangrove planting, effective management, and rehabilitation.
Climate financing	a. Develop a fund for climate financing across sectors (financing to implement adaptation measures. b. Assess options to access climate finance through UNFCCC mechanisms and other related funding avenues financing carbon sequestration by forest and sustainable forest management or Climate resilience and mitigation action.
Training	Provide training for ministerial staff on how to review green infrastructure proposals.
Innovation/technologies	Implementation of climate resilient technologies that have been prioritized and identified within the Technology Needs Assessment for the sectors (water, agriculture, infrastructure, and housing)
Awareness	Perform awareness activities regarding the role of forest conservation, restoration, and sustainable use of forests in climate change.

Source: Table adapted from the partial report: Vulnerability Assessment and Adaptation Measures for the Cross-cutting sectors, Sitaram-Tjin A Soe, F., February 2023

The following table presents an overview of the proposed adaptation measures for the various sectors.

Table 30 Overview proposed adaptation measures per sector

Sector	Impacts	Adaptation
Energy	a) Interruption (burnouts, blackouts etc.) of energy services/supply affecting a large portion of the economy/ population, due to: - Insufficient capacity and outdated infrastructure - Increase in energy demands due to increased temperature. - Less water availability at the Afobaka Hydroplant for energy generation. - Increased maintenance and downtime, because of damage by algal bloom and saltwater intrusion. b) Increased air pollution caused to exhaust gases and increased ambient temperature near urban travel routes due to urban sprawl. c) Shortages of fossil fuels for transportation, due to global impacts of climate change. d) Disrupted energy systems caused by flooding and landslides. e) Competition for water resources in the interior (impacts especially women) due to shortages.	• Coinciding with renewable energy, • Increase reserve margin. • Develop multiple production facilities and install backup generators. • Enhance resilience through better intelligence (IT) and by expanding the number and type of generation units available for dispatch. • Explore possibilities for joint investments with neighboring countries. ***Mitigation or sustainable development measures with adaptation co-benefits:*** a) Introduction of: - Incentives for energy saving bus models. - Energy efficient buildings and houses. b) Promotion of energy efficient household appliances and industrial equipment c) Adoption of international minimum performance standards. d) Deployment of rebates and tax incentive instruments for energy efficient appliances and equipment. e) Development of laws, policies (the Energy Sector Plan), and regulations considering climate change. f) Adjust electricity act to enable/allow small-scale electricity consumers to generate their own electricity and to feed it into the grid.

		g) Create incentives via subsidy reform to encourage more energy efficient consumption. h) Bundling small projects. i) Introduce tariff differentiation. j) Introduction of new utility business models k) Establish performance standards. l) Develop sustainable mini-grid business models. m) Execute energy efficiency audits. n) Develop and implement awareness on conservation and efficiency. o) Conduct research to enable proper functioning of assets. p) Develop educational programs. q) Introduce carbon tax. r) Enable and utilize the co-investment fund. s) Increase reserve margin. t) Introduce renewable energy incentives. u) Hardening existing networks. v) Explore possibilities for joint investments with neighboring countries. i. Improve enforcement of zonal planning and regulation to stimulate efficient city design (smart cities), infrastructure and housing development. ii. Establish/ignite new centers of urban development (separate from Greater-Paramaribo). iii. Remove fossil fuel object subsidies and introduce subject subsidies. iv. Introduction of electric vehicles (EVs)
Water resources	a) Drying out of the water resources in the dry season, resulting in the decreased availability of freshwater of required quality for drinking water supply, irrigation, and fishery/aquaculture.	a) Undertake in-depth studies and establish an observation network and monitoring system, in order to enhance water management and sustainable use of water resources.

	b) Pollution of the water resources in both coastal zone and the rural areas, caused by discharge of untreated domestic, industrial, and agricultural wastewater for into sewer systems and natural courses. c) Increase in health issues, due to water contamination and scarcity of quality water. d) Reduced availability of irrigation water for the rice and banana sector in the coastal districts Nickerie, Coronie and Saramacca, caused by salinization of the water resources in the dry season. e) Flooding. During periods of heavy rainfall, flooding can worsen in the coastal zone when accompanied by high river of sea water levels, leading to great damages and loss. f) Water scarcity and pollution due to prolonged drought and poor waste management practices, in especially the hinterland where ITPs reside and access to water is limited.	b) Addition of the climate change aspect including the law on meteorological services and development of surface water law. Include provision for the protection of water resources, promotion of their sustainable use and for water quality standards and wastewater discharge. c) Assess options for the establishment of an institutional organization for the enhancement of water management. d) Develop robust land management and waste management policies. e) Develop policy, regulations, standards, and best practice guidance to support national water resource management that is adaptive to climate change. f) Consider current integrated water resource management approaches and future proposals with an intent of mainstreaming climate change adaptation processes into these frameworks. g) Identify and implement wastewater recycling schemes, including domestic, industrial, agricultural, mining and forestry sector. h) Develop and upgrade infrastructure for water supply, irrigation. i) Develop and upgrade infrastructure to cope with the effects of climate change and sea level rise e.g., drainage and flood protection
Agriculture	a) Sea level rise and saltwater incursions will have a negative impact on wetland rice production which takes place in the young coastal area. A significant part of the low laying geologically young coastal plain is expected to be inundated if sea level rises.	*Rice:* a) Construction of dikes in low-lying areas. b) Establishment infrastructure for improved rice irrigation. c) Creation of agro-ecological research programs focused on integrated pest management and disease control. d) Establishment of an insurance fund to compensate farmers whose crop production suffers damage from erratic weather events.

	b) Freshwater availability for irrigation of rice can become a problem in certain areas in the case of unexpected long dry periods. c) Lack of forage at the end of the dry season and in the case of unexpected longer droughts. This can result in starvation of cattle. d) Flooding of pastures in the case of intense rains. e) Reduction in productivity of dairy and beef cattle, poultry, and swine due to increased temperatures and prolonged drought. f) Reduction of crop growth, development, and yield of rice due to increased temperatures. g) Irregulated crop calendar of the farmers in the hinterland due to seasonal changes and prolonged dry periods.	e) Research on crop rotation to investigate alternatives for rotating in drought resistant crops. *Bananas:* a) Planting of arboreal hedgerows to protect crops from strong winds. Fruits and vegetables: a) Implementation of alternative growing systems e.g., greenhouses and hydroponic gardens. b) Improvement of drainage systems. c) Implementation of crop diversification. d) Implementation of micro irrigation system and rainwater harvesting ponds *Livestock (poultry, dairy production, sheep, goats and pigs):* a) Rehabilitation of abandoned farms in order to guarantee food security. b) Establishment of measures that prevent further decline in the numbers of productive animals. c) Import of climate resilient dairy cattle breeds. d) Introduction/improvement of climate-control systems on livestock farms. e) Introduction/implementation of measures to prevent especially heat stress. *Aquaculture and fisheries:* a) Creation of measures to improve sustainable aquaculture and fisheries management. b) Protection of fish breeding waters (salt pans, mangrove vegetation, coastal wetlands) and c) Establishment of funding that provides incentives for fishermen to engage in aquaculture.

Cross-cutting sectors	*Health sector:* a) Increased foodborne (diarrhea), waterborne (malaria, dengue) and rodent borne diseases, because of flooding by heavy rainfall. b) Increased heat-stress and heat related illnesses (Salmonella and Campylobacter) due to increase of temperature. c) Food shortages due to flooded agricultural land. d) Increased mental stress, induced by loss of relatives, property, and food amongst others. e) Deaths caused by flooding, landslides, diseases and illnesses, heat-stress amongst others.	a) Develop early warning and response systems. b) Reduce heat stress by installation of the air conditioners. c) Provide training on climate awareness and action, disaster response and recovery. d) Promote climate proof and safe health clinics and hospitals. e) Improve waste management, adequate water supply, sanitation, and energy supply in all health facilities.
	Education: a) Loss and damage of school infrastructure, textbooks, and other school material due to flooding. b) Absenteeism (missed classes) and low school performance. c) Increase in weather related diseases.	a) Increase public awareness. b) Improve development of critical educational resources and innovative communication methods based on climate policies and related action plans. c) Training of education sector staff on climate awareness and action, disaster response and recovery. d) Promote climate proof and safe schools and educational facilities by incorporating flood resistance and, adequate ventilation amongst others into the design and planning phase through building codes and guidelines. e) Improve waste management, adequate water supply, sanitation and energy supply at schools and educational facilities. f) Improve research and data collection on the impacts of climate change on the education system in the different vulnerable urban and rural areas and in the Interior.
	Spatial planning: a) Unsuitable zones/areas for development planning.	a) Relocate utility infrastructure and production facilities to higher elevations and less flood prone areas. b) Implement operational measures and isolate/ protect vulnerable assets/ facilities.

	b) Relocation/displacement of current development (utilities, health, school facilities, agricultural areas) to higher elevated / low risk areas. c) Penetration of seawater and the destruction of beaches. d) Local flooding due to sea level rise as well as severe damage to biodiversity.	c) Develop and implement zoning plans for agricultural zones. d) Determine buffer zones along the coastline and along other water bodies such as rivers and lakes. e) Preserve coastal land and development through Integrated Coastal zone management (ICZM). f) Prohibit new infrastructure works in vulnerable zones. g) Expand sustainable energy sources and decentralize transmission. h) Cooperation and involvement of the community by engaging in climate change planning efforts. i) Build staff capacity by publishing a list of certified/ qualified green infrastructure contractors/ engineers. j) Introduce climate resilient infrastructure. k) Provide training for ministerial staff on how to assess green infrastructure proposals. l) Update existing legislation and regulations relevant to land-use planning.
	Disaster risk reduction: a) Destruction and loss of livelihoods and homes. b) Loss of agricultural land. c) Water pollution: contamination and scarcity of water. d) Disruptions in essential services due to damaged infrastructure: schools, health care facilities, roads and bridges amongst others. e) Disruptions in energy supply.	a) Complement Suriname's Building Code with regulations to incorporate disaster risk reduction measures in public and private infrastructure. b) Promote the inclusion of disaster risk reduction in sectorial and public services regulations, duties, and activities. c) Prioritize sectors to allocate resources to disaster risk reduction activities. d) Increase awareness within the community and provide training on how to respond to climate related disasters. e) Develop specific legislation with regards to disaster management, incorporating climate change. f) Conduct research into past hurricane trends and potential links to climate change.

		g) Establish a disaster relief fund. h) Promote the inclusion of disaster risk reduction roles and responsibilities in the new DRM regulations detailing the responsibility of Districts and Resorts, Sectors and Utilities i) Promote the identification of risk areas in development planning and land use regulations. j) Include disaster risk analysis and climate change studies in all phases of public pre-investment processes. k) Develop legislation to make climate change studies a requirement for the approval of public investments.
	Environment: a) Loss of biodiversity and spread contamination due to flooding. b) Insufficient/ineffective implementation of climate change policies and plans. c) Weak enforcement of climate related laws.	a) Review and update Forest Management Act to include climate change considerations. b) Develop conservation strategies/programs for sectors such as mangrove planting and nature-based solutions. c) Continue analysis on past climate impacts on forests and sustainable forest management with emphasis on mangroves. d) Implementation of conservation strategies designed to protect marine- and wildlife. e) Identification, analysis, and implementation of sustainable forestry options in Suriname including but not limited to soil degradation and nourishment, reforestation planning, irrigation, protected areas, agro-forestry, buffer zones, production and harvesting, natural stands and participatory management. f) Further strengthen National Forest Management System (NFMS). g) Include mangrove conservation and afforestation in REDD+ strategy and identify REDD+ readiness actions needed for mangrove carbon sequestration including

		through mangrove planting, effective management, and rehabilitation. h) Develop a fund for climate financing across sectors. i) Assess options to access climate finance through UNFCCC mechanisms and other related funding avenues financing carbon sequestration by forest and sustainable forest management or Climate resilience and mitigation action. j) Provide training for ministerial staff on how to review green infrastructure proposals. k) Implementation of climate resilient technologies prioritized within TNA. l) Perform awareness activities regarding the role of forest conservation, restoration, and sustainable use of forests in climate change.

Source: Table compiled with information from the partial reports: Vulnerability Assessment and Adaptation Measures for the energy, agriculture, water resources and cross-cutting sectors, 2023

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Chapter 3

National Greenhouse Gas Inventory

3 National Greenhouse Gas Inventory

3.1. Introduction

Suriname ratified the UN Framework Convention on Climate Change (UNFCCC) in 1997 and the Paris Agreement in 2019 as a non-Annex I Party and with those formalities committed itself to its obligations. As per Article 12 of the UNFCCC, each party is required to report to the Conference of Parties (COP) information on its emissions by sources and removals by sinks of all greenhouse gases (GHGs) not controlled by the Montreal Protocol.

Suriname's contribution to global GHG emissions, which drive climate change, is very small and the country acts as a net sink when absorptions from the sector Forestry and Other Land Use (FOLU) are taken into account. In its First National Communication (NC1) to the UNFCCC in 2005, the country developed a GHG inventory for base year 2003. In 2016 the Second National Communication (NC2) was submitted to the UNFCCC with the GHG inventory developed for base year 2008.

The GHG inventory for the Third National Communication (NC3) covers the period 2000 up to 2017, with 2008 as base year. The rationale behind selecting the same base year is mainly that for this inventory more categories are included in particular for the Agriculture, Forestry and Other Land use (AFOLU) and Waste sectors. For NC3 data from the previous inventories were assessed to see if recalculations were needed/ possible. As such, this inventory updates the information presented in the previous inventory (NC2). The period 2000 – 2017 was selected in order to use time series, to enable Suriname to track the emissions trend.

3.2. Methodology

The GHG inventory is prepared for the time frame 2000-2017 based on the methodologies contained in the Intergovernmental Panel on Climate Change (IPCC, 2006). The preparation of the GHG inventory for all sectors followed the 2006 IPCC Guidelines and the Refinement to the 2006 IPCC Guidelines.

Sectoral (bottom-up) approach was used to estimate the GHG emissions and removals from the sectors Energy, Industrial Processes and Product Uses (IPPU), AFOLU and Waste. The reference approach was used for the estimation of CO_2 emissions from the Energy sector.

Removals of GHGs occur in the FOLU sector as a result of forest policy (e.g. management of protected areas and reforestation). Furthermore, GHG emissions from bunker fuels were estimated and reported as a memo item (these emissions are not included in the national total).

This inventory estimated the anthropogenic GHG emissions and removals of carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O). Indirect emissions from nitrogen dioxide (NO_x), carbon monoxide (CO), non-methane volatile organic compounds (NMVOC) and sulfur dioxide (SO_2) are not included in the estimation of the GHG emissions, as they are not emitted and as such are not the main source of GHGs.

The GHG inventory estimates are expressed in mass units of carbon dioxide, methane and nitrous oxide emissions, as well as units of carbon dioxide equivalents (CO_2eq) terms using the 100-year Global Warming Potentials (GWPs) as recommended by the IPCC in its Second Assessment Report. GHG emissions and removals were computed by applying the 2006 IPCC inventory software. A combination of the Tier 1 and Tier 2 approaches was used for the AFOLU sector. Default emission factors from the 2006 IPCC Guidelines were used for many of the categories where country specific values were not available.

3.3. The Inventory Process

The GHG Inventory process consists of the following key-steps:

- Project organization structuring
- Stakeholder consultation process
- Training and capacity building programme
- Data collection
- Identification of data gaps
- Uncertainty assessment and quality assurance/ quality control
- Preparation of GHG Inventory Report

Abovementioned key steps are addressed in more detail in the subparagraphs below.

3.3.1. Project Organization Structure

A project organization structure (see figure 11 in chapter 1) was established to prepare the NC3, which includes the GHG Inventory. The Project Steering Committee was mainly responsible for management decision-making, using consensus, when the Project Coordinator required guidance.

The GHG inventory was coordinated by a Coordinating Lead Author, who was responsible for managing the technical expert group (TEG), consisting of sectoral experts. The Energy, IPPU and Waste sectors were each under the responsibility of an inventory expert, while the Foundation for Forest Management and Production Control (SBB), as lead institution in collaboration with the Ministry of Agriculture, Livestock and Fisheries (LVV), were responsible for the AFOLU sector. In fact, an agreement was established between the coordinating Ministry for

Climate Change Policy (ROM) and SBB. Furthermore, each inventory expert was responsible for identifying/ verifying data sources, entering and documenting the input data (activity data and emission factors).

3.3.2. Stakeholder Consultation Process

The stakeholder consultation process consisted of two main workshops. During the first workshop, stakeholders were informed of the preparation of Suriname's Third National Communication, the national GHG inventory project, as well as start a dialogue on the availability of relevant data. The methodology, based on the 2006 IPCC Guidelines for the GHG inventory, was also shared with the stakeholders. Considering the COVID-19 measures, stakeholders had the opportunity to participate either physically or virtually. The second stakeholder consultation workshop took place physically and had the objective to validate the assumptions and standards used for GHG inventory and to seek the inputs from a wide range of stakeholders. The inventory experts presented the results from the GHG inventory for all the sectors. Additionally, the assumptions, data, standards, gaps and uncertainties were all shared with the stakeholders.

3.3.3. Training and Capacity Building Program

Over the course of the development of the GHG inventory, training and capacity building activities were provided. The inventory experts followed online courses provided by the Greenhouse Gas Management Institute (GHGMI). Furthermore, with support from the Global Support Program (GSP) a capacity building (virtual) training was provided for the inventory experts and key-stakeholders. The overall objective of this national training was to gain knowledge and acquire capacity in the country to achieve the necessary level of expertise to develop national GHG inventory. In addition to this national capacity building activity, personal guidance and support to the inventory experts was provided by independent international specialists.

3.3.4. Data Collection

Data collection for the GHG inventory is not yet formalized, however, steps are being taken by the GOS to formalize a sustainable data collection process, using different instruments such as MoU's and contracts. Activity data for each sector and category were obtained from multiple sources, such as a number of relevant Ministries and other institutions, the General Bureau of Statistics (ABS) and the private sector. The inventory experts used primarily available national data: data collected and published by ABS, SBB, the Center for Agriculture Research Suriname (CELOS), national studies and reports, the private sector such as the State Oil Company Suriname, mining company Newmont and other commercial companies. In the absence of national data, international data providers were consulted (e.g., FAOSTAT, IEA) and in any other cases, expert judgement was used or utilized.

The data collection process encountered numerous challenges and obstacles. Overall, low awareness and capacities among key stakeholders, a lack of commitment of data providers in addition to many data gaps and constraints, were the main challenges and impediments in conducting this GHG inventory.

Documentation on the data is stored in the online climate change knowledge database for archiving and retrieval. This database, called *Dondru*, was launched in June 2022 as an online database to hold, among others, all the inventory data and related information. *Dondru* functions as the storage unit for the inventory data and helps to streamline documentation and archiving protocols of the activity data and emission factors, reports, and relevant publications.

3.3.5. Identification of Data Gaps, Uncertainty Assessment and data review for Quality Assurance

The inventory started with a comprehensive assessment of each IPCC category, including each category's relevance to Suriname and the availability of data required to estimate emissions from these categories. Suriname lacks a quality assurance/quality control (QA/QC) system as an integral part of the process. However, the inventory team, consisting of sectoral experts, performed routine checks on the data and information provided by the various stakeholders to ensure data integrity, completeness and correctness. The experts encountered many gaps and inconsistency in the data provided and as such frequent consultations, with relevant stakeholders, took place to reduce the data uncertainty, address errors and omissions. In cases where the data gaps could not be filled in, splicing technics (extrapolation, interpolation) according to the IPCC Guidelines were used in addition to surrogate data and expert judgement, to perform the trend analysis.

3.3.6. Preparation of GHG Inventory Report

This GHG inventory report is based on the sectoral GHG inventory reports, drafted by the inventory experts (see References). The sectoral reports were internally reviewed by the CLA and the PMU and externally by international experts. Finally, the GHG inventory report could be compiled based on the information and obtained data from the sectoral reports.

3.4. Overview of National GHG Emissions and Removals

This section provides a summary of the results of the National GHG inventory for this Third National Communication. The inventory is structured into four main sectors and further divided in categories. Figure 22 presents the sectors and main categories of emissions by sources and removals by sinks that are included[22] in this national GHG inventory.

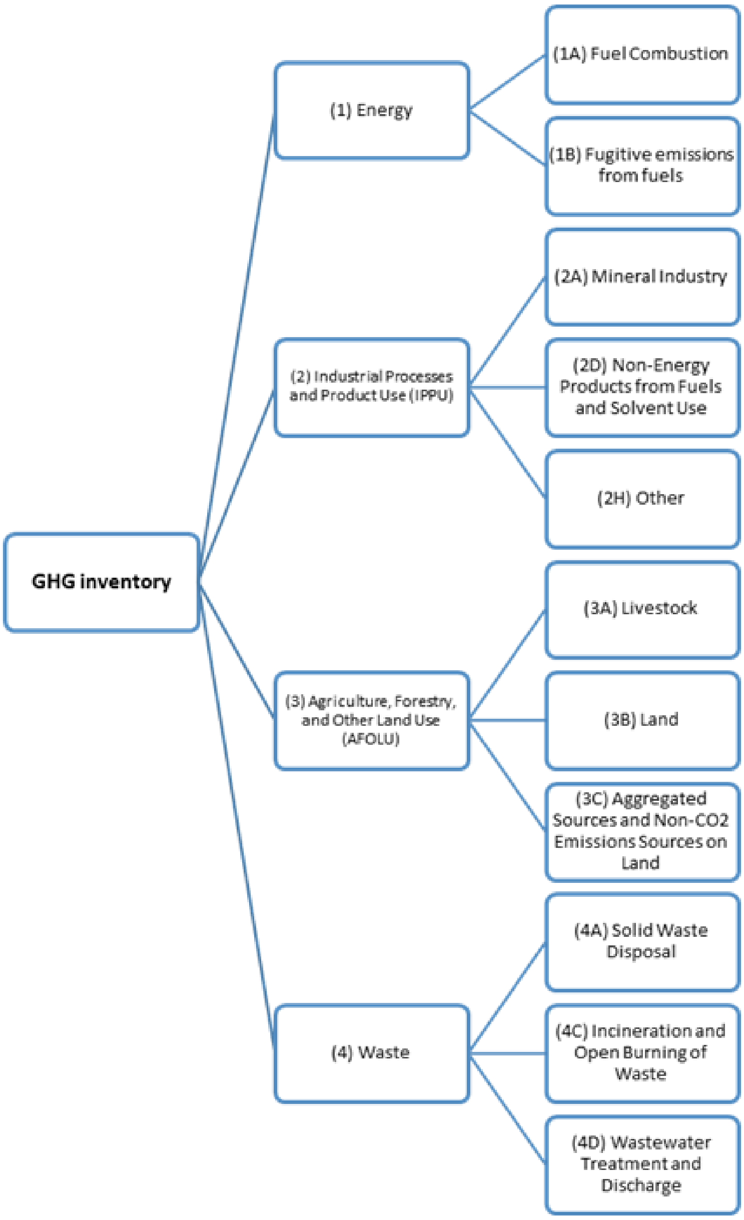


Figure 22 Sectors and categories of the GHG inventory
Source: Figure adapted from the Green House Gas Inventory (GHGI) Report as part of the NC3 report, R. Jharap, 2023

[22] These categories are included in the Inventory based on data received from data providers.

3.4.1. Trend Emissions and Removals for the period 2000-2017

Suriname's total aggregated GHG emissions for the period 2000-2017 in Gg CO_2eq (excluding removals) are presented in figure 23.

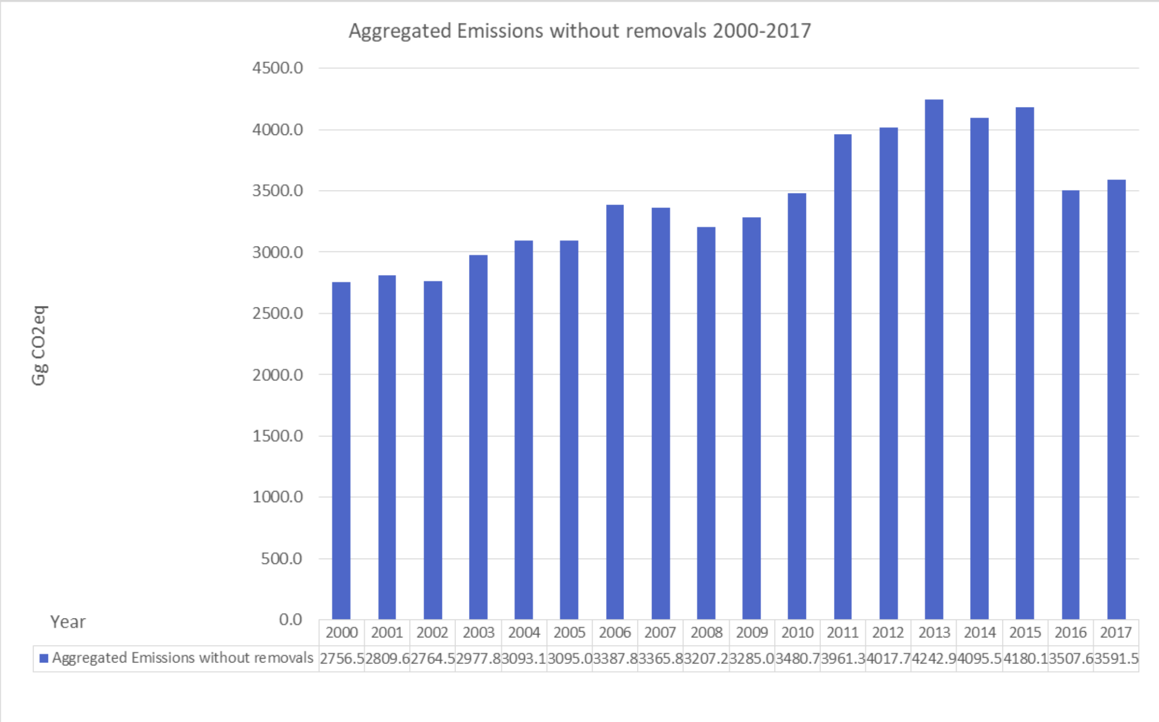


Figure 23 Aggregated emissions (excluding removals) for the period 2000-2017
Source: Figure adapted from the Green House Gas Inventory (GHGI) Report as part of the NC3 report, R. Jharap, 2023

The total aggregated emissions (excluding removals) increase with an average rate of 2% per year from 2,756.5 Gg CO_2eq in 2000 to 3,591.5 Gg CO_2eq in 2017. The following figure 24 and table 31 includes the total GHG emissions (without removals) per sector for the years 2000-2017.

The Energy sector has increased steadily over the period 2000-2017 and is the main emitter of greenhouse gasses, followed by the AFOLU sector with a slightly increasing profile over the whole period. Table 31 also shows that, compared to the Energy sector, the contribution of both the IPPU and Waste sector are relatively insignificant. The period 2007-2013 experienced a small dip in alumina refining, due to the departure of a mine operator in 2008. The mine ownership was transferred to the refinery operator, resulting in an uptake in production – and thus emissions in the Energy sector increased gradually. At the end of 2015, the alumina refinery activities completely came to an end, thus portraying a -sharp decrease in both the Energy and IPPU sector.

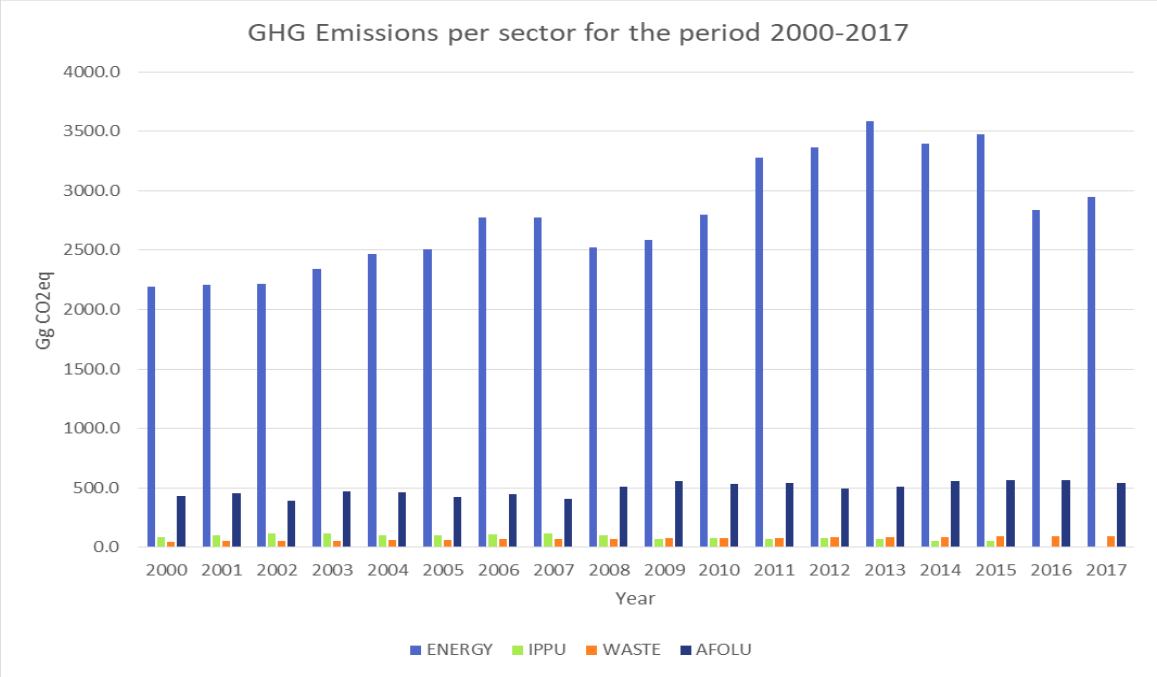


Figure 24 Emissions (excluding removals) per sector for the period 2000-2017
Source: Figure adapted from the Green House Gas Inventory (GHGI) Report as part of the NC3 report, R. Jharap, 2023

Table 31 Emissions (excluding removals) per sector for the period 2000-2017

Year	Energy (Gg CO_2eq)	IPPU (Gg CO_2eq)	Waste (Gg CO_2eq)	AFOLU (Gg CO_2eq)	Total GHG emissions
2000	2194.5	86.0	45.8	430.1	2756.5
2001	2209.9	96.3	48.7	454.7	2809.6
2002	2212.9	113.8	49.9	387.9	2764.5
2003	2341.7	113.3	52.2	470.6	2977.8
2004	2469.2	101.5	57.4	465.0	3093.1
2005	2510.8	103.3	61.4	419.5	3095.0
2006	2771.0	106.3	64.5	446.0	3387.8
2007	2777.4	112.6	67.5	408.3	3365.8
2008	2525.2	103.2	70.6	508.2	3207.2
2009	2588.1	70.7	72.9	553.4	3285.0
2010	2797.8	77.4	76.5	529.0	3480.7
2011	3276.2	67.1	78.1	539.8	3961.3
2012	3367.0	78.8	82.5	489.4	4017.7
2013	3585.7	64.2	85.2	507.7	4242.9
2014	3400.2	54.2	87.6	553.5	4095.5
2015	3476.1	51.4	90.5	562.0	4180.1
2016	2841.5	6.5	92.8	566.8	3507.6
2017	2949.4	8.5	95.5	538.1	3591.5

Source: Table adapted from the Green House Gas Inventory (GHGI) Report as part of the NC3 report, R. Jharap, 2023

Suriname is one of the most forested countries having a forest coverage of 93% with the ability to act as a huge sink of carbon. Thus, the country is net carbon negative in terms of GHG emissions including the removals. The following figure 25 presents the national GHG emissions including removals.

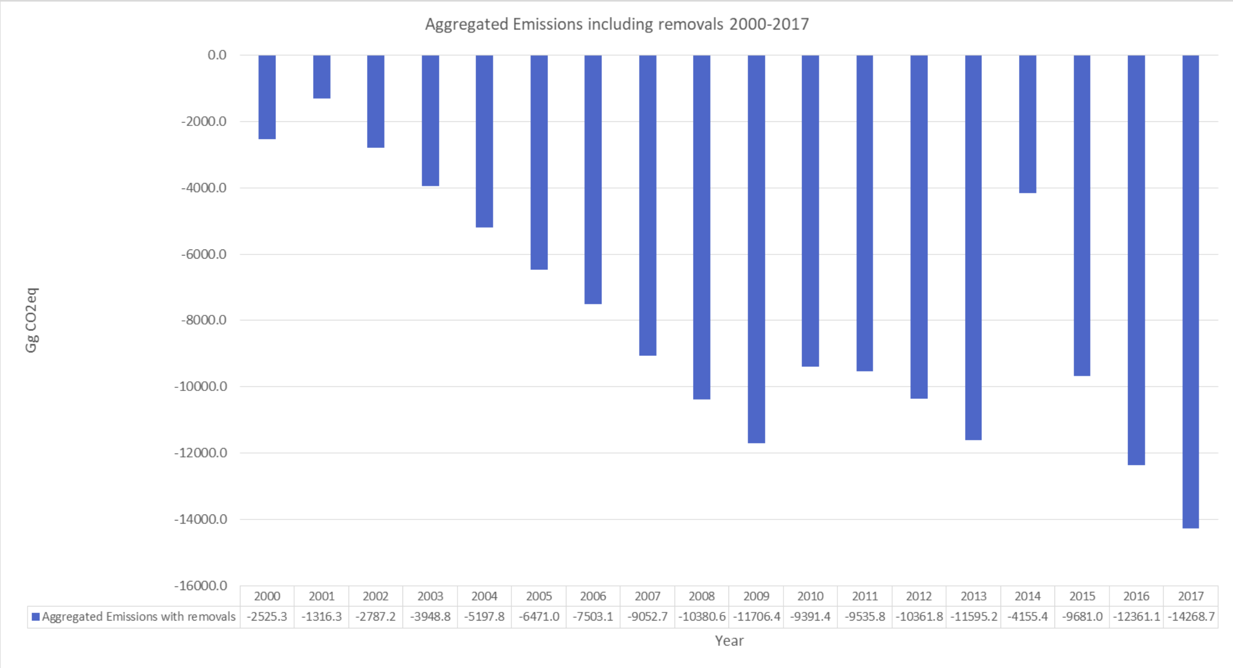
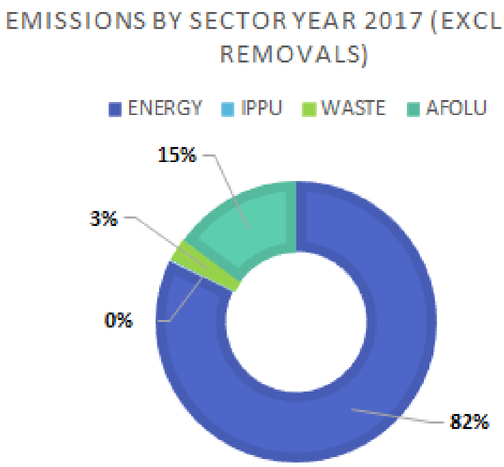


Figure 25 Aggregated emissions including removals for the period 2000-2017
Source: Figure adapted from the Green House Gas Inventory (GHGI) Report as part of the NC3 report, R. Jharap, 2023

3.4.2. Emissions and Removals for year 2017

Suriname contributed a total of 3,591.5 Gg CO_2eq of GHGs to the atmosphere in the year 2017. Figure 26 presents the contribution of each sector to the total national GHG emissions (excluding removals) for the year 2017.



Sector	Year 2017 (Gg CO2eq)
ENERGY	2949.4
IPPU	8.5
WASTE	95.5
AFOLU	538.1

Figure 26 GHG emissions (excluding removals) for year 2017
Source: Figure adapted from the Green House Gas Inventory (GHGI) Report as part of the NC3 report, R. Jharap, 2023

The total GHG emissions for year 2017 in Gg CO_2eq (including removals) is shown in figure 27.

Sector	Year 2017 (Gg CO2eq)
ENERGY	2949.4
IPPU	8.5
WASTE	95.5
AFOLU sinks	-17322.1

Figure 27 Overview GHG emissions (including removals) for base year 2017
Source: Table adapted from the Green House Gas Inventory (GHGI) Report as part of the NC3 report, R. Jharap, 2023

3.4.3. Trend Emissions and Removals by Gases for the period 2000-2017

The GHGs included in this inventory are Carbon dioxide (CO_2), Methane (CH_4) and Nitrous-Oxide (N2O). Indirect GHGs are Carbon Monoxide (CO), Nitrogen Oxides (NOx) and Non-Methane Volatile Organic Compounds (NMVOC). Other gases, not controlled by the Montreal Protocol, such as Sulphur Oxides (SO_x), are not included in the inventory, mainly due to lack of data and/or categories emitting these gases are not represented in the country.

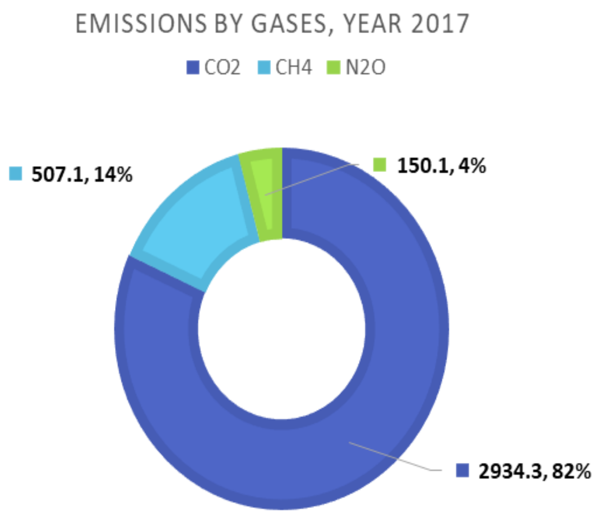
CO_2 is the most dominant GHG in the country, due to emissions from the Energy sector and the AFOLU sector. Under the inventory period 2000-2017, the net CO_2 emissions in the year 2000 was 2,269.1 Gg and increases to 2934.3 Gg in 2017. CH_4 is the second most dominant GHG from the Agriculture sector, in particular the categories rice cultivation and enteric fermentation. The net CH_4 emissions in the year 2000 was 18.3 Gg and increased to 24.2 Gg in 2017. N_2O comes mainly from land management and wastewater disposal. The net N_2O emissions is estimated to be 0.3 Gg in 2000 and in 2017 it increased to 0.5 Gg. The emission trend by gasses (in Gg CO2eq) for 2000-2017 is depicted in table 32.

Table 32 Trend emissions by gases for the period 2000-2017

	Gas (Gg CO2eq)		
Year	**CO2**	**CH4**	**N2O**
2000	2269.1	384.0	103.4
2001	2294.1	421.6	93.9
2002	2314.1	362.9	87.5
2003	2443.7	436.9	97.2
2004	2557.9	429.1	106.0
2005	2600.1	405.1	89.8
2006	2861.7	409.4	116.7
2007	2872.4	400.0	93.4
2008	2623.8	417.6	165.8
2009	2642.0	492.5	150.6
2010	2857.9	482.5	140.2
2011	3318.1	501.8	141.3
2012	3414.9	479.3	123.4
2013	3617.4	504.4	121.1
2014	3430.1	530.7	134.7
2015	3500.3	534.9	144.8
2016	2824.7	532.9	150.0
2017	2934.3	507.1	150.1

Source: Table adapted from the Green House Gas Inventory (GHGI) Report as part of the NC3 report, R. Jharap, 2023

The emissions by gases for the year 2017 are depicted in figure 28. Both CH_4 and N_2O can be seen as rather insignificant compared to the prominent CO_2.



Emission by gases (Gg CO_2eq)	**Year 2017**
CO_2	2934.3
CH_4	507.1
N_2O	150.1

Figure 28 Emissions by gases for year 2017

Source: Figure adapted from the Green House Gas Inventory (GHGI) Report as part of the NC3 report, R. Jharap, 2023

3.4.4. Key Category Analysis

"Non-Annex I Parties are encouraged in Decisions 17/CP.8 and 2/CP.17, to the extent in which such is possible, to undertake any key category analysis (level/ trend or both) to assist in developing inventories that better reflect their national circumstances". The key category analysis is an essential element to identify the categories that have a significant influence on the national GHG inventory and also acts as a driving factor to improve the inventory's quality. In order to identify the key categories for the NC3 inventory, the experts first analyzed the key categories from NC2. They identified categories, in addition to those flagged by the Level and Trend assessment in the NC2, that are deemed significant, and this could be due to expected growth or completeness of the inventory.

3.4.5. Completeness

The following notation keys were used according to the IPCC 2006 Guidelines (IPCC, 2007):

- X Estimated
- NA Not Applicable
- NO Not Occurring
- NE Not Estimated

3.5. GHG Emissions and Removals per Sector

This paragraph elaborates further on the GHG emissions and removals for all sectors as mentioned in the 2006 IPCC Guidelines: Energy, Industrial Processes and Product Use (IPPU), Agriculture, Forestry and Other Land Use (AFOLU), and Waste.

3.5.1. Energy Sector

Scope of the sector

The main energy carriers in Suriname are fuel (oil, gasoline, kerosene, and diesel), electricity and liquefied petroleum gas (LPG). Fuel is mostly consumed for transportation purposes as well as for electricity generation. Besides domestic and imported fuel for electricity generation, the country also depends on hydroelectric power generation accounting for approximately 50% of total electricity generation. The sparsely inhabited Interior relies on electricity from isolated small-scale diesel generation systems with a total capacity of about 4.5 MW and solar energy. Electricity demand increased by 2.7% between 2013 and 2017. LPG is mostly used by coastal households for cooking. The state-owned company Staatsolie Maatschappij Suriname produces 15,000 barrels of oil per day and exports crude oil, diesel oil, fuel oil, and bitumen. Fugitive emissions occur, due to gas venting and flaring.

The transportation sector can be divided in road, air and waterborne transportation. The road network is affected by a high motorization rate (303 vehicles/1,000 population in 2015 (IDB, 2019)). Data for road transportation is obtained from the General Bureau of Statistics. Suriname has one large international airport with a capacity of 300,000 passengers annually, a smaller international airport where actually the majority of its flights are domestic, and several small domestic airstrips located in the Interior. However, data on the flight frequency of these small domestic airstrips is hardly available. For the GHG inventory only emissions from domestic aviation are included. GHG emissions from international aviation is listed as a memo item and not included in this inventory. Although Suriname has several harbors, data was not available, hence no GHG estimations could be made regarding waterborne transport.

Methodology

The GHG emissions due to fossil fuel combustion were calculated following the IPCC 2006 guidelines and by applying the Tier 1 method. The IPCC inventory software calculates direct CO_2 emissions and non-CO_2 emissions (CH_4 and N_2O) for the Energy sector. Furthermore, other gases like CO, NOx and NMVOC fell outside the estimated accuracy of the main CO_2, CH_4 and N_2O emissions. Not all categories, according to the 2006 IPCC Guidelines, are included in this inventory. Only those categories are included of which the associated activities occur in the country and of which sufficient data is available in order to estimate the emissions.

Figure 29 presents the structure of activities and source categories for the Energy sector that are included in this inventory.

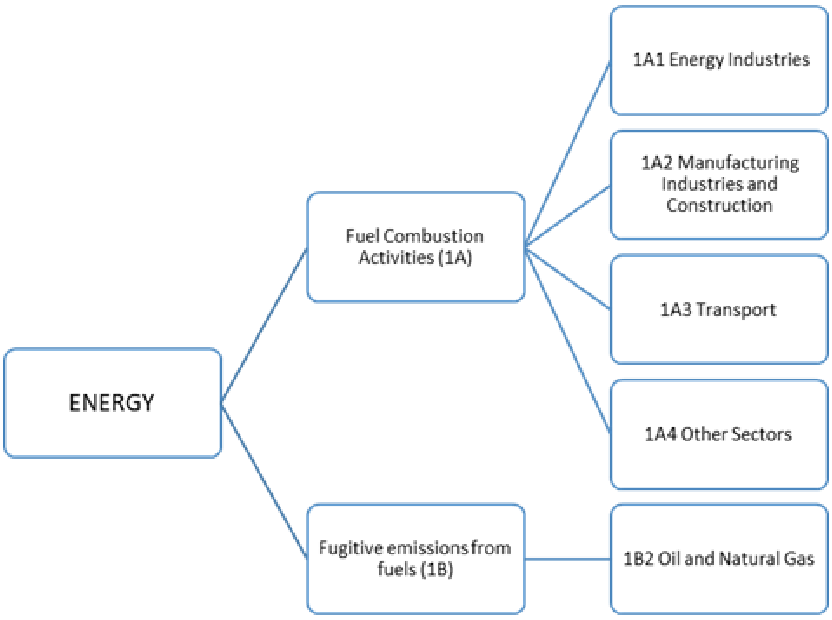


Figure 29 The structure of activities and source categories for the Energy sector
Source: Figure adapted from the Green House Gas Inventory (GHGI) Report as part of the NC3 report, R. Jharap, 2023

Both the Sectoral and the Reference Approach were applied, allowing for the verification of the reported emissions. Activity data required for calculating the emissions were derived from various Ministries, the Electricity Company Suriname (EBS), the private sector, national reports and studies, and also some data were based on expert judgement from discussions with national experts. As previously mentioned, the inventory experienced data gaps e.g. in the Manufacturing Industries and Construction and in the Transportation category; for example, the fuel sales forthcoming from the fuel suppliers/retailers were not available.

The results varied across the years between the two applied approaches, with higher emissions for the sectoral approach for most years. The disparity was on the high side, for several years, specifically during 2011-2015, ranging from 21% to 37% (Table 33). The significant disparities between the two approaches may occur, due to the assumptions made, since the national energy balance is not disaggregated on fuel level. Another impacting factor would be rolling stocks from one year to the following year, as this is difficult to track within the country's context. It is important to note that the country has just recently begun producing annual energy balances, which are meant to contain more disaggregated data and improve activity data (AD) for this sector.

Table 33 Comparison of the reference and sectoral approaches (Gg CO2) for 2000-2017

Year	Reference Approach	Sectoral approach	Differences %
2000	2,114.1	2,142.8	-1.3
2001	2,261.6	2,156.0	4.9
2002	2,168.6	2,161.5	0.3
2003	2,055.8	2,291.8	-10.3
2004	1,966.6	2,418.0	-18.7
2005	2,097.1	2,457.6	-14.7
2006	2,302.0	2,709.3	-15
2007	2,675.2	2,710.1	-1.3
2008	2,893.0	2,459.8	17.6
2009	2,875.9	2,515.5	14.3
2010	2,850.9	2,723.6	4.7
2011	2,517.3	3,192.6	-21.2
2012	2,285.2	3,280.6	-30.3
2013	2,181.8	3,496.9	-37.6
2014	2,202.4	3,316.1	-33.6
2015	2,624.0	3,387.3	-22.5
2016	2,516.1	2,757.4	-8.7
2017	2,585.1	2,864.2	-9.7

Source: Table adapted from the Green House Gas Inventory (GHGI) Report as part of the NC3 report, R. Jharap, 2023

__Results GHG emissions activities Energy sector__

GHG emissions for the period 2000-2017 are presented in figure 30 and table34 below. They are structured according to the two activities: Fuel Combustion Activities and Fugitive emissions from fuels.

Table 34 shows that the emissions from the Energy sector increased from 2,194.5 Gg CO_2eq in 2000 to 2,949.3 Gg CO_2eq in 2017.

Main GHG emitters are the activities under Fuel Combustion (Subsector 1A). These are presented in figure 31, disaggregated to the categories Energy Industries (electricity generation), Manufacturing Industries and Construction, Transportation (Road and Domestic aviation) and other sectors (residential). In addition, Fugitive Emissions from Fuel (Subsector 1B) from the Oil and Natural Gas category are also included in this figure.

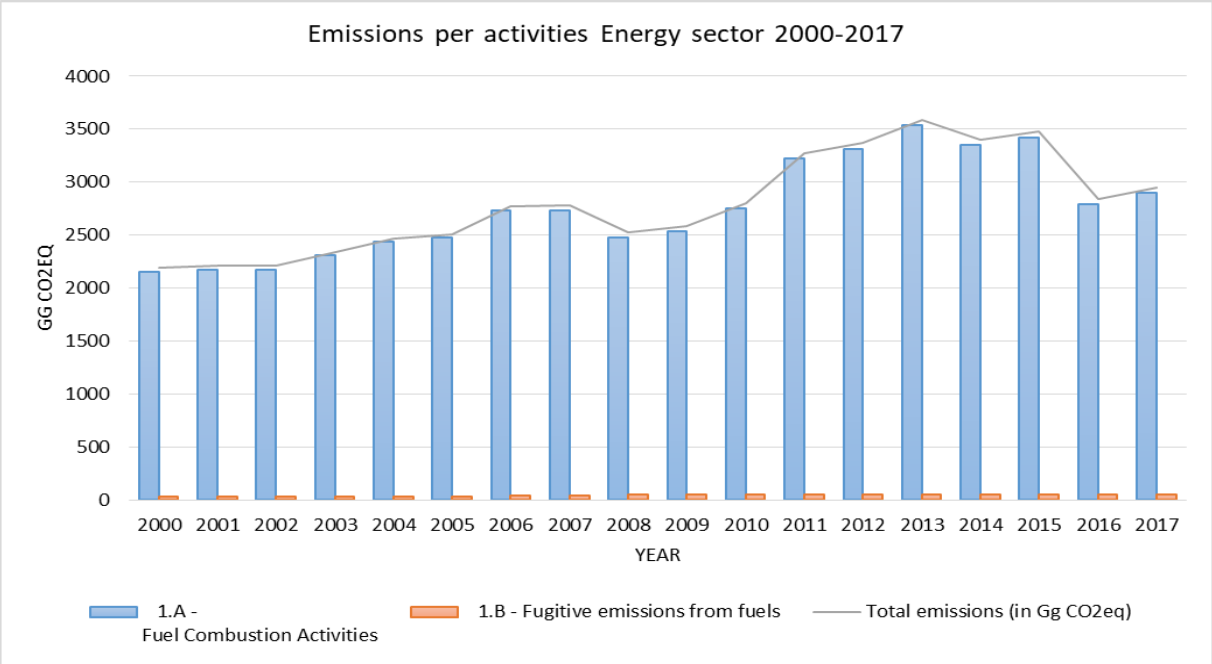


Figure 30 Contribution of the main subsectors to emissions in the Energy sector (in Gg CO2eq)
Source: Figure adapted from the Green House Gas Inventory (GHGI) Report as part of the NC3 report, R. Jharap, 2023

Table 34 GHG emissions in Gg CO2eq from activities in the Energy sector

	1.A - Fuel Combustion Activities	1.B - Fugitive emissions from fuels	Total emissions (in Gg CO2eq)
2000	2158.6	35.9	2194.5
2001	2172.3	37.5	2209.8
2002	2177.5	35.4	2212.9
2003	2307.8	33.9	2341.7
2004	2436.0	33.2	2469.2
2005	2475.3	35.5	2510.8
2006	2730.9	40.1	2771.0
2007	2731.8	45.6	2777.4
2008	2475.2	50.0	2525.2
2009	2538.0	50.1	2588.1
2010	2748.3	49.5	2797.8
2011	3224.7	51.5	3276.2
2012	3315.7	51.3	3367.0
2013	3534.0	51.7	3585.7
2014	3347.2	53.0	3400.2
2015	3422.6	53.6	3476.2
2016	2789.9	51.6	2841.5
2017	2898.0	51.3	2949.3

Source: Table adapted from the Green House Gas Inventory (GHGI) Report as part of the NC3 report, R. Jharap, 2023

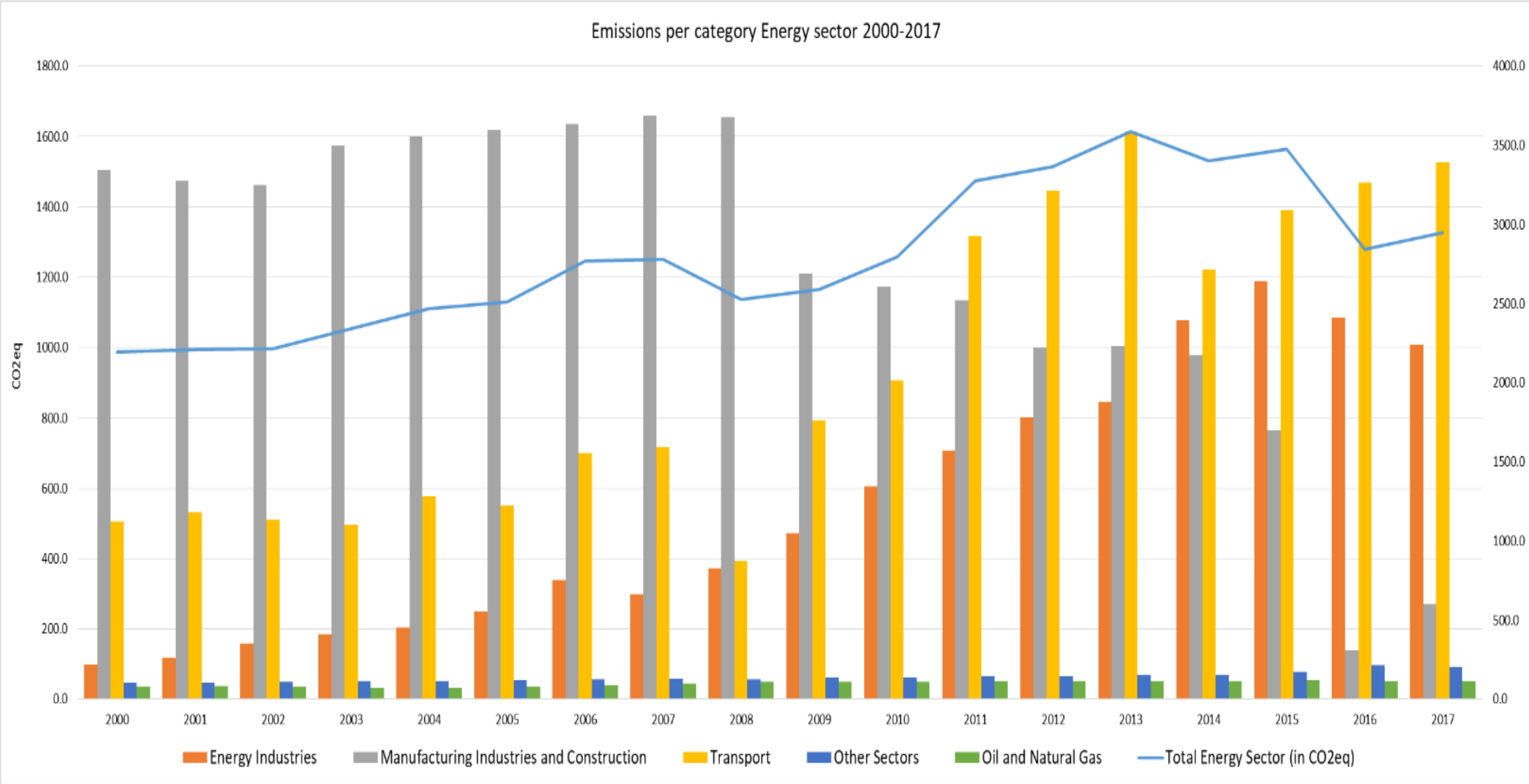


Figure 31 Contribution of the categories to emissions in the Energy sector (in Gg CO2eq)
Source: Figure adapted from the Green House Gas Inventory (GHGI) Report as part of the NC3 report, R. Jharap, 2023

Table 35 presents the emissions per category in the Energy sector for the period 2000-2017 in Gg CO_2eq.

Table 35 Emissions per Energy categories 2000-2017 (Gg CO2eq)

Year	Total Energy sector (Gg CO_2eq)	Energy Indus tries	Manufacturing Industries and Construction	Trans port	Other Sectors	Fugitive emissions from fuel
2000	2194.5	100.0	1506.1	506.5	46.1	35.9
2001	2209.8	118.8	1474.9	531.3	47.4	37.5
2002	2212.9	157.9	1461.4	509.3	48.8	35.4
2003	2341.7	184.9	1574.9	496.9	51.3	33.9
2004	2469.2	204.6	1600.6	577.8	53.1	33.2
2005	2510.8	250.1	1618.6	551.4	55.2	35.5
2006	2771.0	338.5	1635.7	701.0	55.7	40.1
2007	2777.4	297.8	1659.7	715.8	58.5	45.6
2008	2525.2	371.5	1654.1	393.5	56.1	50.0
2009	2588.1	471.4	1211.6	793.7	61.3	50.1
2010	2797.8	606.4	1173.6	905.7	62.6	49.5
2011	3276.2	707.8	1133.5	1318.1	65.3	51.5
2012	3367.0	803.3	1000.4	1446.3	65.7	51.3
2013	3585.7	844.6	1005.2	1615.0	69.2	51.7
2014	3400.2	1077.1	977.1	1223.3	69.7	53.0
2015	3476.2	1189.3	764.1	1391.1	78.1	53.6
2016	2841.5	1085.4	139.2	1468.9	96.3	51.6
2017	2949.3	1008.5	270.3	1527.3	92.0	51.3

Source: Table adapted from the Green House Gas Inventory (GHGI) Report as part of the NC3 report, R. Jharap, 2023

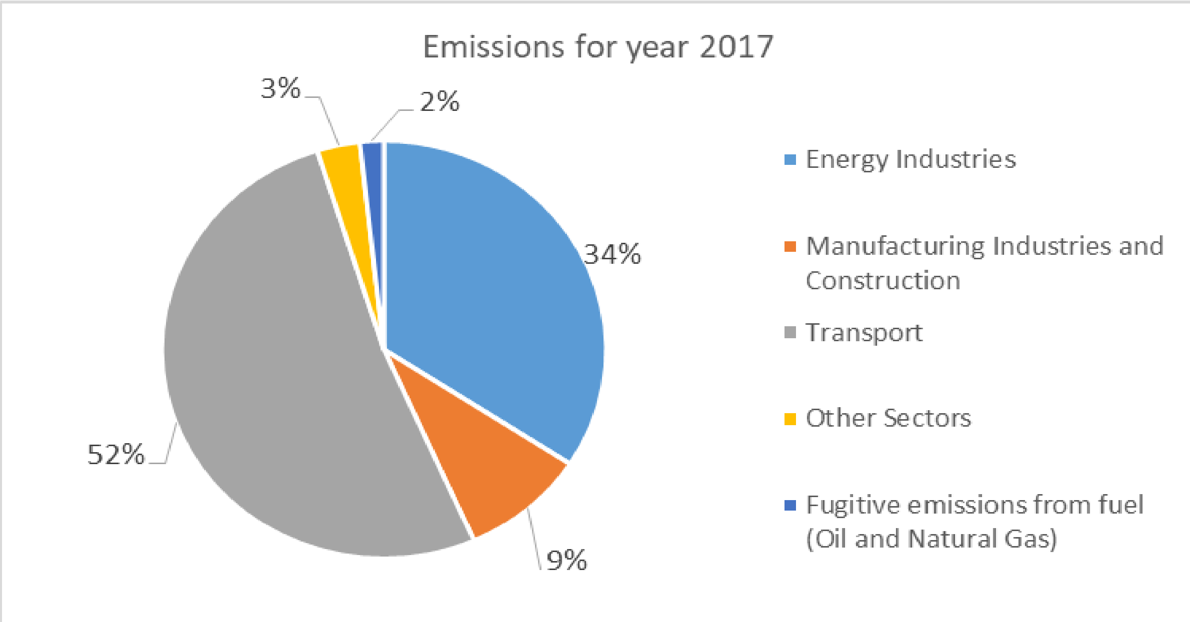
The rising trend in the period 2000-2017 can be explained by an increased demand of fuel under the subsector 'Fuel Combustion Activities'. The categories 'Manufacturing Industries and Construction as well as '(Road) Transportation' can be accounted for this rising trend. The mining sector (gold and oil) under category 'Manufacturing Industries and Construction' tends to be the biggest emitter till 2010. The second biggest emitter from 2010 onwards is the Transport sector. The emission of this category increased from 905.7 Gg CO_2eq in 2010 to 1,527.3 Gg CO_2eq in 2017. The emission from the Transport category increased far more than that compared to energy industries. The small dip between the year 2007 and 2008 is due to the departure of a mine operator in 2008 resulting in the decrease in aluminum refining. The mine ownership was transferred to the refinery operator resulting in an uptake in production – and thus GHG emissions – the subsequent years. The downtrend for Fuel Combustion Activities, which started in 2013 can be attributed to the winding down of these alumina refinery activities, which completely stopped at the end of 2015. The slight uptake noticeable for 2016-2017 can be attributed to the commission of the gold refinery which started in the 4th quarter of 2016 and slowly ramped up production the following year (1.A.2 – Manufacturing Industries and Construction). Fugitive emissions increased during the 2005-2008 period, due to increased crude oil production.

International Bunkers

International bunkers include only international aviation. Emissions from the marine were not estimated, due to a lack of data. The CO_2eq emissions were calculated according to the IPCC guidelines using a tier 1 approach and default emissions factor. Emissions from international aviation in 2017 accounted for 25 Gg CO_2eq, are not included in the national totals.

Emissions for year 2017

The year 2017 shows an emission of 2,949.4 Gg CO_2eq. Figure 32 presents a breakdown in the energy categories, with the Transport sector producing the highest emission of 52%, subsequently followed by the Energy industries category with 34% and the Manufacturing Industries and Construction category (9%).



Sector and categories	2017
Total Energy Sector (in CO2eq)	**2,949.3**
Energy Industries	1,008.5
Manufacturing Industries and Construction	270.3
Transport	1,527.3
Other Sectors	92.0
Fugitive emissions from fuel (Oil and Natural Gas)	51.3

Figure 32 Emissions for year 2017

Source: Table adapted from the Green House Gas Inventory (GHGI) Report as part of the NC3 report, R. Jharap, 2023

Emissions by gases Energy sector

CO_2 emissions steadily increased for the period 2000-2017 and accounted for 99% of the total Energy emissions for the year 2017. Both CH_4 emissions and N_2O emissions are negligible as both accounts for less than 1% of the total Energy emissions (see table 36 below).

Table 36 Emissions by gases (in Gg CO2eq) Energy sector for the period 2000-2017 Emissions by gases (in Gg CO2eq) Energy sector for the period 2000-2017

GHGs Years	CO_2	CH_4	N_2O
2000	2178.0	4.9	11.6
2001	2192.8	5.1	11.9
2002	2196.3	5.0	11.7
2003	2325.0	4.9	11.9
2004	2450.6	5.5	13.2
2005	2492.4	5.5	12.9
2006	2748.5	7.1	15.4
2007	2754.6	7.2	15.6
2008	2508.6	5.6	11.0
2009	2564.4	7.5	16.2
2010	2771.9	7.7	18.2
2011	3242.8	8.4	25.0
2012	3330.6	9.8	26.7
2013	3547.3	8.7	29.8
2014	3367.7	8.6	23.9
2015	3439.5	10.8	25.9
2016	2807.7	9.1	24.7
2017	2914.2	9.3	25.9

Source: Table adapted from the Green House Gas Inventory (GHGI) Report as part of the NC3 report, R. Jharap, 2023

3.5.2. Industrial Processes and Products Use (IPPU) Sector

Scope of the sector

Suriname's manufacturing industry is microscopic and only a few industries are significant to the country's economic growth, such as the oil, gold and bauxite industry. The latter played a significant role until 2014 with regard to the closing of its refinery. Furthermore, the country depends heavily on the revenues from crude oil and gold. The food and beverages industry plays a limited part in the economic sector as nearly all consumer goods are imported.

Methodology

The methodologies used in the Industrial Processes Sector were based on the 2006 IPCC Guidelines applying Tier 1 and default emission factors. Figure 33 presents the structure of activities and source categories for the IPPU sector that are included in this inventory. Activity data was retrieved from direct data providers from the industry.

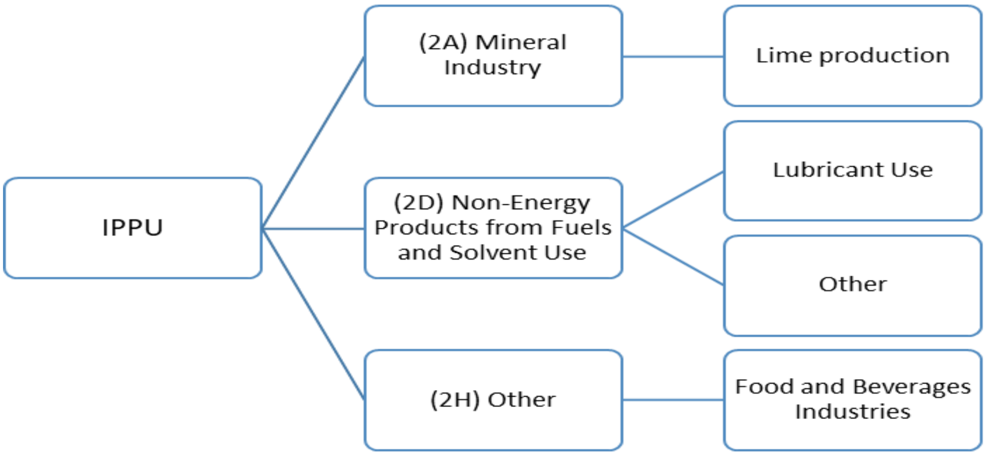
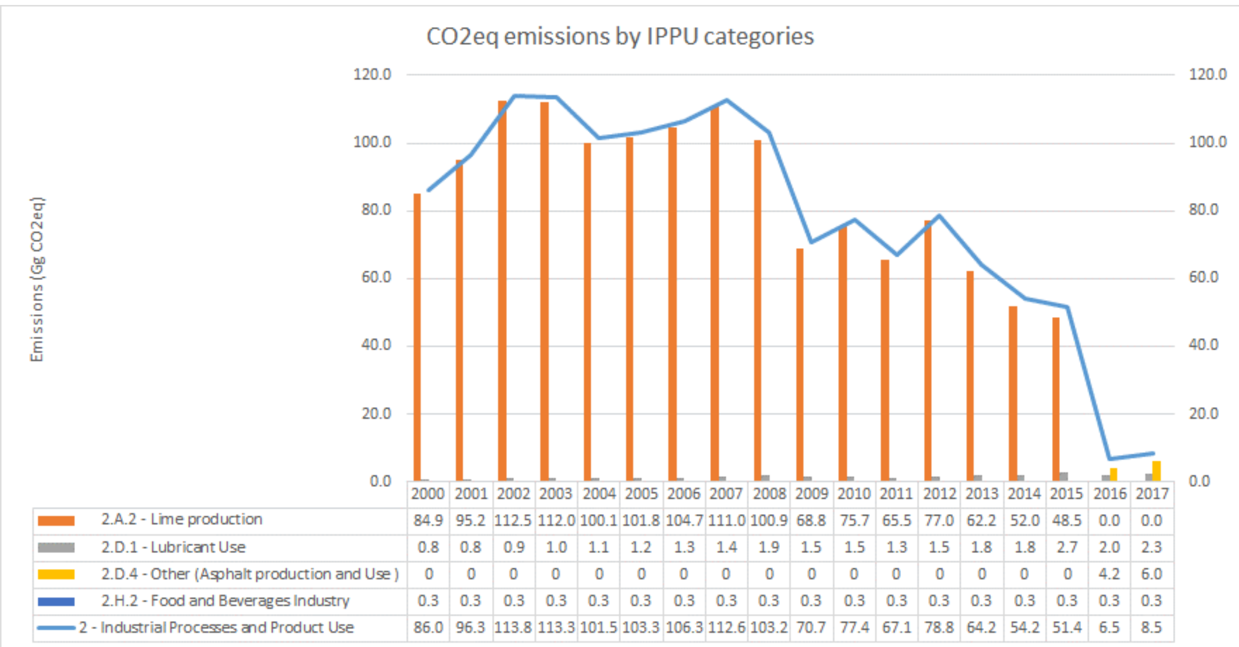


Figure 33 Structure of activities and source categories for the IPPU sector
Source: Figure adapted from the Green House Gas Inventory (GHGI) Report as part of the NC3 report, R. Jharap, 2023

Results GHG emissions activities IPPU sector

The IPPU sector emits the least GHGs, as there are very few major industries (such as the State Oil Company Suriname and some companies from the Food and Beverage industries) or industrial process emissions in Suriname. Moreover, there is not sufficient data available. As such, only a couple of categories are included in estimating the GHG emissions for the IPPU sector. These categories are Lime production, Lubricant Use, Other (Asphalt Production and Use) and the Food and Beverages Industry. Figure 34 presents the emissions per category for the IPPU sector.



	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
2.A.2 - Lime production	84.9	95.2	112.5	112.0	100.1	101.8	104.7	111.0	100.9	68.8	75.7	65.5	77.0	62.2	52.0	48.5	0.0	0.0
2.D.1 - Lubricant Use	0.8	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.9	1.5	1.5	1.3	1.5	1.8	1.8	2.7	2.0	2.3
2.D.4 - Other (Asphalt production and Use)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4.2	6.0
2.H.2 - Food and Beverages Industry	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
2 - Industrial Processes and Product Use	86.0	96.3	113.8	113.3	101.5	103.3	106.3	112.6	103.2	70.7	77.4	67.1	78.8	64.2	54.2	51.4	6.5	8.5

Figure 34 Contribution of the categories to emissions in the IPPU sector (in Gg CO2eq)
Source: Figure adapted from the Green House Gas Inventory (GHGI) Report as part of the NC3 report, R. Jharap, 2023

The total emissions for IPPU sector were 86 Gg CO_2eq in 2000, which slowly increased to 113.8 Gg CO_2eq in 2002, then gradually decreased to 51.4 Gg CO2eq in 2015, and finally sharply plummeted to 8.5 Gg CO_2eq in 2017 as shown in Figure 35. The sharp decrease in GHG emission from 2015-2016 can be explained by the closing of the alumina refinery.

Emissions for year 2017

In 2017, the category 'Non-Energy Products from Fuels and Solvent Use" (2.D.) ~~includes~~ emissions generated from Lubricant Use and Asphalt Production and Use for 96% of total IPPU emissions (see figure 36). Emission from category Mineral Industry (0%) doesn't occur, because of the closing of the alumina refinery in 2015. Category 'Food and Beverages Industries (2.H) generates 0.3% of total IPPU emissions.

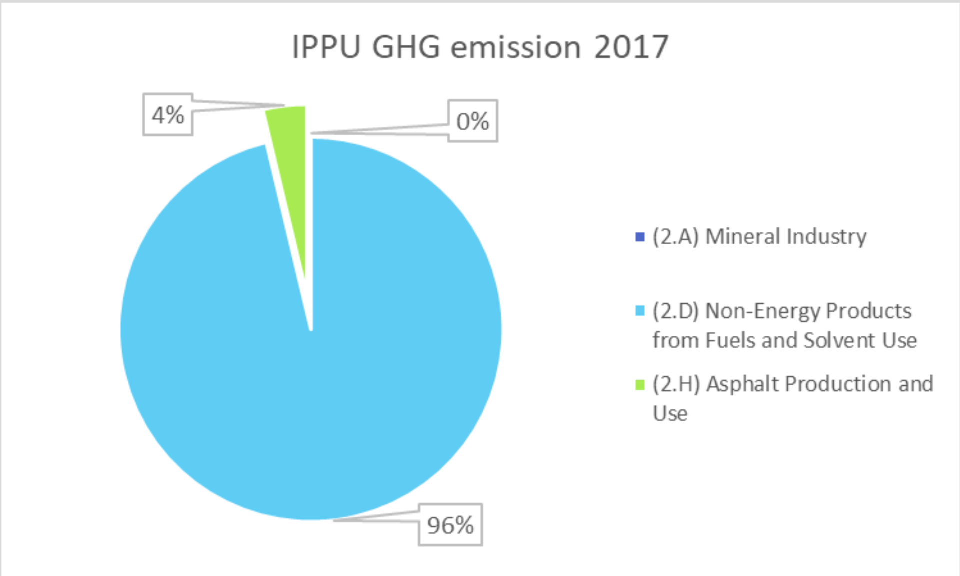


Figure 35 IPPU emissions for year 2017 (in %)
Source: Figure adapted from the Green House Gas Inventory (GHGI) Report as part of the NC3 report, R. Jharap, 2023

Emissions by gases

Calculations show that only CO_2 and a small amount of SF6 are emitted within the IPPU sector; the GHGs CH_4 and N_2O do not occur within this particular sector. Although Suriname, as a non-Annex 1 country, is not required to report on this, the emitted amount of SF6 in 2017 was calculated and accounted for 0.18 Gg CO_2. Emissions from CO_2 decreased from 86 Gg in 2000 to 8.5 Gg in 2017, due to the closing of the alumina refinery (see figure 35).

3.5.3. AFOLU Sector

The AFOLU sector accounts for GHG sinks, as well as sources. The 2006 IPCC Guidelines were followed, whereby the methodologies and approaches, to estimate GHG emissions and removals from AFOLU, are described in Volume 4. The AFOLU sector activities can be divided into three clusters of emission/removal categories, namely Livestock (3A), Land (3B) and Aggregate sources and non-CO_2 emission sources from land (3C). Figure 36 depicts the AFOLU structure in categories as included in the inventory.

All categories were reported except for the subcategory Liming (under category 3C). No estimations were made, since liming is not a common practice in the agriculture sector in Suriname; if any, data is not available. The subcategory Harvested Wood Products (under category 3D) was also not estimated, due to lack of data. For this GHG inventory a close collaboration between SBB and the Ministry of Agriculture, Animal Husbandry and Fisheries (LVV) was established, mainly to avoid double counting. Based on the methodology as provided in the 2006 IPCC Guidelines, calculation for the agriculture sector was done with the IPCC software, while the FOLU sector used the commercial based EXCEL program. At the end the results have been combined in order to make a statement on behalf of the AFOLU sector.

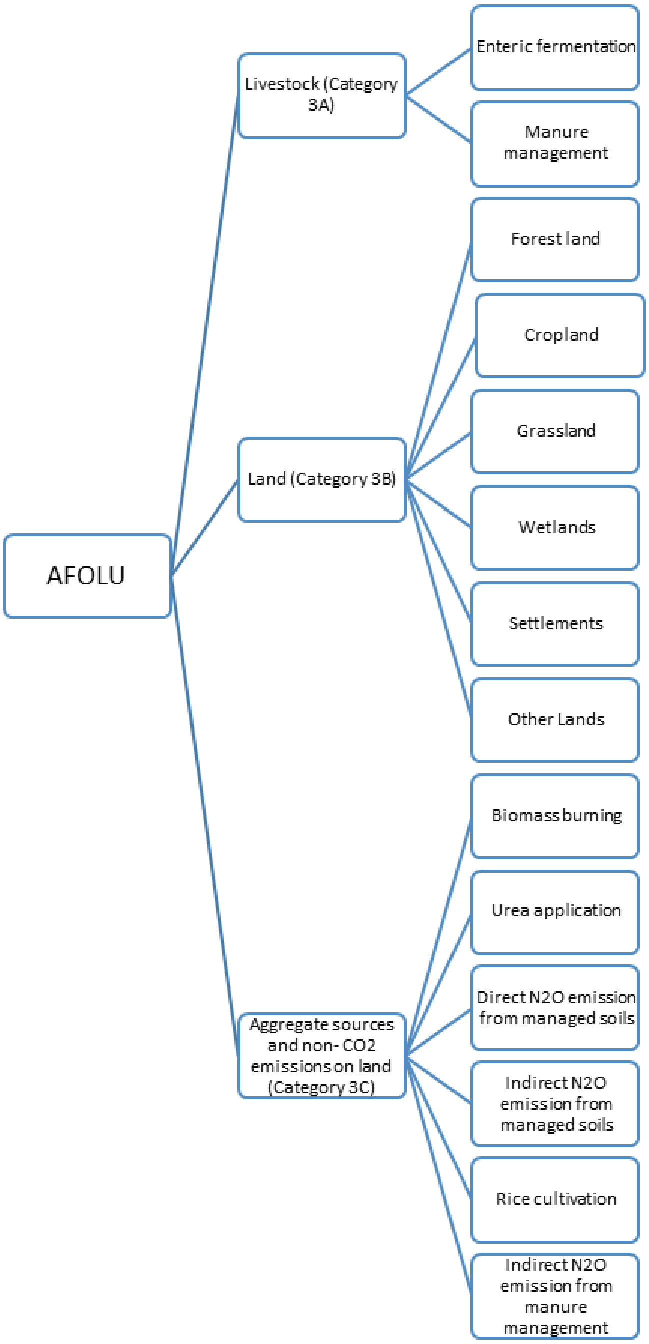


Figure 36 AFOLU structure of activities and source categories for the sector as included in the inventory
Source: Figure adapted from the Green House Gas Inventory (GHGI) Report as part of the NC3 report, R. Jharap, 2023

The AFOLU GHG emissions in this NC3 differs compared to the emissions in the NC2. For NC3 the emission values were updated and significantly improved, both in utilized methodology, as well as the number of categories included. The following improvements were made for the AFOLU sector in this GHG inventory:

- Manure management data was adjusted to include manure management systems practiced in the country, of which the percentage contribution was established through expert judgement;

- National estimated data of organic amendments data in rice cultivation were obtained through expert judgement, instead of using the IPCC default values;
- Country specific emission factors (EFs)/ parameters were used for some categories such as above ground biomass, below ground biomass and deadwood values for forest land;
- Land Use Land Cover Maps were used to extract the Land Use Land Cover changes over the years together with Deforestation maps (GIS- based maps);
- A systematic land representation framework was used streamlining with the six IPCC classes;
- Update of biomass and stock change factors for some categories streamlining with the 2021 Forest Reference Emission Level (FREL) of Suriname.

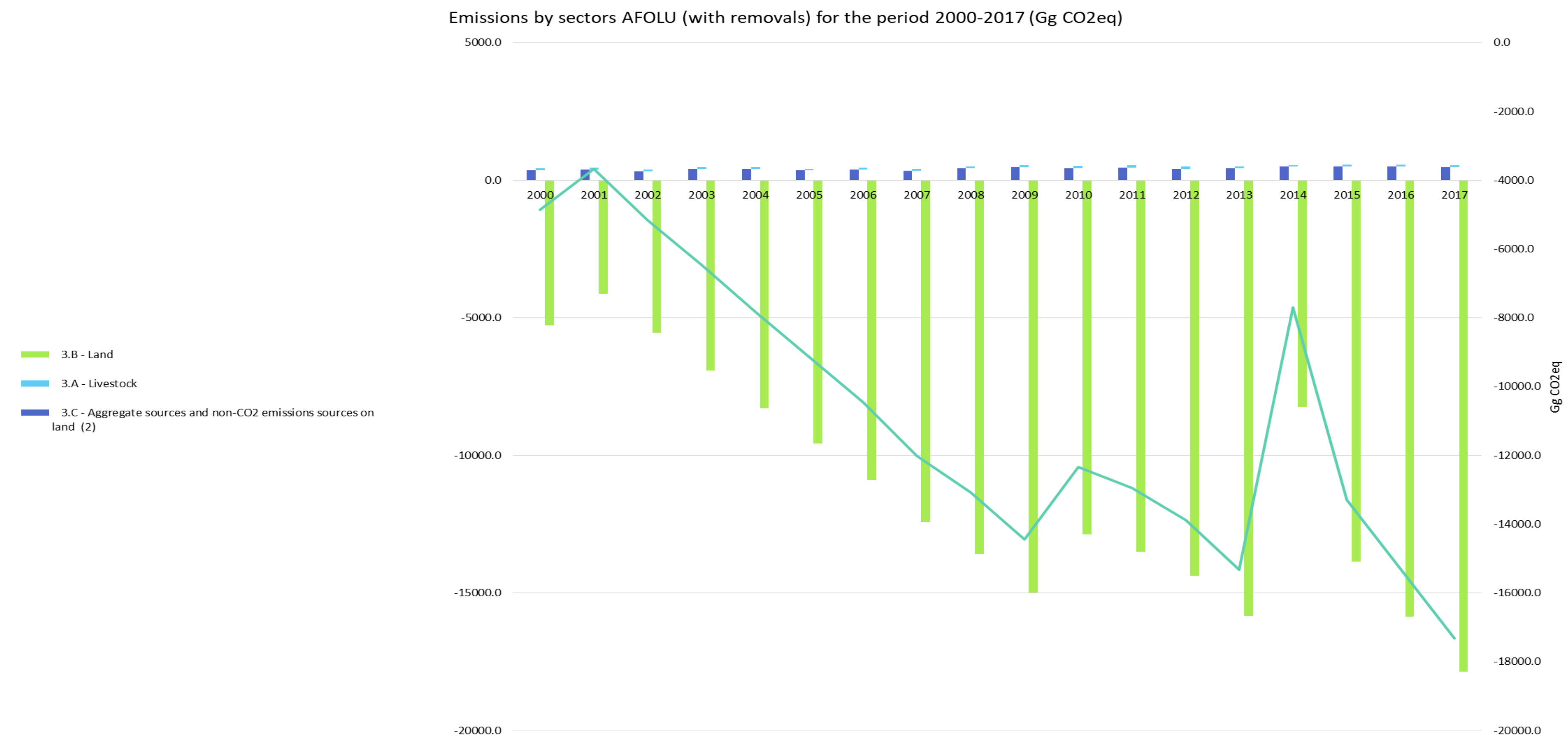
Note that no specific recalculations for the year 2008 were performed, due to the improvements in activity data and emission factors (country specific EFs based on available forest inventory data). Furthermore, it is worth mentioning, that comparison between NC3- and NC2-GHG inventory was challenged, due to the unavailability of meta- and input data from NC2.

Estimates of GHG emissions and removals are first presented under AFOLU for all categories, and then divided under 'Agriculture' and 'Forestry and Other Land Use' (FOLU).

3.5.3.1. Emission trend by AFOLU categories for the period 2000 – 2017

The AFOLU sector shows an increase in GHG emissions and removals for the period 2000-2017 (figure 37). Overall, the sector acts as an increasing net sink from 2000 at 4,851.7 Gg CO_2eq to 17,322.1 Gg CO_2eq in 2017.

The sink trend is mainly driven by removals from the 3B Land category. In the year 2000 the net removal from the Land category was 5,281.8 Gg CO_2eq, while a net removal of 17,860.2 Gg CO_2eq was calculated for year 2017. Due to a high peak of deforestation, as a consequence of gold mining activities (under Settlements/ Land category), a decrease in net removal can be noticed in 2014. The 3A Livestock category recorded a fluctuation trend for the period between 2000 and 2017, showing a downward trend for the periods 2000 up to 2003 and 2012 up to 2014 and an upwards trend for the period 2006 up to 2010. Category 3C also shows a fluctuation trend between 2000 and 2017 with an estimated emission of 354 Gg CO_2eq in 2000 and 481.6 Gg CO_2eq in 2017. It is worth mentioning that the inter-annual variation is not driven by the change in methodology. Note that the emissions estimated within the FOLU sector should be taken by caution, as further explained in section 3.5.3.5.



	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
3.B - Land	-5281.8	-4125.9	-5551.7	-6926.6	-8290.9	-9566.0	-10890.9	-12418.5	-13587.8	-14991.4	-12872.1	-13497.1	-14379.5	-15838.1	-8250.9	-13861.1	-15868.7	-17860.2
3.A - Livestock	76.1	71.1	61.9	59.4	67.1	59.4	67.8	68.4	80.6	82.7	89.3	85.6	90.3	71.6	56.3	60.2	57.3	56.6
3.C - Aggregate sources and non-CO2 emissions sources on land (2)	354.0	383.7	326.0	411.2	398.0	360.1	378.2	339.9	427.6	470.7	439.7	454.2	399.1	436.2	497.2	501.8	509.5	481.6
3a Livestock + 3b Land + 3c Aggregate sources and non-CO2 emissions sources on land	-4851.7	-3671.1	-5163.8	-6456.0	-7825.9	-9146.5	-10444.9	-12010.2	-13079.6	-14438.0	-12343.1	-12957.2	-13890.1	-15330.4	-7697.4	-13299.0	-15301.9	-17322.1

Figure 37 Trend in emissions/ removals in the AFOLU sector, period 2000-2017 (Gg CO2eq)
Source: Figure adapted from the Green House Gas Inventory (GHGI) Report as part of the NC3 report, R. Jharap, 2023

3.5.3.2. Emissions for year 2017

The AFOLU sector acted as a net sink at -17,322.1 Gg CO_2eq in the year 2017. Sub sector 3.B-Land acts as a removal accounting for 97% (in particular the Forest land category) CO_2eq, while the categories 'Livestock' and 'Aggregate sources and non-CO_2 emissions sources on land' contributes minimal, respectively less than 1% and 3% (see figure 38).

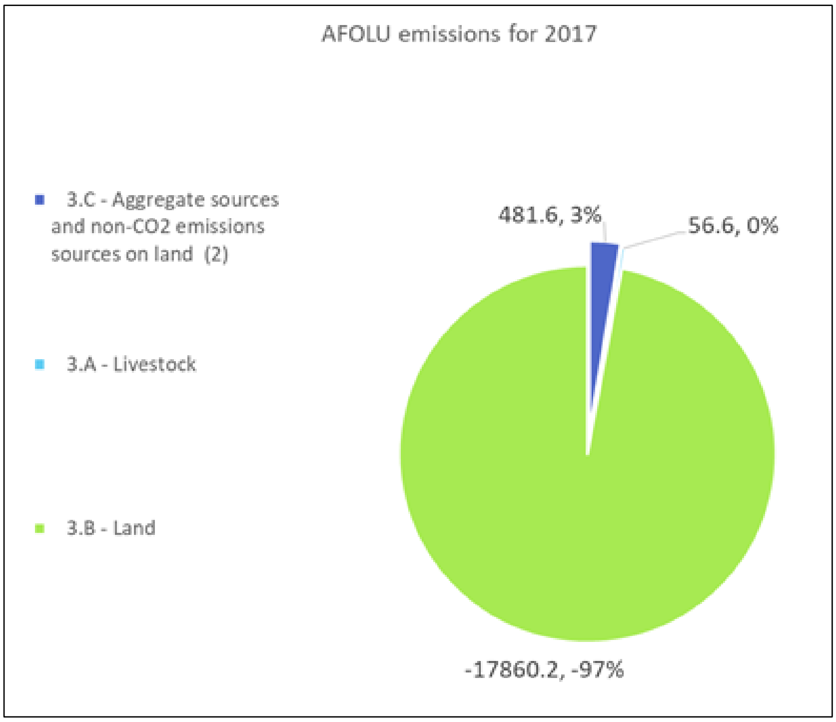


Figure 38 Emissions and removals AFOLU per category for the year 2017
Source: Figure adapted from the Green House Gas Inventory (GHGI) Report as part of the NC3 report, R. Jharap, 2023

3.5.3.3. Emissions by gases

CO_2 was the most prevalent GHG emission for the AFULO sector in 2017 with 96.45%, followed by CH_4 at 2.50% and N_2O at 1.05% (see figure 39).

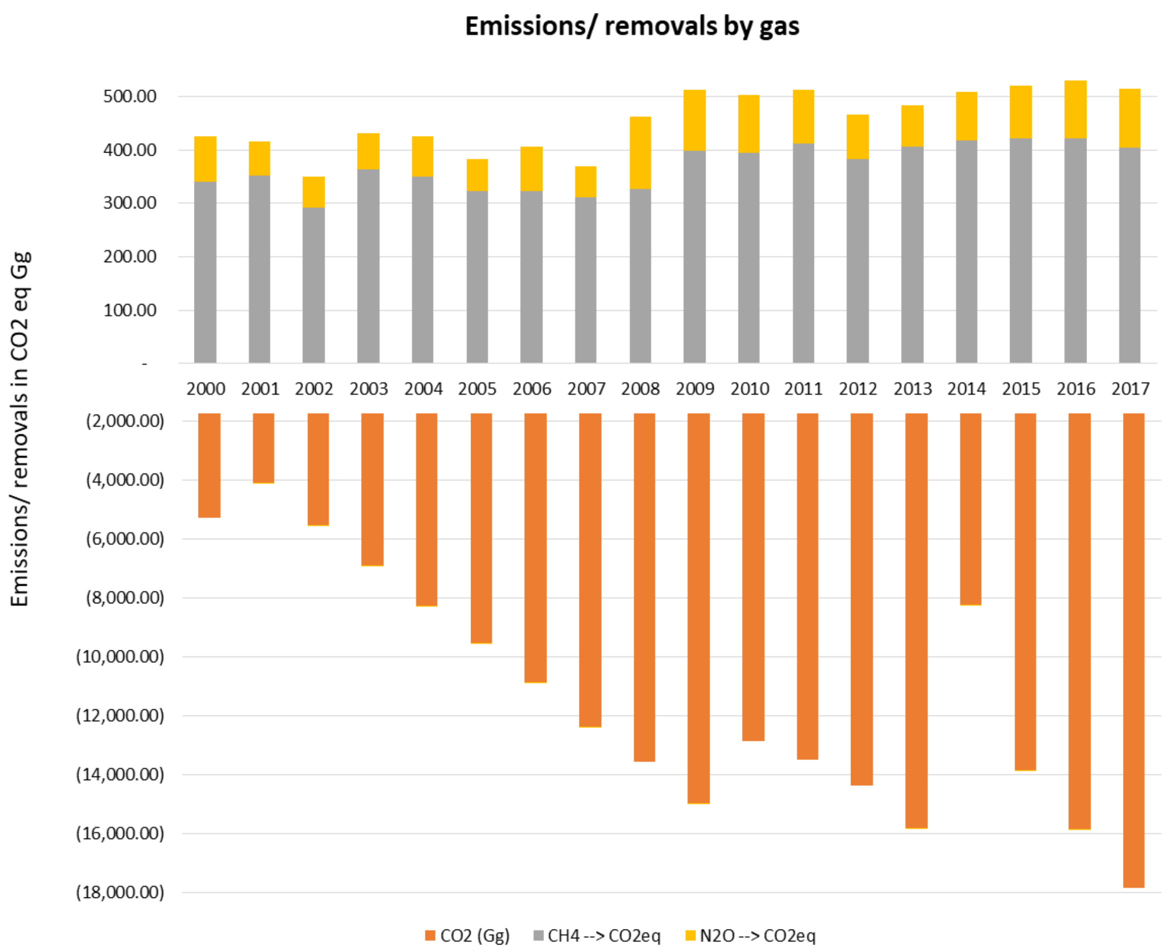


Figure 39 Emissions/ removals by gases AFOLU sector for the period 2000-2017 (Gg CO2eq)
Source: Figure adapted from the Green House Gas Inventory (GHGI) Report as part of the NC3 report, R. Jharap, 2023

3.5.3.4. Agriculture sector

Scope of the sector

Suriname's agricultural sector consists of a variety of crops including rice, bananas, vegetables, plantains, citrus, fruits and cassava. However, rice and bananas, Suriname's most important crops, face challenges to improve their cost structures and competitiveness. The livestock sector remains important, with products such as poultry, beef, pork, milk and eggs. The relative importance of agriculture in Suriname's economy has declined over the last two decades, from around 18% of GDP in the mid-1990s to 9% in 2018. Still, the sector remains socio-economically significant, as it is a major provider of employment in rural areas in addition to being a key contributor to food security through the production of rice, the population's main staple food. The potential for agricultural development is strong, with 1.5 million hectares considered suitable for agricultural production, of which only an estimated 120,000 hectares currently being utilized.

Methodology
The Tier 1 approach (including default emission factors) was applied to estimate GHG emissions for the Agriculture sector. Emissions were calculated using the IPCC software program. The 2000-2017 GHG emissions for the Agriculture sector in Suriname included the following categories as depicted in figure 40.

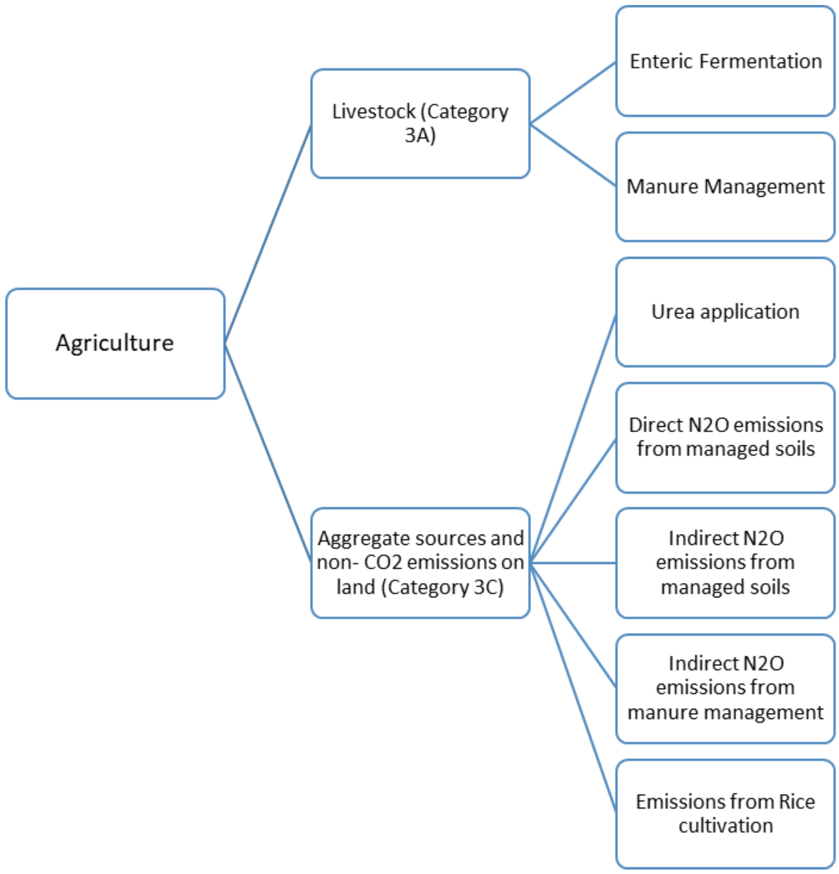
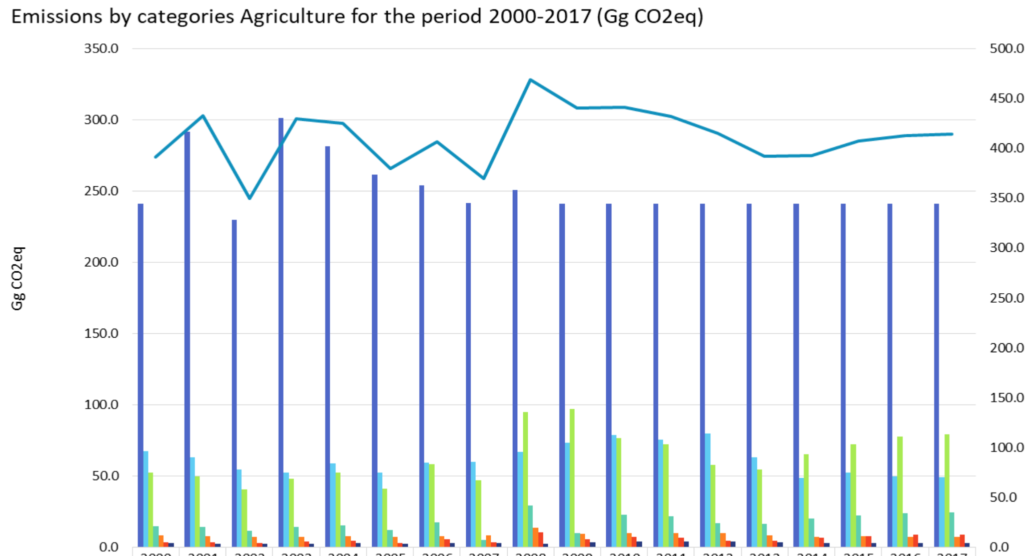


Figure 40 Subsectors and categories for the Agriculture sector
Source: Figure adapted from the Green House Gas Inventory (GHGI) Report as part of the NC3 report, R. Jharap, 2023

Activity data were obtained from the Agriculture Statistics Department of the Ministry of Agriculture, Animal Husbandry and Fisheries (LVV), FAOSTAT (for nitrogen data), IPCC defaults values and expert judgement.

Results GHG emissions activities Agriculture sector
The emissions in the Agriculture sector fluctuated over the period 2000-2017, but increased slowly as seen in figure 41. Total emissions from Livestock and Aggregated sources and non-CO_2 emissions on land in the country showed an

increase across the time series at 325.82 Gg CO_2eq in 2000 and 471.52 Gg CO_2eq in 2017. The emissions trend is dominated by rice cultivation followed by Enteric fermentation and managed soils.



	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
3.C.7 - Rice cultivation	241.1	291.6	230.0	301.0	281.5	261.6	254.0	241.7	250.7	241.1	241.1	241.1	241.1	241.1	241.1	241.1	241.1	241.1
3.A.1 - Enteric Fermentation	67.7	63.0	54.5	52.3	59.0	52.3	59.6	60.2	66.9	73.3	79.1	75.4	80.1	63.0	48.9	52.3	49.7	49.2
3.C.4 - Direct N2O Emissions from managed soils (3)	52.3	49.6	40.8	48.1	52.6	41.4	58.7	47.3	95.1	97.0	76.6	72.6	57.7	54.7	65.6	72.3	77.9	79.5
3.C.5 - Indirect N2O Emissions from managed soils	15.1	14.3	11.7	14.2	15.7	12.0	17.7	5.2	29.4	10.2	23.0	21.8	17.0	16.3	20.1	22.4	24.2	24.7
3.A.2 - Manure Management (1)	8.4	8.0	7.5	7.2	8.1	7.2	8.2	8.2	13.8	9.5	10.2	10.2	10.2	8.6	7.4	7.9	7.6	7.4
3.C.3 - Urea application	3.9	3.7	2.9	4.1	4.6	3.1	5.5	3.8	10.6	5.5	7.2	6.8	4.4	4.7	7.0	7.9	8.9	9.1
3.C.6 - Indirect N2O Emissions from manure management	2.9	2.7	2.5	2.5	3.2	2.5	3.2	3.3	2.7	3.8	4.1	4.1	4.3	3.5	2.9	3.2	3.1	2.9
Total	391.5	433.0	349.8	429.3	424.7	380.0	406.8	369.6	469.1	440.4	441.4	432.0	414.8	391.9	392.9	407.2	412.5	413.9

Figure 41 Emissions by categories Agriculture for the period 2000-2017 (Gg CO2eq)
Source: Figure adapted from the Green House Gas Inventory (GHGI) Report as part of the NC3 report, R. Jharap, 2023

Emissions for year 2017

The inventory shows that for the year 2017, rice cultivation (58%), direct N_2O emissions from managed lands (19%) and enteric fermentation (12%) had the largest hare in the total CO_2eq emissions for agriculture (see figure 42).

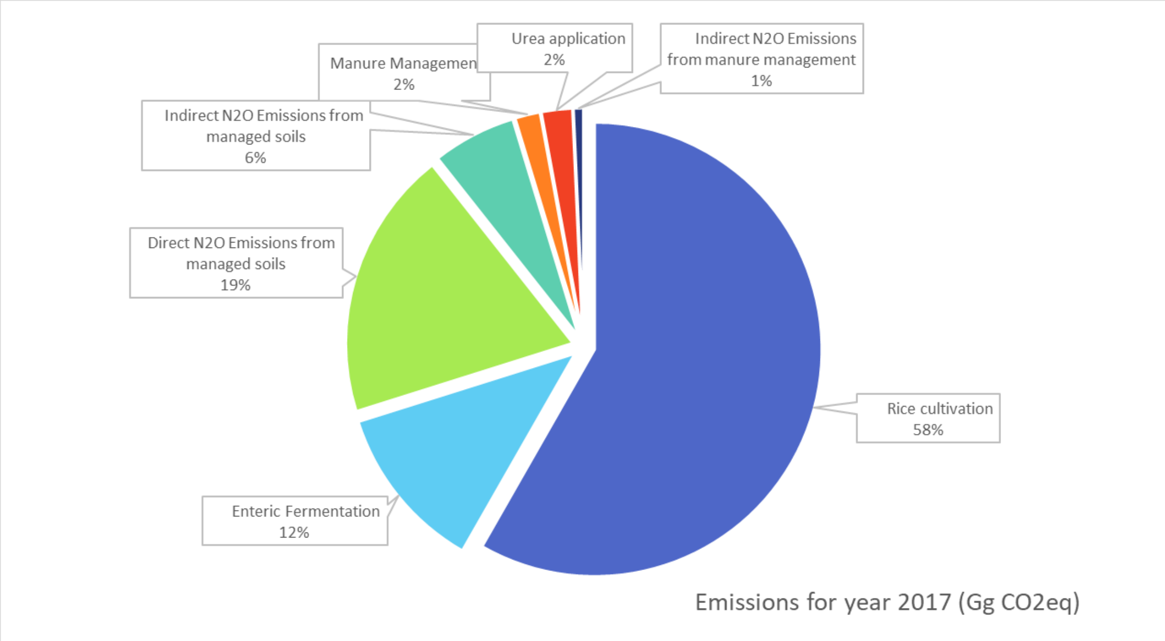


Figure 42 Emissions for all Agriculture categories for year 2017 (Gg CO2eq)

Source: Figure adapted from the Green House Gas Inventory (GHGI) Report as part of the NC3 report, R. Jharap, 2023

Emissions by gases

CH_4 emissions accounted for an average of 79% in the Agriculture sector for the period 2000-2017. CH_4 emissions are generated by rice cultivation and enteric fermentation. N_2O emissions accounts for an average of 20% and is generated by Managed soils and Indirect N_2O emissions from manure management. CO_2 emissions generated under Urea application is with 1% emitted within the Agriculture sector (see figure 43).

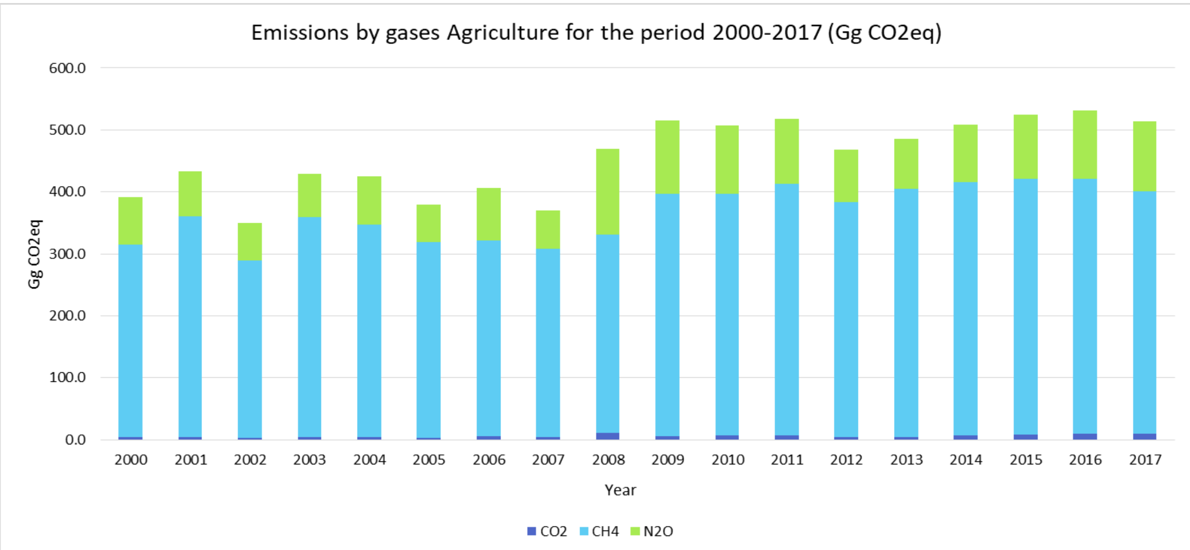


Figure 43 Emissions by gases for the period 2000-2017 (Gg CO2eq)
Source: Figure adapted from the Green House Gas Inventory (GHGI) Report as part of the NC3 report, R. Jharap, 2023

3.5.3.5. Forest and Other Land Use Sector (FOLU)

Scope of the sector

With a tropical forest cover of approximate 93%, accounting for almost 0.4% of the total forest on earth, Suriname is known as a HFLD country. The historically low annual deforestation rate of 0.02% for the period 2000-2009, increased to 0.1% in 2014, due to an increased demand for natural resources (such as gold) and it slowly stabilized to 0.07% in 2019. Mining is the main driver for deforestation for the period 2000-2017 (69%), followed by infrastructure (18%) and agriculture (5%).

Methodology

The FOLU sector comprises estimates of emissions and removals of GHGs associated with the increase or decrease of carbon (in above-ground and below-ground biomass, dead organic matter and soil organic matter) through land use changes, for example, conversion of forest land to settlements.

For the GHG inventory year 2000-2017, CO_2 emissions and removals are estimated for changes in the FOLU sector. The methodologies adopted are consistent with those in the 2006 IPCC Guidelines for National Greenhouse Gas Inventories, volume 4 (AFOLU). Suriname reported the following FOLU sub-categories, based on the 2006 IPCC Guidelines: Forest land, Cropland, Grassland, Wetland, Settlements and Other land. Other categories according to the IPCC guidelines, were not included in the estimation of the GHG emissions for the FOLU sector. These categories are, 'liming' as it is not common practice in Suriname, and 'Harvested Wood Products', due to a lack of data. Figure 44 presents an overview of the categories included in the inventory.

Activity Data in the FOLU sector was collected using a combination of remote sensing data and ground proofing surveys, whilst applying different land representation approaches: Approach 2: Total land-use area, including changes between categories; Approach 3: Spatially-explicit land-use conversion data, in accordance with chapter 3 of the IPCC guidelines (2006).

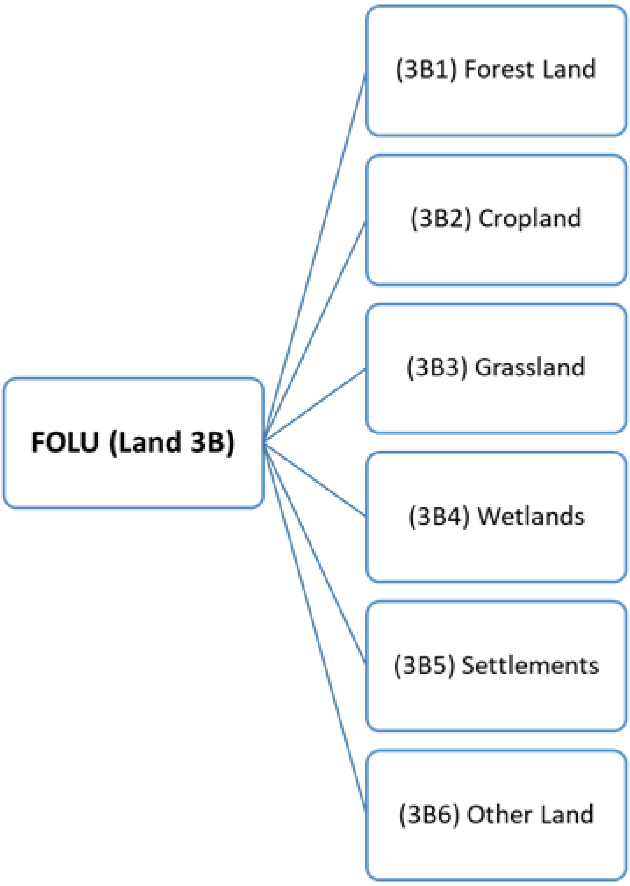


Figure 44 Structure of activities and source categories for the Forestry and Other Land Use (FOLU) sector as included in the inventory
Source: Figure adapted from the Green House Gas Inventory (GHGI) Report as part of the NC3 report, R. Jharap, 2023

Below is a concise overview covering the land use classes included, the key categories and tiers used:

- The inventory for the FOLU sector was mainly conducted using a combination of Tier 1-, Tier 2 method and Approach 3;
- The Landsat and Sentinel 2A imagery tools were applied for the annual wall-to-wall monitoring of the Activity Data (AD), following a standard protocol and the methodology as recommended by Olofsson et al. (2014) and Olofsson et al. (2020) for land-use and land-use change area estimations. This is done in accordance with Approach 3;
- Activity data was disaggregated by drivers of deforestation, using ancillary data and field experience from multiple institutions. Throughout this process, guidelines for the visual interpretation of the different land use and land cover classes (LULC) were developed and adjusted (SBB, 2021), in accordance with Approach 3;
- Data from pre-selected forest inventory plots, throughout the country, were utilized to estimate the national forest carbon stocks, instead of a full National Forest Inventory (NFI) (covering the whole country). This required for the assembling of data from the different inventory plots in a national database starting from 2012.

- In 2019, 11 additional mangrove NFI plots were established in the coastal area (SBB, 2019), resulting in a total of 13 mangrove plots. Within this national database, above-ground biomass and dead wood (lying and standing) were assessed in accordance with Tier 2, based on national data, but using pantropical allometric estimates. Belowground biomass was assessed using Tier 2.
- To calculate the emissions due to logging, a field procedure was developed and carried out in ten locations, using a randomly stratified approach. 200 felled trees were measured, 150 skid trail plots were established, 100 log yards and 200 road widths were measured, haul roads within nine concessions were partly mapped and skid trails were mapped and measured in about 550 ha of logging units (Zalman et al., 2019). These emission factors are considered country specific.
- All carbon pools (AGB, BGB, Litter, DW, and SOM) were estimated for all IPCC land uses (Forest land, Cropland, Grassland, Settlements, Wetland and Other land).
- It's worth mentioning that a stepwise approach will be conducted gradually in the future to improve towards a combination of Tier 2 and Tier 3.

Note:
It is worth mentioning that the results presented here, need to be carefully used due to the following constraints: • The Activity data (AD) for the emission/ removal estimates for the FOLU sector consisted of two Land Use Land Cover (LULC) maps for the years 2000 and 2015. These maps were based on Landsat images, providing only one-time conversion for the entire time series that may not represent an actual conversion throughout the time series. Furthermore, deforestation maps available for in between those two years, 2000 and 2015, have been incorporated in the time series, to make sure the consistency is present with the data set used in the Forest Reference Emission Level (FREL) of Suriname which has been submitted in 2021 to the UNFCCC. • Regarding the Emission Factor (EF), for most of the parameters, IPCC default values have been used. For those parameters, where country specific data was available, and the same values have been used for the FREL, those data have been incorporated in the estimation of the emission/ removal for the FOLU sector. • Some main observations can be made: (1) more LULC data sets will provide better emission/ removal estimates for each year. At this moment the Forest Cover Monitoring Unit (FCMU) is in the process of improving monitoring method with a sample based monitoring method that will produce a more robust data set for both qualitative better activity data and uncertainty assessment; (2) re-assessing the re-growth parameter by conducting national forest inventory might provide better estimate of the removals from the forest of Suriname; (3) no accuracy assessment was done on the LULC data, due to a lack in capacity on how to do a QAQC on de LULC map which has more detail classes and which is produced not only based on Landsat images but also ancillary and field knowledge data.

Results GHG emissions activities FOLU sector

The CO_2 emissions and removals from the FOLU sector are estimated for the GHG inventory year 2000-2017 and presented in table 37 and figure 45 below.

Table 37 GHG emissions and removals per FOLU category 2000-2017 (Gg CO2eq)

	Forest land	Cropland	Grassland	Wetland	Settlements	Otherland
2000	-5859	-20	528	29	42	0
2001	-6449	-37	462	54	1753	17
2002	-7750	31	303	54	1792	18
2003	-8997	25	142	54	1831	18
2004	-10233	19	-20	54	1871	18
2005	-11377	13	-184	54	1910	19
2006	-12570	7	-350	54	1949	19
2007	-13963	1	-518	54	1989	19
2008	-15057	-5	-687	54	2059	49
2009	-16262	-11	-859	54	2068	20
2010	-17874	93	-803	95	5299	318
2011	-18425	88	-962	95	5384	322
2012	-19234	83	-1120	95	5470	327
2013	-20618	78	-1280	95	5555	332
2014	-20708	312	-1115	183	12943	133
2015	-21663	29	-1605	131	9005	241
2016	-22858	-26	-1823	125	8555	159
2017	-22862	-117	-2091	105	7030	73

Source: Table adapted from the Green House Gas Inventory (GHGI) Report as part of the NC3 report, R. Jharap, 2023

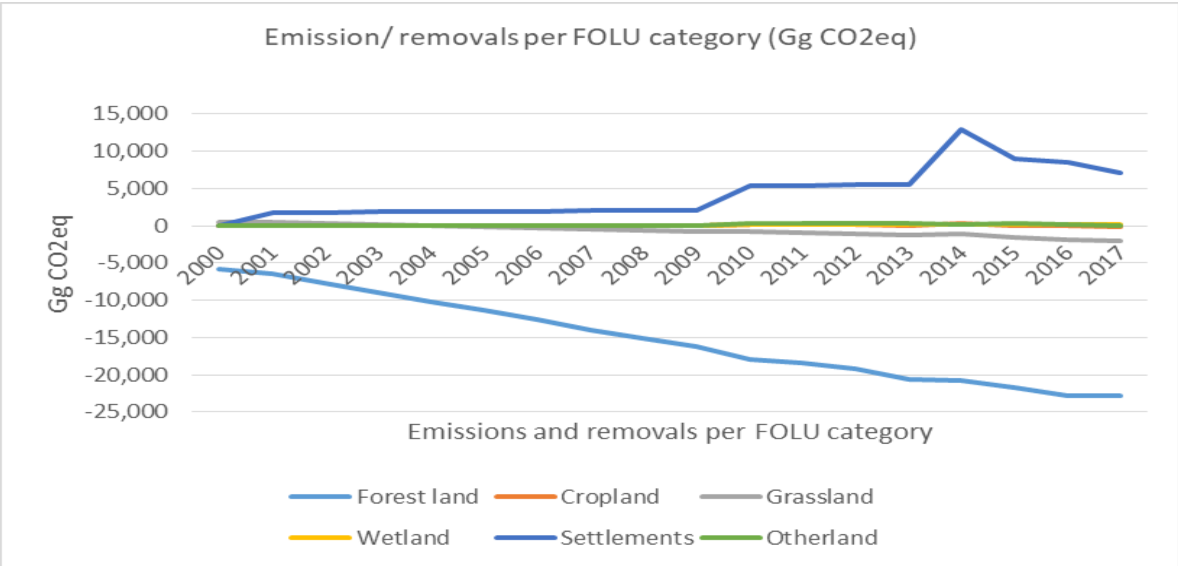


Figure 45 Trend in emissions and removals 2000-2017 for each FOLU category (Gg CO2eq)
Source: Figure adapted from the Green House Gas Inventory (GHGI) Report as part of the NC3 report, R. Jharap, 2023

GHG Emissions for the FOLU sector are largely driven by the Settlements category, in particular by the conversion of Forest Land to Settlements, due to gold mining and infrastructure development. Removals are driven by Forest land category most probably as a result of forest policy, such as the different forest management practices implemented over the years.

Emissions for year 2017

Emissions and removals for all categories within the FOLU sector for the year 2017 are presented in table 38. The sub- categories Settlements (7,030 Gg CO_2eq), Wetlands (105 Gg CO_2eq) and Other Land (73 Gg CO_2eq) together, account for 22% of the total emissions, while the sub-categories Forest land (22,862 Gg CO_2eq), Grassland (2,091 Gg CO_2eq) and Cropland (117 Gg CO_2eq) are net sink sources covering almost 76% of the total emissions.

Table 38 Emissions per FOLU categories year 2017

FOLU categories	Emission in Gg CO_2 eq (2017)
Forest land	-22,862
Cropland	-117
Grassland	-2,091
Wetland	105
Settlements	7,030
Other Land	73

Source: Table adapted from the Green House Gas Inventory (GHGI) Report as part of the NC3 report, R. Jharap, 2023

Emissions by gases

CO_2 is the predominant removal of gas in this sector, but there are also removals of other GHGs such as CH_4 and N_2O, however, these are very insignificant compared to the removals of CO_2 (see table 39).

Table 39 Emissions by gases for the FOLU sector (Gg CO2eq)

Year	CO_2 (Gg CO2eq)	CH_4 (Gg CO2eq)	N_2O (GgCO2eq)
2000	-5,282	0	NE
2001	-4,092	-24	-10.31
2002	-5,518	-24	-10.31
2003	-6,892	-24	-10.31
2004	-8,257	-24	-10.31
2005	-9,532	-24	-10.31
2006	-10,857	-24	-10.31
2007	-12,384	-24	-10.31
2008	-13,554	-24	-10.31
2009	-14,957	-24	-10.31

Year	CO_2 (Gg CO2eq)	CH_4 (Gg CO2eq)	N_2O (GgCO2eq)
2010	-12,853	-13	-5.85
2011	-13,478	-13	-5.85
2012	-14,360	-13	-5.85
2013	-15,819	-13	-5.85
2014	-8,213	-27	-11.57
2015	-13,828	-23	-9.99
2016	-15,842	-19	-8.18
2017	-17,847	-9	-3.97

Source: Table adapted from the Green House Gas Inventory (GHGI) Report as part of the NC3 report, R. Jharap, 2023

3.5.4. Waste Sector

Scope of the sector

The growth in population and change in lifestyle, due to economic development, led to an increased amount of waste in Suriname and a change in the composition of waste. The largest source of waste in the country is household waste (91.6% of all waste disposed in 2017). Collected waste is dumped by the responsible authorities in official open dumps (the country has no sanitary landfills) that are poorly managed, with minimal capping works to minimize methane emissions. Wastewater form various sectors, such as households, industries, food and beverages companies and so on, is discharged without the necessary purification treatment on the sewer or on surface water.

Methodology

In Suriname, the national waste inventory focused on three main emission sources, namely: the solid waste disposed in open dumps (CH_4), incineration and open burning (CO_2, CH_4 and N^2O), and domestic and industrial wastewater (CH_4 and N_2O). The category 'Biological Treatment and other' is not common in the country. The same applies for the category 'Composting', which is not practiced on a large or commercial scale. Land farming (of oil contaminated soil) is also not included in the inventory, due to a lack of detailed information, although, it may be a source of GHG emissions. Figure 46 presents the structure of activities and source categories for the Waste sector that are included in this inventory.

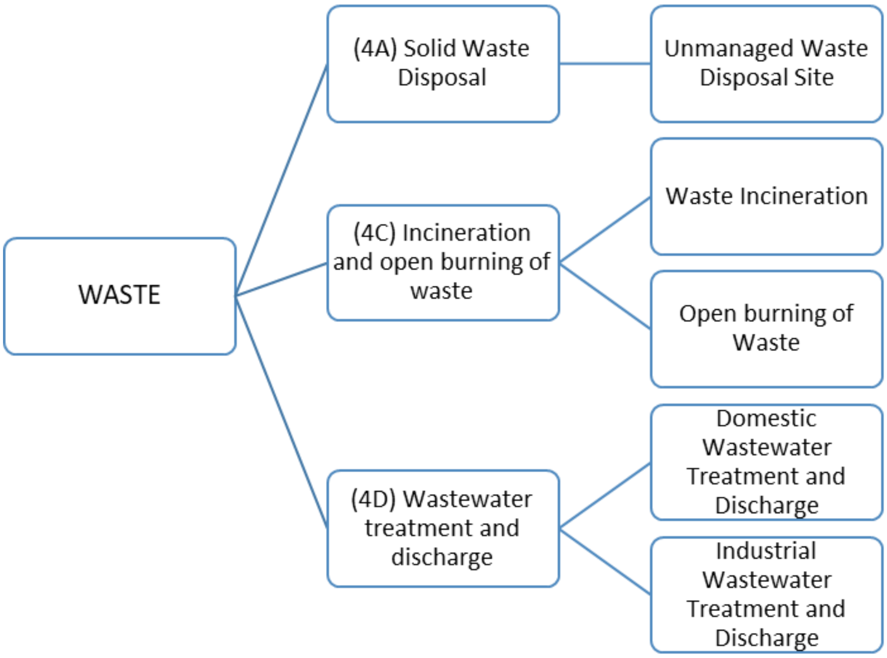
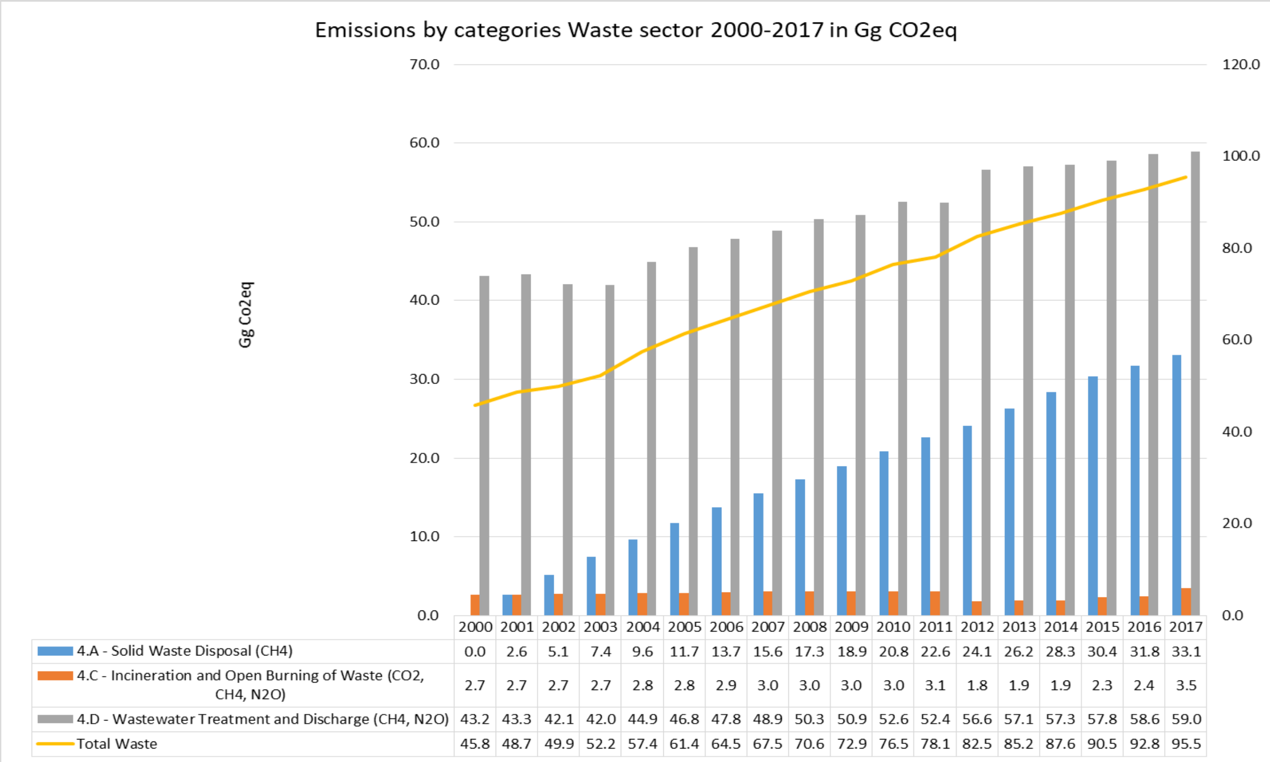


Figure 46 Structure of activities and source categories for the Waste sector
Source: Figure adapted from the Green House Gas Inventory (GHGI) Report as part of the NC3 report, R. Jharap, 2023

A Tier 1 approach was used, including default emission factors and as far as possible, local activity data was used to calculate the emissions produced by the Waste sector. The activity data for the Waste sector were gathered from various sources, mainly from the General Bureau of Statistics (ABS), private sector, international data (FAO) and from desk research.

Results

Figure 47 shows the emissions from the Waste sector for the period 2000-2017. The general upward emission trend is driven by the emissions associated with wastewater treatment and discharge, as well as solid waste disposal. The total GHG emissions estimated from 'Wastewater treatment and discharge', which accounted for 45.8 Gg CO_2eq increased to 59 Gg CO_2eq in 2017. Emissions from 'Solid waste disposal on land' is the second biggest emitter in the Waste sector and slowly increased over the period as a result of increased consumption and a larger population since the previous inventory (NC2). The contribution from 'Incineration and Open Burning of waste' is negligible with 3.5 Gg CO_2eq in 2017.



	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
4.A - Solid Waste Disposal (CH4)	0.0	2.6	5.1	7.4	9.6	11.7	13.7	15.6	17.3	18.9	20.8	22.6	24.1	26.2	28.3	30.4	31.8	33.1
4.C - Incineration and Open Burning of Waste (CO2, CH4, N2O)	2.7	2.7	2.7	2.7	2.8	2.8	2.9	3.0	3.0	3.0	3.0	3.1	1.8	1.9	1.9	2.3	2.4	3.5
4.D - Wastewater Treatment and Discharge (CH4, N2O)	43.2	43.3	42.1	42.0	44.9	46.8	47.8	48.9	50.3	50.9	52.6	52.4	56.6	57.1	57.3	57.8	58.6	59.0
Total Waste	45.8	48.7	49.9	52.2	57.4	61.4	64.5	67.5	70.6	72.9	76.5	78.1	82.5	85.2	87.6	90.5	92.8	95.5

Figure 47 Emissions by categories Waste sector for the period 2000-2017
Source: Figure adapted from the Green House Gas Inventory (GHGI) Report as part of the NC3 report, R. Jharap, 2023

Emissions for year 2017

The emissions from 'Wastewater treatment and discharge' is the main source of GHGs in the Waste sector with 62%. Solid waste disposal is the second biggest emitter with 34% in 2017, followed by category Incineration and open burning of waste with 4%, which is relatively small compared to the other two categories.

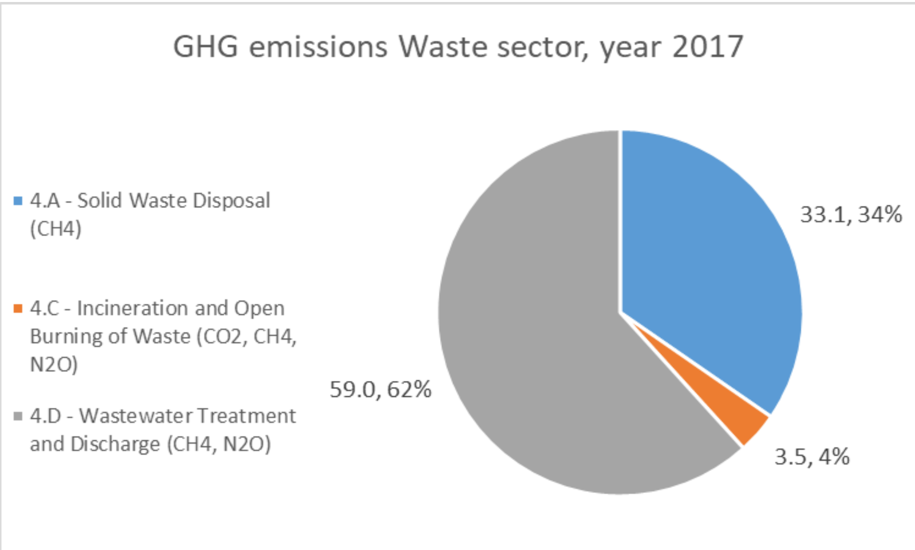


Figure 48 Emissions Waste sector for 2017 (Gg CO2eq)
Source: *Figure adapted from the Green House Gas Inventory (GHGI) Report as part of the NC3 report, R. Jharap, 2023*

Emissions by gases

Table 40 depicts the emissions by gases for the waste sector for all relevant categories. CH_4 is the biggest GHG with approximate 3.98 Gg, equivalent with 83.6 Gg CO_2eq. Emissions from N_2O are the second largest (0.03 Gg N_2O is equivalent with 9.3 Gg CO_2eq), followed by 2.45 Gg CO_2 from 'Solid waste disposal'.

Table 40 Overview estimated GHG emissions (Gg) for 2017

CATEGORIES	CO_2 (Gg)	CH_4 (Gg)	N_2O (Gg)
WASTE	**2.453**	**3.988**	**0.030**
Solid Waste Disposal	***0***	***1.576***	***0***
Incineration and open burning of waste	***2.453***	***0.038***	***0.001***
• ***Waste incineration***	*0.885*	*0*	*0*
• ***Open burning of waste***	*1.586*	*0.038*	*0.001*
Wastewater treatment and discharge	**0**	**2.375**	**0.029**
• ***Domestic wastewater treatment and discharge***	*0*	*2.203*	*0.029*
• ***Industrial wastewater Treatment and discharge***	*0*	*0.172*	*0*

Source: Table adapted from the partial report for the National GHG Inventory for Suriname Waste sector 2000-2017, Zuilen, L. et.al, 2022

3.6. Uncertainty Estimation and QA/QC

According to the 2006 IPCC Guidelines, the inventory estimates must be published with the uncertainty range using a tier 1 uncertainty analysis across the sectors. The level of uncertainty of data in the Suriname NC3 was difficult to assess. During the process of inventory, it was noted that there were many inter-annual fluctuations in the data for all sectors. In addition to that, many data gaps occurred and to determine the integrity and accuracy of the data was challenging. For example, data from the Agriculture Statistical Department within the Ministry of LVV is not assessed on uncertainties as the purpose of data collection is to analyze development in agriculture production. Moreover, metadata within the sectors was lacking. Most of the activity data for the sectors is derived from secondary sources that hardly report uncertainty ranges in their metadata.

An integral part of an inventory process is the quality assurance/quality control (QA/QC). This review mechanism is devised to improve transparency, consistency, comparability, completeness, and accuracy. As previously stated, Suriname does not have a QA/QC system for the GHG inventory in place. However, data quality check was regularly conducted during the whole inventory cycle by the inventory experts, the CLA and the PM. In addition to the internal screenings, draft - and the final reports were reviewed by international experts.

3.7. Problems Encountered

Compilation of the GHG inventory was challenging, since Suriname has a small pool of experts. Therefore, recruitment of qualified experts took much longer than anticipated. Due to the limited knowledge and experience in performing the inventory using the IPCC 2006 Guidelines was limited, it was necessary to provide capacity building activities. Unfortunately, these were not sufficient enough. More in-depth and one-on-one sessions are needed to be knowledgeable about the operational aspects related to the IPCC software. The experts experienced some technical difficulties, such as glitching of the software when entering data, while some functions were not properly working.

Furthermore, the COVID-19 pandemic occurred during the inventory process, causing difficulties in the engagement of stakeholders and data providers. The main issue was the availability of activity data for computation of the GHG emissions. All sectors, with the exception of the AFOLU sector, experienced a lack in activity data. Although activity data for most of the categories within the AFOLU sector were available, there is still room for improvement especially with respect to uncertainties in data quality.

3.8. Recommendations

As presented in the previous section, various challenges exist in compiling of the GHG inventory. As such, the following recommendations for improvement can be considered as presented in table 41.

Table 41 Recommendations for improvement of the GHG inventory

Sector	Recommended improvements
ALL SECTORS	Improve the activity data collection by raising awareness on the GHG inventory among stakeholders and by closely engaging data providers.
	Formalize the collection of activity data through instruments such as legal contracts, MoU etc.
	Develop a capacity building program in collecting and storing activity data, in particular targeting data providers
	Develop capacity building program targeting GHG inventory experts (e.g, about the 2006 IPCC Guidelines, performing uncertainty assessments etc.)
	More in-depth and one-on-one sessions are needed with regards to using the IPCC software
	Develop a QA/QC plan for the GHG inventory.
	Establish arrangements for implementing QA/QC procedures, manage and operate the inventory database, and document and archive inventory information and the operation of the inventory
	Develop and implement a Monitoring, Reporting and Verification (MRV) tool for the GHG inventory.
	A transition from default EFs and Tier 1 methodologies to country-specific emission factors and Tier 2 or 3 methodologies is needed with particular focus on key categories.
ENERGY	Conduct studies to determine the emissions factors for electricity generation.
	Perform surveys on vehicle characteristics for the road transport sector (e.g. fuels economy baseline for different classes of vehicles.).
	Perform surveys on both maritime and aviation activity data (both national and international).
	Develop an approach to collect activity data on bio-fuel consumption.
	Develop an approach to collect activity data up to Tier 2 for all possible sources relevant to Suriname within the Manufacture and Industry category
IPPU	Promote an understanding among industrial owners and other stakeholders regarding the significance of GHG estimation
	Develop an approach to collect activity data up to Tier 2 for all possible sources relevant to Suriname within the IPPU category.

AFOLU	Perform a survey on synthetic fertilizer data, disaggregated to the content of N????
	Engage with the customs department to determine whether more disaggregated fertilizer data can be collected.
	Train extension workers, farmers to collect disaggregated data on livestock, such as dietary information, weight, milk production
	Improve land cover classifications including managed and unmanaged forest land
	Disaggregate forest data by forest type to natural and plantation forests
	Introduction of age class data in plantations and natural forests
	Inclusion of annual crop data and perennial crop data in GIS-based monitoring
	Undertake local studies to determine country specific emission factors
	Include Collecting data for HWP wood products (see chapter 12 of the 2006 IPCC GL)
WASTE	Develop an approach to collect more accurate and regularly updated activity data on solid waste generation and composition.
	Establish a waste data management system for all categories according to the 2006 IPCC Guidelines.
	Update activity data for liquid wastes by treatment facilities.
	Undertake local studies to determine country specific emission factors.

Source: Table adapted from the Green House Gas Inventory (GHGI) Report as part of the NC3 report, R. Jharap, 2023

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Chapter 4

Measures to Mitigate Climate Change

4 Measures to Mitigate Climate Change

4.1. Introduction

Mitigating the effects of climate change and stabilizing atmospheric GHG concentrations, requires emission reductions at a global level. Suriname, as a party to the UNFCCC, is committed to report on the country's mitigation strategies to address GHG emissions, in this Third National Communication (NC3).

As per the Convention, each party shall provide to the COP information on the general steps taken or envisaged for formulating, implementing, publishing, and regularly updating national and, where appropriate, regional programs containing measures to mitigate climate change. Based on the GHG inventory, this NC3 is to provide information on national programs containing measures to mitigate GHG emissions, by addressing anthropogenic emissions by sources and removals by sinks.

The aim of the mitigation assessment is to inform policy selection and design by comparing policy options, based on their expected GHG effects. For this mitigation assessment the Energy-, Agriculture- and Forestry sector are identified. The following sections elaborate further on the identification of these sectors.

4.2. Methodology

Measures to mitigate climate change are defined as any human (anthropogenic) intervention that can either reduce the sources of GHG emissions (abatement) or enhance their sinks (sequestration) (UNFCCC, 2008). In the context of the UNFCCC, a mitigation assessment is a national-level analysis of the various technologies and practices that have the capacity to mitigate climate change.

A key source analysis was performed to identify the sectors with the highest GHG emissions estimated within the GHG Inventory. In line with the GHG inventory, the base year is set to be the year 2008. The assessment was carried out with reference to the Business As Usual (BAU) projections from 2008-2030, focusing on historical development trends for each identified sector. The BAU and mitigation scenarios for the Energy sector were assessed by the Long-range Energy Alternatives Planning System (LEAP) simulation software. Both the Agriculture sector and Forestry sector made use of the commercial based Excel program, to carry out the BAU and mitigation scenarios. This chapter summarizes the sectoral Mitigation Assessment reports from sectoral experts.

Type of Scenarios

This mitigation assessment includes a minimum of two scenarios for each sector. The scenarios are representations of plausible and internally consistent future GHG situations. They are critical to mitigation assessments as they are an important precursor to assess the impact of policies and actions on GHGs (for example, by comparing baselines to policy scenarios). 'Policies and actions' is a mitigation term that is used to refer to interventions to reduce GHG emissions made or mandated by a Government, institution, or other entity, and may include, among others, laws, directives, and decrees; regulations and standards; taxes, charges, subsidies and incentives; information instruments; voluntary agreements; implementation of new technologies, processes or practices; and public or private sector financing and investment; (WRI, 2016). A description for each scenario is stated as follows:

- *Baseline or reference scenario;*
  A "baseline" or "reference" scenario is a description of a plausible future in which no specific policies and actions are taken to encourage actions that reduce GHG emissions or enhance carbon sinks (UNFCCC, 2008).
- *Mitigation scenario with measures (WM);*
  A scenario that represents the events or conditions most likely to occur in the presence of the policy or action being assessed. It is the same as the baseline scenario, except that it includes the prioritized policies and actions being assessed.

The process for mitigation assessment is depicted in figure 49.

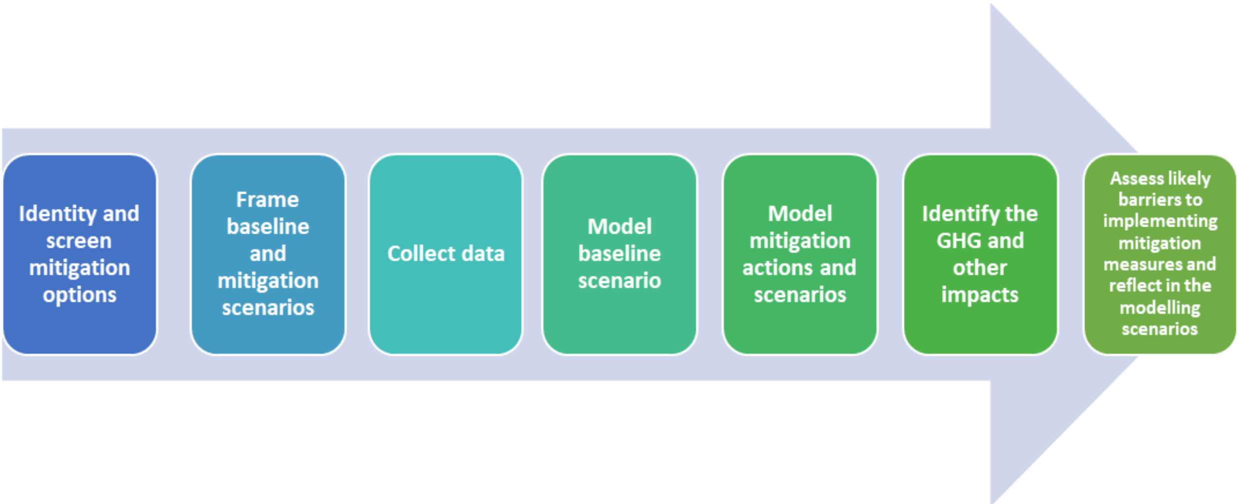


Figure 49 Process followed for mitigation assessment
Source: Figure adapted from the Mitigation Assessment Report, Jharap. R., 2023

4.3. National and Sectoral Policy Framework

Over the past decade Suriname experienced a fiscal deficit and high public debt. This led to limited ability to invest in mitigation and resilience capacity building to address climate change impacts across the country. Nevertheless, Suriname remains committed to climate compatible development, focusing on mitigation interventions mainly in the context of forest management and renewable energy.

The following table depicts an overview of national policies and strategies with respect to climate change mitigation.

Table 42 Overview of relevant national policies and strategies

Policy, Plan, Strategy	Description
National Development Plan (OP) 2017-2021 (2017)	The Development Plan 2017-2021 indicates the development goals and the outcomes for broad policy areas.
Development plan 2022-2026 ("Meerjaren Ontwikkelingsplan" (MOP))	The Multi-Annual Development Plan 2022-2026 builds on the Recovery Plan 2020-2022 and further implements the Planning Act, which has as its mission towards a balanced socially-just development of society.
National Climate Change Policy, Strategy and Action Plan for Suriname (NCCPSAP) (2014-2021)	The NCCPSAP presents a climate-compatible development roadmap with the aim to "reduce the country's vulnerability through the implementation of climate resilience measures in the coastal area as well as in the interior, while implementing development through sustainable and clean technology". The NCCPSAP identified the lack of climate change data as a limitation for effective planning and decision making.
Nationally Determined Contribution (NDC 2020 (2019))	The NDC was submitted in 2019 and introduces a systematic approach to address both mitigation and adaptation that will enable strengthening resilience, maintaining the carbon stock, reducing emissions while sustainably developing Suriname's economy, and limiting impacts and adaptation costs. The NDC includes (enhanced) contributions from four of the six emitting sectors, as identified in the Second National Communication/GHG Inventory: electricity, road transport, agriculture and forests.
Second National Communication (NC2)	The NC2 provides a greenhouse gas inventory which demonstrates that Suriname's contribution to global emissions is relatively low due to Suriname's small industrial sector. The GHG inventory for the NC2 was carried out for year 2008. Four of the six emitted sectors were included in the 2019 NDC, namely forests, electricity, agriculture and

	transport. Merged together they cover an estimated 70% of emissions (NC2).
REDD+	Suriname started its REDD+ Readiness Preparation in 2012, aiming at a future participation in the REDD+ mechanism, that economically compensates its efforts to reduce emissions from deforestation, forest degradation, conservation, sustainable forest management and enhancement of carbon stocks. As part of its preparations, Suriname developed its REDD+ Strategy, a five-year plan that should result in participation in the REDD+ mechanism.
Forest Reference Emission Level (FREL) report to the UNFCCC (2021)	The FREL assesses the country's performance in reducing emissions and increasing removals associated with the implementation of REDD+ activities. The FREL enables result-based payments for REDD+ implementation that can support the current mining paradigm in Suriname into a more diversified economy with social equity and harmony with nature.
Electricity Act 2016	The Electricity Act aims at improving efficient energy production, while allowing privatization and enhancing the regulatory framework through the creation of the Energy Authority of Suriname and the publication of an Electricity Sector Plan every five years. This Act establishes a solid ground for the future development of renewable energy (RE) sources.
Policy Note LVV 2010-2015	The policy note builds on the 2005–2010 Agriculture Sector Programme (ASP), which focused on three main objectives: 1) food security and safety, 2) income generation, and 3) contribution to the economy.
National Master Plan for Agricultural Development in Suriname	The Master Plan includes a wide range of objectives and activities to be undertaken in order to accelerate Suriname's transition into a modern and knowledge-intensive agricultural system. Furthermore, emphasis is placed on increasing the agricultural sector's contribution to GDP, the trade balance, employment, and food security.
National Forest Policy (NFP) (2005)	The policy aims to enhance the contribution of the forests to the national economy and the welfare of the current and future generations, taking into account the preservation of the biodiversity.

Source: Table adapted from the Mitigation Assessment Report, based on the preparatory sectoral Mitigation Assessment Reports drafted by the sectoral experts (Energy, Agriculture and Forestry), Jharap. R., 2023

4.4. Energy Sector: BAU and Mitigation Scenarios for GHG Emissions

Suriname is experiencing a growing electricity demand. Over the past decade, this demand has amounted to an average of 6% annually, while estimates indicate a 50% increase within five years as a direct effect of Suriname's economic development. As a result, electricity production is expected to meet the rising demand, while remaining accessible and affordable. With this in mind, the Government is currently re - evaluating fuel-based expansion plan options, as well as renewable energy options, such as natural gas, solar PV and hydro-projects.

As accentuated in the National Energy Policy 2013-2033, the GOS envisions "A modern, and efficient energy sector", which provides all citizens with access to reliable and affordable energy supplies and long-term energy security towards enhancing the quality of life of all Surinamese citizens, advancing international competitiveness and environmental sustainability".

Emphasizing the above, the Government of Suriname intends to expand the availability of electricity through the implementation of the Electricity Act (2016). Furthermore, the Act intends to ensure affordable energy supply and increases the environmental quality of electricity generation. The Act also promotes renewable energy sources by giving customers the opportunity to generate electricity for their own consumption, for example using solar panels and feed the excess power into the grid. The Energy Authority Suriname is established as regulator, as stipulated in the Energy Act (2016).

Suriname is also intended to develop an Energy Efficiency Framework (EEF) to further promote energy efficiency (EE) measures and awareness.

Mitigation efforts in the sector are primarily driven using the NDC 2020. This document contains well founded strategies to attain a broad access to electricity and renewable energy penetration. The NDC sets the target with an unconditional contribution to maintain the share of electricity from renewable sources above 35% by 2030.

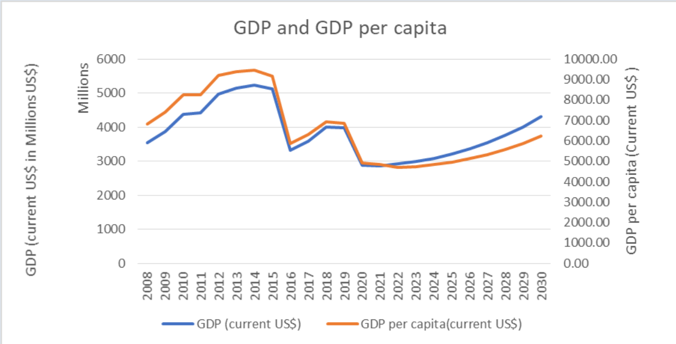
The Government is pursuing an integrated Energy policy and regulatory framework, by developing an Energy Sector Plan (ESP), a 20-year strategic plan as well as a 5-year technical and regulatory plan. The ESP is expected to be published in the beginning of the year 2023.

4.4.1. Set of Assumptions Considered for the Energy BAU Scenario

Baseline projections are based on historical data retrieved from the NC3-GHG inventory for base year 2008 to 2017. The mitigation assessment was carried out following the GHG inventory that was conducted during the COVID-19 pandemic. Due to the pandemic, a number of data providers could not be engaged resulting in data gaps. For the mitigation assessment, various sources were used for filling in the data gaps identified in the GHG inventory.

The BAU scenario was constructed for all the sectors and categories in LEAP as shown in figure44. The average annual growth of the subsectors/fuels from 2008 to 2030 are based on the historical data from 2008 until 2017. Furthermore, it could be noted that there are limited energy conservation and energy efficiency activities, based on the historical trend in Suriname, in addition to limited renewable energy contribution to the energy mix. This assumption is based on the history of renewable energy in Suriname, where this contribution remained constant at around 50% of the total energy mix. Table 43 provides the assumptions with respect to those categories with limited data available, in order to construct the BAU scenario.

Table 43 Assumptions for categories with limited data available

Category	Assumptions
Demographic and economic parameters	Projections for the period 2008-2030 for GDP and GDP per capita are presented in figure 1 and used for the LEAP modeling. The steep decrease from 2015-2016 can be explained by the closing of the alumina refinery. Again in 2020, the GDP dropped, but now due to the COVID-19 pandemic, and based on data from Planbureau, it will slowly increase mainly due to continuing economic and financial issues in the country.  Figure 50 GDP and GDP per capita growth and projection until 2030 *Source: Figure adapted from the Mitigation Assessment Report, Jharap. R., 2023*
Energy Industries	
Energy demand and generation	Energy demand projection is based on the planning of the Energy Authority Suriname. Electricity demand was 552MW in 2021 and it is projected to increase to 731 MW until 2025. In 2040 it is expected to further increase to 1,600MW and it is estimated that the electricity production will be 4TWh. To meet this demand, additional capacity is required. An increase in Residual Fuel Oil (MW) will take place from 104 MW in 2008 to 769 MW in 2030. The capacities of the diesel and hydropower plants will remain the same until 2030, while the capacity of Solar PV will increase linearly from 2008-2030.
Petroleum generation	No changes in Oil refining activities occurred in the period 2008-2015. Refinery capacity expanded from 2015 till 2017. After 2017, the growth rate is set at 0%, because no additional refinery expansion activities are planned.
Other Energy Industries	The GHG inventory presented only data of Liquefied Petroleum Gases (LPG) for the years 2016 and 2017. As such, no representative trend was possible. For this reason, the LPG is not taken into account for further analysis.
Manufacturing Industries and Construction	
Non-Ferrous metals	The GHG inventory included data for diesel for only 2 years (2016 and 2017). Since it is impossible to make a representative trend and projections based on data for only 2 years, diesel is not taken into account for further analysis.

4.4.2. BAU Scenario for the Energy Sector

The total GHG emissions for the period 2008-2030 are presented in figure 51 and table 44. The GHG emission in 2008 was 3,013.7 Gg CO_2eq, while the emissions in 2030 could lead up to 4,953.8 Gg CO_2eq. The historical GHG emissions fluctuates, depending on the economic situation in the country. The increase in GHG emissions between 2018 and 2019 are related to the GDP growth of the country. A decrease is noticed between 2020 and 2021, due to the COVID-19 pandemic. Towards 2030, steady increases of GHG emissions are expected for the energy sector; this is closely related to the predictions concerning GDP growth by the General Bureau of Statistics in Suriname.

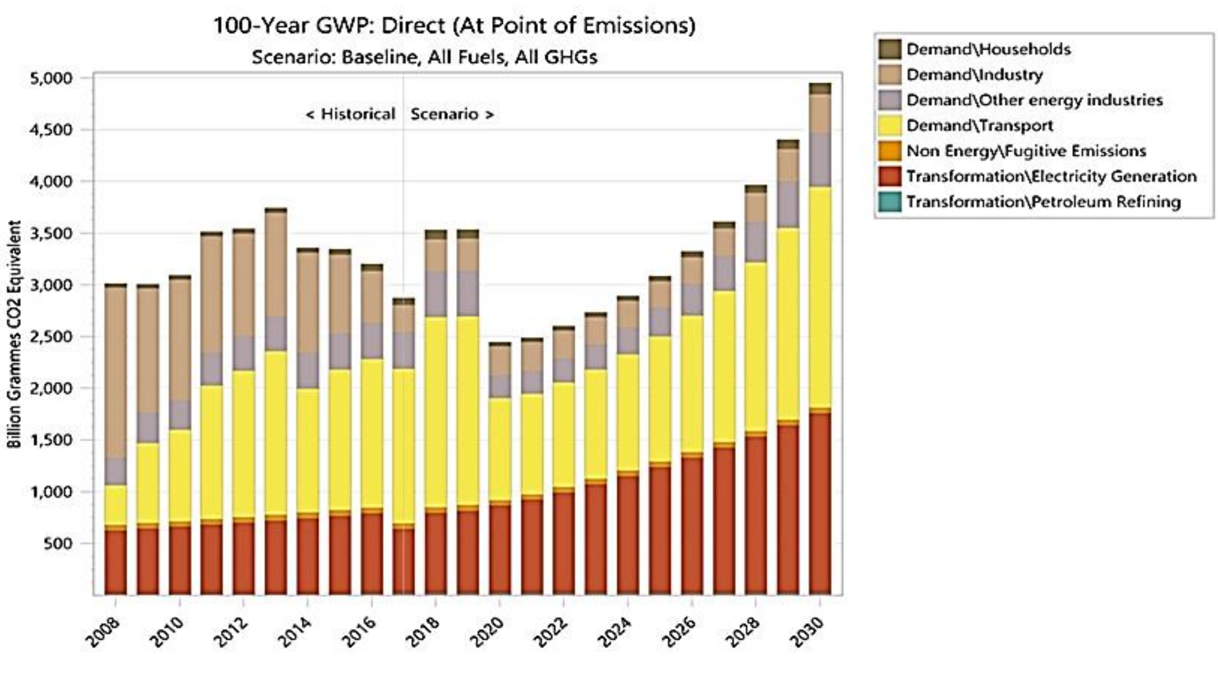


Figure 51 Total GHG emissions historical data and projection until 2030[23]
Source: Figure adapted from the partial report, Mitigation report on the Energy sector, Raghoebarsing, A. & Rampadarath, A., February 2023

[23] Note: Billion grammes equals to Giga grammes

Table 44 Overview of GHG emissions from year 2018-2030 (in Gg CO2eq)

Year	Demand Total					Transformation Total			Non-Energy		Total
		Transport	Households	Industry	Other energy industries		Electricity Generation	Petroleum Refining		Fugitive Emissions	
2018	2,683.70	1,838.90	92.6	313.4	438.8	797.5	782.8	14.7	51.1	51.1	3,532.30
2019	2,667.90	1,828.50	91.9	311.5	436	818.5	803.8	14.7	51.1	51.1	3,537.50
2020	1,530.30	989.9	42.3	279.7	218.3	869	854.3	14.7	48	48	2,447.30
2021	1,514.90	975.9	41.5	282.7	214.8	924.8	910.1	14.7	47.9	47.9	2,487.60
2022	1,557.50	1,014.30	43.7	275.1	224.5	996	981.3	14.7	48.1	48.1	2,601.60
2023	1,610.30	1,060.10	46.2	267.9	236.1	1,074.20	1,059.50	14.7	48.3	48.3	2,732.80
2024	1,689.90	1,126.50	50	260.5	253	1,154.50	1,139.80	14.7	48.6	48.6	2,893.00
2025	1,798.20	1,212.70	54.9	255.6	275	1,240.80	1,226.10	14.7	49	49	3,088.00
2026	1,942.10	1,322.30	61.3	255.3	303.3	1,331.90	1,317.20	14.7	49.4	49.4	3,323.40
2027	2,132.00	1,460.80	69.5	262.5	339.3	1,429.90	1,415.20	14.7	49.9	49.9	3,611.80
2028	2,381.90	1,635.60	80	281.1	385.1	1,534.10	1,519.40	14.7	50.5	50.5	3,966.50
2029	2,709.70	1,856.10	93.6	316.6	443.3	1,643.90	1,629.20	14.7	51.2	51.2	4,404.70
2030	3,140.90	2,135.00	111.2	376.8	517.8	1,761.00	1,746.30	14.7	52	52	4,953.80

Source: Table adapted from the Mitigation Assessment Report, Jharap. R., 2023

Table 44 indicates that under branch 'Demand', the share of the transport sector will increase by 16.1% in 2030 compared to 2018. Under branch 'Transformation', Electricity Generation can be accounted for the second sub-category with the most GHG emitted, as it increases with 123% in 2030 compared to 2018. The third sector with the most GHGs emitted is 'other energy industries' under branch 'Demand', and its share will increase by 18% in 2030 compared to 2008.

Figure 52 and figure 53 present the GHG emissions as percentage of the total GHG emissions for each sub-category for the respective years 2018 and 2030.

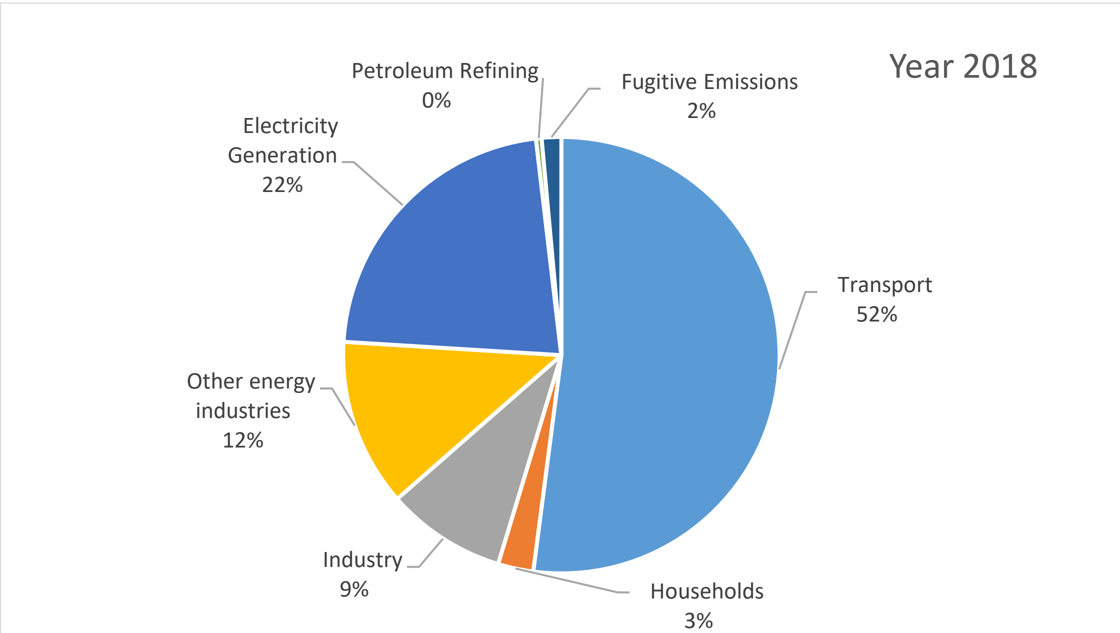


Figure 52 GHG emissions (%) per category for year 2018
Source: Figure adapted from the Mitigation Assessment Report, Jharap. R., 2023

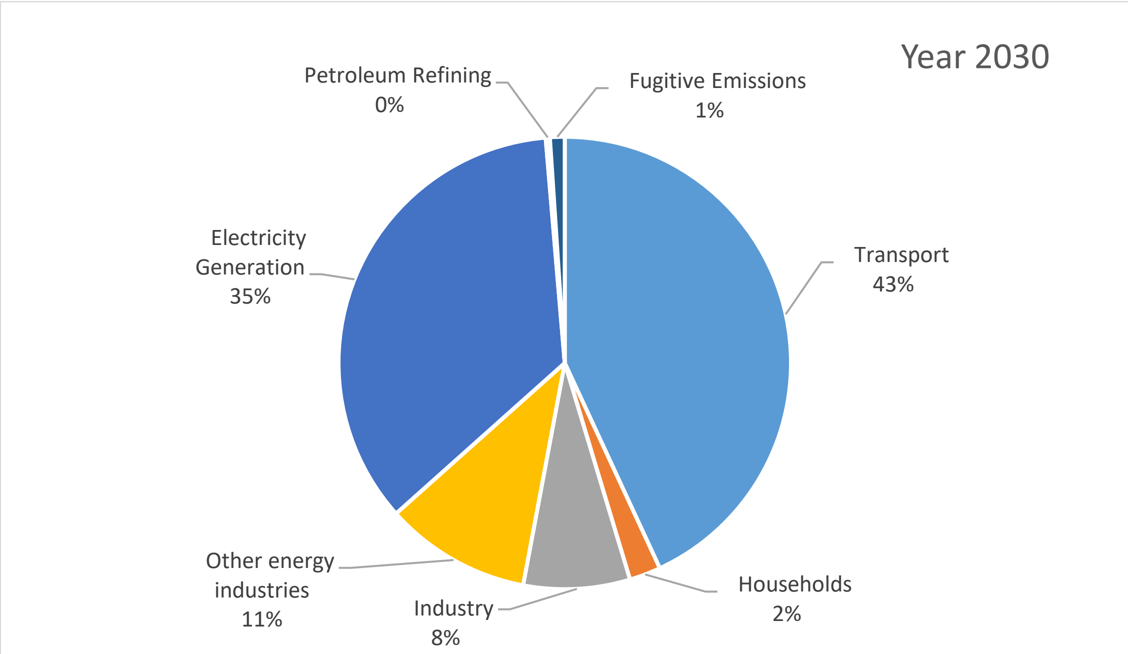


Figure 53 GHG emissions (%) per category for year 2030

Source: Figure adapted from the Mitigation Assessment Report, Jharap. R., 2023

For the energy sector, the GHG emissions according to the baseline scenario were calculated for the period 2008-2030, using the LEAP modeling software based on the assumption as elaborated in table 41. Figure 54 and table 43 clearly show that the categories 'electricity generation', 'transport' and 'industry' are the leading emitters in the energy sector. Therefore, it is important to focus the mitigation efforts on these categories. The fuels that can cause the most GHG emissions within these categories until 2030 are:

- HFO (Residual Fuel Oil) in electricity generation and non-ferrous metals (industry);
- Diesel for Road in the Transport sector;
- Gasoline for Road in the Transport sector;
- Natural Gas in other energy industries.

4.4.3. Energy Mitigation Scenarios and the Assumptions Considered

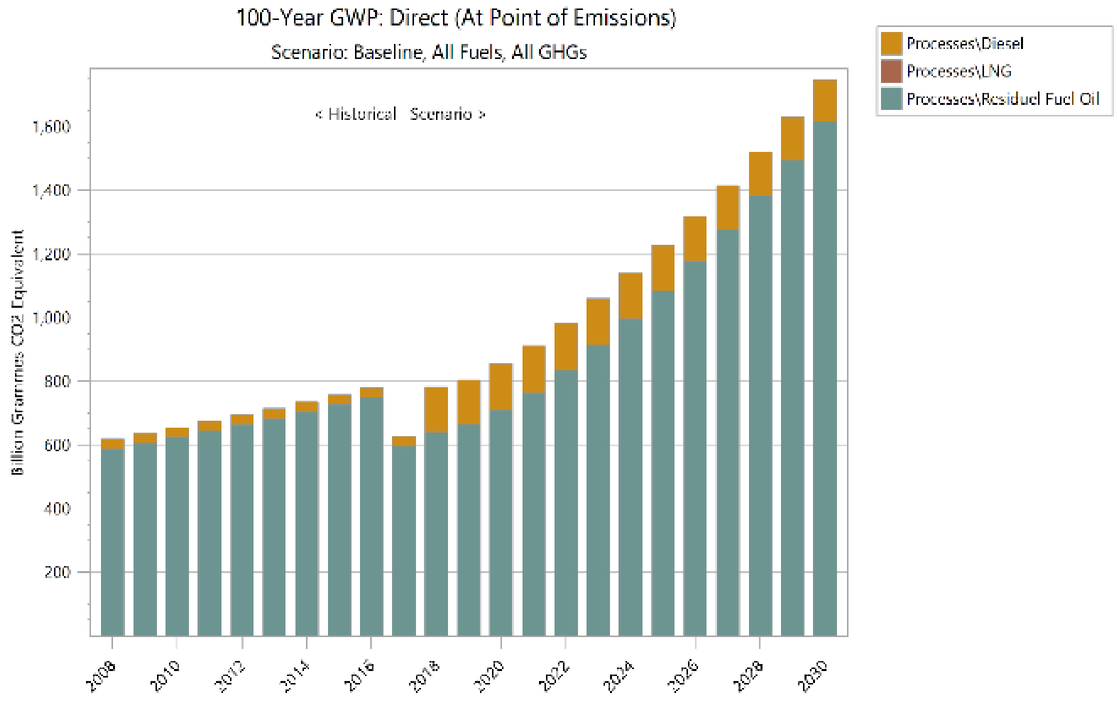
For the mitigation assessment, the following three (3) scenarios were identified and constructed in LEAP, in order to calculate the potential reduction in GHG emissions within the energy sector.

Mitigation scenario 1: Energy Industries – Electricity generation: Implementation of PV and Hydro projects, and use of reduced GHG emissions power plants.

According to the planning from the Energy Authority Suriname (EAS), 10% PV will be added from 2027 until 2030 (adding annually 10MW to the total generation) resulting in a reduction of 3.9% of CO_2eq which is a reduction of 869 Gg of CO_2eq (2018 – 2030). From the year 2026 onwards, a significant reduction could be seen in the results (see figure 54); due to the implementation of a 200MW CCGT power plant and several PV projects. As such, the demand can be covered by the combined cycle gas turbine (CCGT) and PV power plants.

Mitigation scenario 2: Energy Industries – Electricity generation: Energy Efficiency.

The NDC proposed to promote energy efficiency (EE) and energy conservation through energy saving equipment (energy efficient appliances) by providing them to customers at reduced prices, including equipment labelling and performance standards. Introducing this measure will reduce the electricity consumption of households and industries. The assumptions are that this measure will be implemented in the period 2020-2030 and that a maximum saving in energy can be reached for up to 26.7% until 2030 when energy efficiency measures and energy conservation measures are applied. With the implementation of this measure a GHG reduction of 7.7% can be reached compared to the baseline. This equals to a reduction of 1,712Gg of CO_2 equivalents (2018 – 2030) (see figure 54).



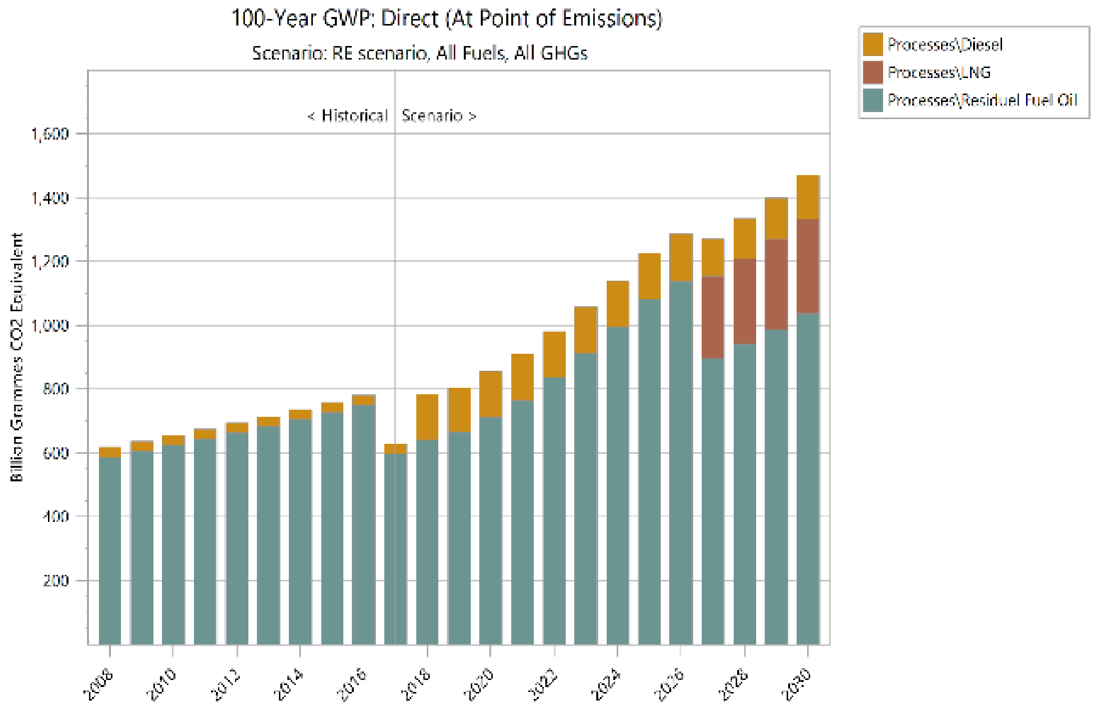
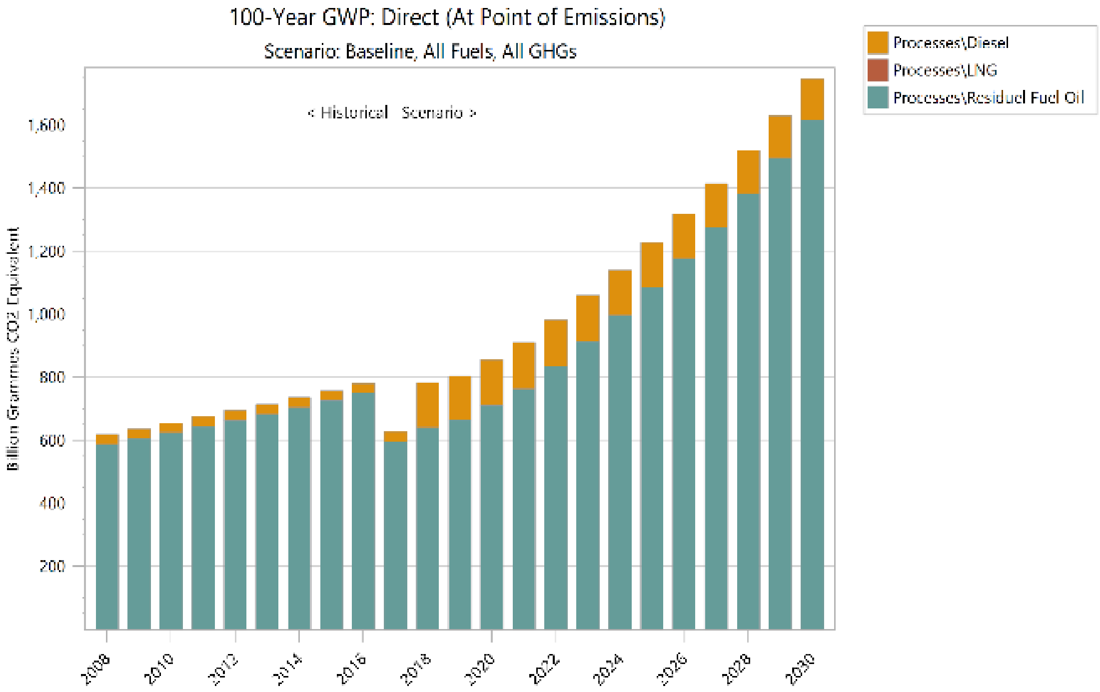


Figure 54 Electricity generation: baseline and GHG emissions trend based on mitigation measures
Source: Figure adapted from the partial report, Mitigation report on the Energy sector, Raghoebarsing, A. & Rampadarath, A., February 2023



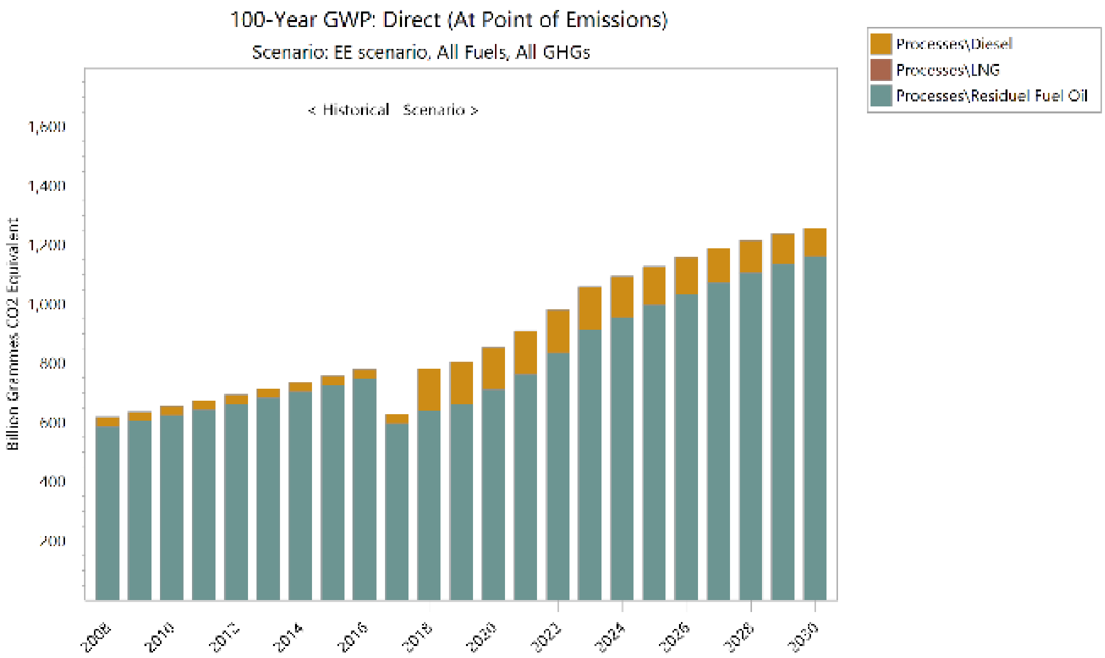


Figure 55 Energy efficiency: baseline and GHG emissions trend based on mitigation measures
Source: Figure adapted from the partial report, Mitigation report on the Energy sector, Raghoebarsing, A. & Rampadarath, A., February 2023

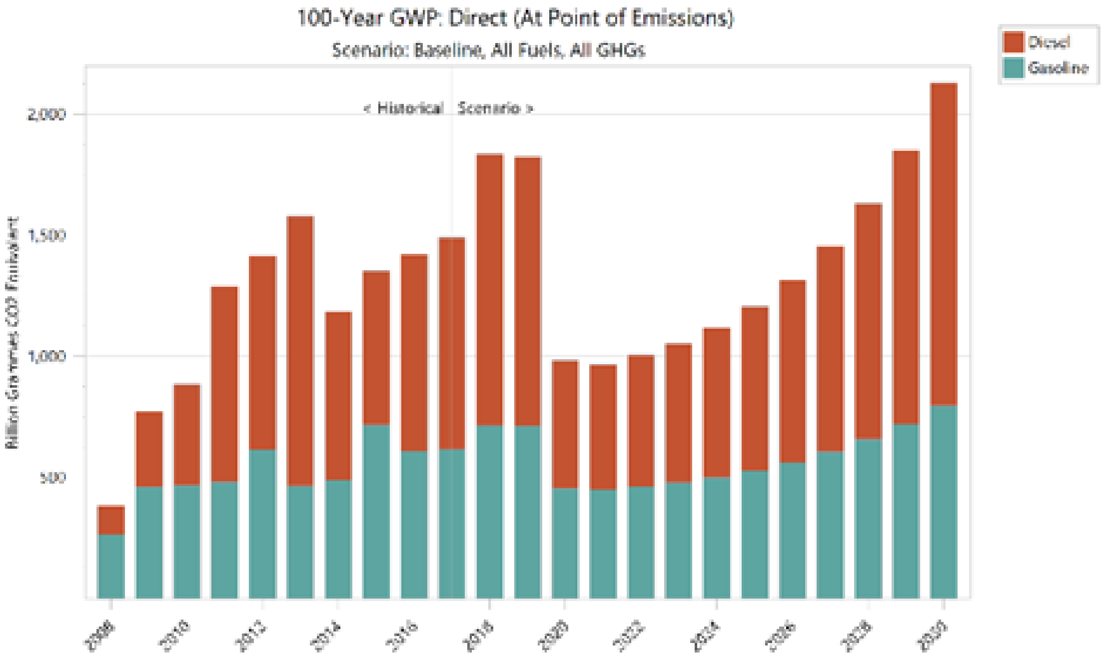
Mitigation scenario 3: Transport – Road: improve road conditions and improve public transport

The NDC proposed the following four measures:

- Redesign pedestrian friendly streets and redesign free bus-routes: this will be executed between 2023 and 2025;
- Redesign bus routes towards consolidated line structures;
- Improve the public transport system, including adding separate bus lanes, public bus hubs outside the city center and shuttle bus inside the city center;
- Spatial Planning: Deployment via Public-Private-Partnerships (PPPs) of water taxis and water buses for passenger transport / optimal use of the Surinamese waterways for the transport of people and goods; for example, over the Suriname river (especially for freight traffic).

The assumption applied is that implementing these mitigation actions will result in a combined reduction of on-road emissions by 7.0% until 2030. A reduction in GHG emissions of 623 Gg CO_2eq (2018–2030) can be reached which equals to 2.1% reduction (see figure 55).

Figure 56 projects the total GHG emission of the baseline, of the 3 scenarios separately, and of all mitigation scenarios combined. After the implementation of all 3 scenarios, there will be a total reduction of 915.50 Gg CO_2eq in 2030 compared to the baseline.



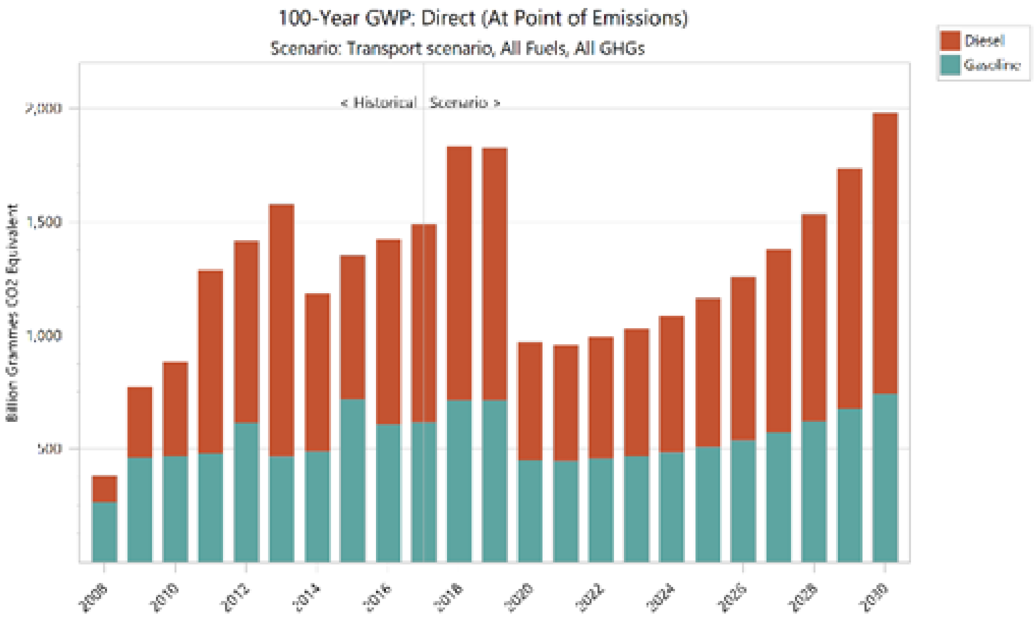


Figure 56 Transport sector: baseline GHG emissions and GHG emission trends based on mitigation measures

Source: Figure adapted from the partial report, Mitigation report on the Energy sector, Raghoebarsing, A. & Rampadarath, A., February 2023

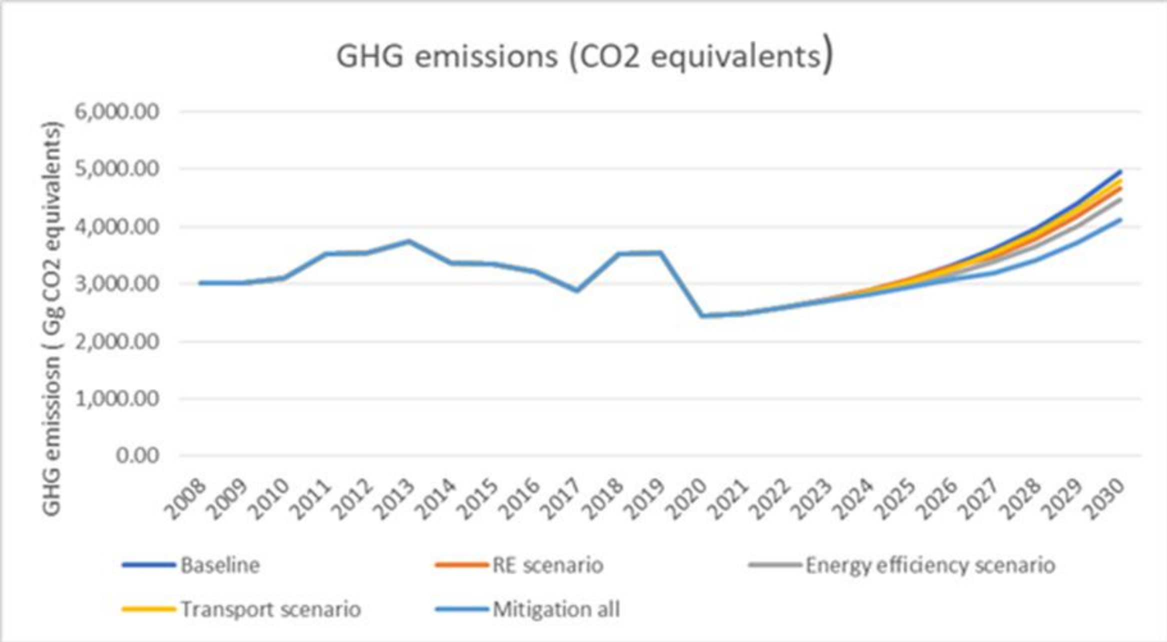


Figure 57 Projections of the total GHG emissions for the baseline, all 3 sectors separately, and for all mitigation scenarios combined

Source: Figure adapted from the partial report, Mitigation report on the Energy sector, Raghoebarsing, A. Rampadarath, A., February 2023

The GHG reduction will commence from 2025 onwards, considering that most of the measures will be implemented by 2025 and beyond. Table 45 presents the total GHG emissions per sector, the respective reduction, and the total mitigation potential in Gg CO_2eq.

Table 45 All scenarios including respective reduction in Gg CO2eq and the total mitigation potential

Scenarios (Gg CO2eq)	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Baseline	3,532.30	3,537.50	2,447.30	2,487.60	2,601.60	2,732.80	2,893.00	3,088.00	3,323.40	3,611.80	3,966.50	4,404.70	4,953.80
Renewable energy scenario	3,532.30	3,538.30	2,448.10	2,488.50	2,601.70	2,731.60	2,892.00	3,087.00	3,292.50	3,467.60	3,780.50	4,174.60	4,676.90
Reduction	*0*	*0.8*	*0.8*	*0.9*	*0.1*	*1.2*	*1*	*1*	*30.9*	*144.2*	*186*	*230.1*	*276.9*
Energy efficiency scenario	3,532.30	3,537.50	2,447.30	2,487.60	2,601.60	2,732.80	2,847.40	2,989.90	3,165.40	3,385.40	3,662.70	4,013.80	4,464.80
Reduction	*0*	*0*	*0*	*0*	*0*	*0*	*45.6*	*98.1*	*158*	*226.4*	*303.8*	*390.9*	*489*
Transport scenario	3,531.30	3,539.60	2,436.20	2,477.20	2,589.00	2,709.90	2,859.80	3,044.50	3,266.10	3,537.90	3,871.80	4,289.60	4,804.20
Reduction	*1*	*2.1*	*11.1*	*10.4*	*12.6*	*22.9*	*33.2*	*43.5*	*57.3*	*73.9*	*94.7*	*115.1*	*149.6*
Mitigation potential	**1.00**	**2.90**	**11.90**	**11.30**	**12.70**	**24.10**	**79.80**	**142.60**	**246.20**	**444.50**	**584.50**	**736.10**	**915.50**

Source: Table adapted from the partial report, Mitigation report on the Energy sector, Raghoebarsing, A. & Rampadarath, A., February 2023

4.5. Agriculture Sector: BAU and Mitigation Scenarios for GHG Emissions

One of the goals of the Government of Suriname is the transition of the Agriculture sector to a modern and innovative agri-food system. With a 9% share in Suriname's GDP, the agriculture and fisheries sectors have an important role in social and environmental aspects (Van Dorpe et al, 2020).

The 2010-2015 Policy Note states the following agricultural policy strategic objectives: (i) guarantee the food security of the population of Suriname, (ii) secure agricultural health and food safety, (iii) develop a sustainable agricultural sector, (iv) transform the agricultural sector into the primary food producer and supplier of the Caribbean region.

As a follow up 'The National Master Plan for Agricultural Development in Suriname' (2015) has the overarching goal to accelerate Suriname's transition into a modern and knowledge intensive agricultural system. The National Climate Change Policy, Strategy and Action Plan for Suriname ((NCCPSAP), 2015) express a preference for intensive agriculture, concentrated in relatively few areas, with no harm to environmental values, and guiding agricultural development towards land, that is already cultivated, or was cultivated in the past and since abandoned, in order to avoid clearing natural growth in new areas.

Suriname's Agriculture, Forestry and Other Land Use (AFOLU) GHG profile is dominated by emissions/removals from Forestry and Other Land-use (FOLU) sector followed by Agriculture. The GHG inventory for the Agriculture sector included the emissions for the categories enteric fermentation, manure management, rice cultivation, indirect N_2O emissions from manure management, direct and indirect N_2O emissions from managed soils, and Urea application. Results of the GHG inventory 2000-2017 show that for the base year 2008, rice cultivation, direct emissions from managed soils and enteric fermentation contain the biggest share in the total CO_2eq.

4.5.1. Set of Assumptions Considered for the Agriculture BAU Scenario

The baseline scenario for the Agriculture sector is constructed from data from the Agriculture GHGI 2000-2017 as entered in the IPCC software program. The BAU was constructed using an Excel based modeling tool to both assess the GHG emissions related to the category rice cultivation in the Business-as-usual (BAU) scenario and the projections of the three mitigation scenarios for 2018–2030. Furthermore, the BAU is modeled based on manually Tier 1 re-calculation of all emissions related to rice cultivation, i.e., CH_4 emissions from continuously flooded rice cultivation, N_2O and CH_4 emissions from biomass burning of paddy residues, CO_2 and N_2O emissions from Urea and synthetic fertilizer application in rice cultivation, for the time series 2000-2017, followed by a linear extrapolation to 2030. The input data for the emission sources in rice is provided in table 46.

Table 46 Emissions sources and input data

Emission Source	Input Data
Biomass burning baseline	- Area burnt (ha)
Continuously flooded rice cultivation baseline	- Planted area (ha) - Harvested area (ha) - Cultivation period (number of days) - Organic amendments (tonnes/ha)
Urea application baseline	- Urea application (tonnes/yr.)
Synthetic fertilizer baseline (direct and indirect N_2O emissions)	- Nitrogen application (tonnes/yr.)

Source: Table adapted from the partial report, Final Mitigation Assessment Report on the Agriculture sector, Samoender, I., February 2023

4.5.2. BAU Scenario for the Agriculture Sector

The total emissions in rice cultivation are the sum of CH_4 emission from continuously flooded rice cultivation, N_2O and CH_4 emissions from biomass burning, CO_2 emission from urea application and Direct and indirect N_2O emissions from applied synthetic fertilizer (Nitrogen), in $GgCO_2eq$. Figure 58 presents the BAU scenario for rice cultivation.

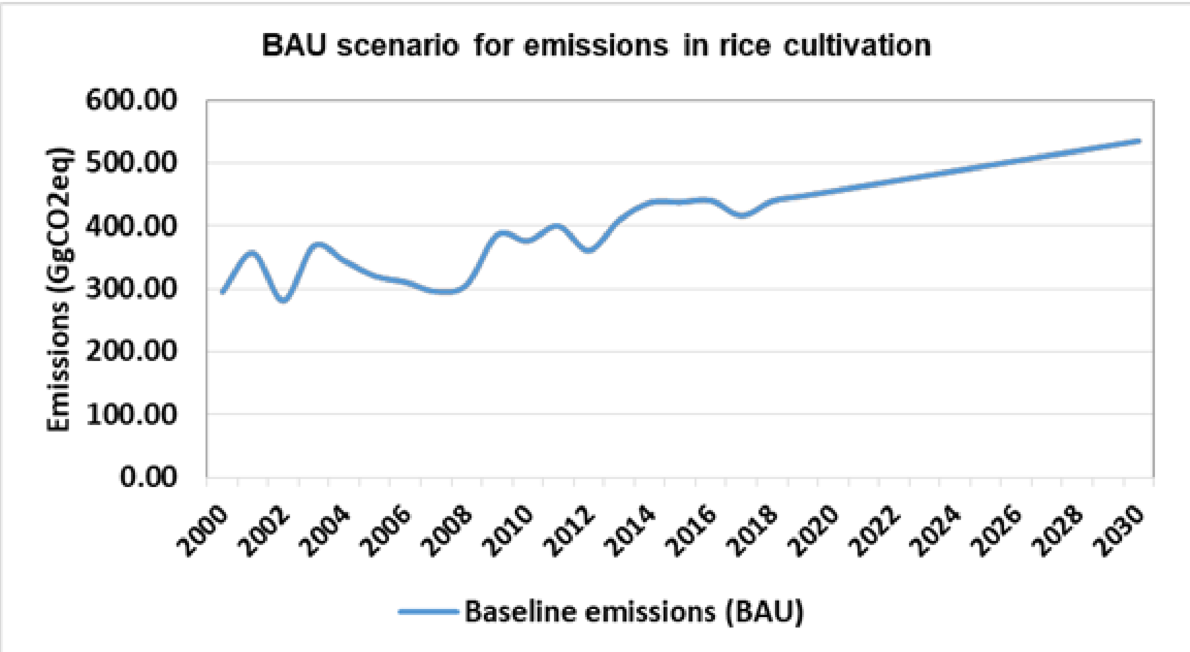


Figure 58 BAU scenario for rice cultivation
Source: Figure adapted from the partial report, Final Mitigation Assessment Report on the Agriculture sector, Samoender, I., February 2023

The total GHG emissions from rice cultivation in the base year 2008 was estimated at 302.98 Gg CO_2eq. The emissions will increase by 75%, to 535.72 Gg CO_2eq in 2030. The CH_4 emissions from continuously flooded rice cultivation accounts for the highest GHG emissions in 2008 at 250.66 Gg CO_2eq increasing to 437.77 Gg

CO_2eq in 2030. The emissions from biomass burning will increase from 15.06 Gg CO_2eq in 2008 to 32.87 Gg CO_2eq in 2030. Similarly, the CO_2 emissions from Urea application would increase from 12.81 Gg CO_2eq in 2008 to 22.36 Gg CO_2eq in 2030, whereas the direct and indirect emissions from synthetic fertilizer application would increase from 24.46 Gg CO_2eq in 2008 to 42.71 Gg CO_2eq in the year 2030. Therefore, the GHG emission reduction measures in agriculture were proposed in rice cultivation.

4.5.3. Agriculture Mitigation Scenarios and the Assumptions Considered

The proposed mitigation measures (mitigation scenarios) are consistent with national policy plans, strategies, and programs. Other national circumstances, such as population density and availability of resources, are also considered. The assessment of national policy plans, strategies, and programs regarding agriculture shows that mitigation is proposed mainly in rice cultivation. Rice cultivation is also the largest GHG emitter according to the GHG inventory 2000-2017. In general, improved cultivation practices and water management in rice cultivation can be proposed as mitigation options. The proposed mitigation measures, descriptions of the measures and assumptions are presented in table 47.

Table 47 Proposed mitigation measures, descriptions of measures and assumptions Proposed mitigation measures, descriptions of measures and assumptions

Mitigation measures	Description	Assumptions
Single aeration of paddy fields	Area of continuously flooded area decreases while single drainage area increases. All other factors remain the same as in the baseline	80% of continuously flooded rice will be converted to single drainage system by 2030
Shorten cultivation time of rice	Cultivation period for rice is reduced. All other factors remain the same as in the baseline.	50% of long cultivation rice varieties will be converted to short period (100 days) varieties by 2030
Reduction in fertilizer application	The amount of urea applied to the continuously flooded rice system is reduced. All other factors remain the same as the baseline.	100% of the rice area will reduce urea application from 400kg/ha to 250kg/ha by 2030.

Source: Table adapted from the partial report, Final Mitigation Assessment Report on the Agriculture sector, Samoender, I., February 2023

Figures 59, 60 and 61, show the scenarios for the mitigation potential of these measures from 2017 to 2030, when separately implemented, while figure 62 shows the scenario for combined effect of all measures.

Mitigation scenario 1: Agriculture – rice cultivation: single aeration of paddy fields

In 2030, the mitigation projection in the agriculture sector, by implementing single aeration in rice cultivation longer than 3 days, is 395.63 GgCO_2eq. This measure is estimated to contribute to 26.14% in reductions in agriculture. The mitigation potential of 140.09 Gg CO_2eq can be achieved in 2030, if 80% of the rice cultivation area will be converted to this water management practice. Subsequently, a further reduction can be achieved if more than 80% of the acreage is converted to this new practice.

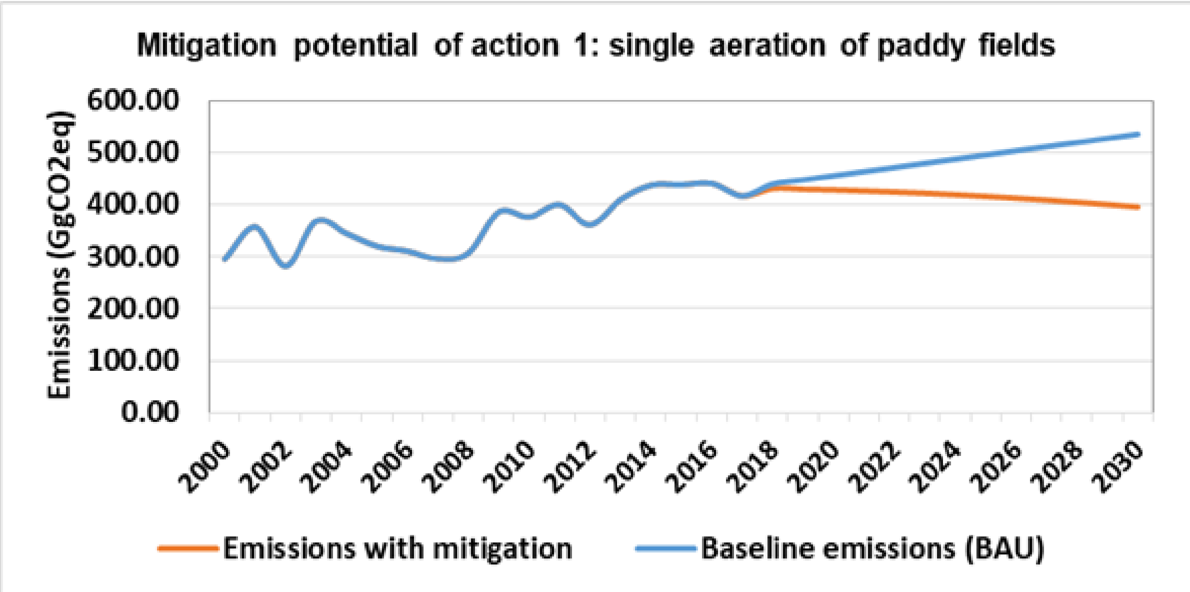


Figure 59 Mitigation scenario 1: Single aeration of paddy fields implemented
Source: Figure adapted from the partial report, Final Mitigation Assessment Report on the Agriculture sector, Samoender, I., February 2023

Scenario 2: Agriculture – rice cultivation: shorten rice cultivation time

The conversion of 50% of the rice cultivation consisting of varieties with a cultivation time of 100 days by 2030 will, according to calculations, lead to an average cultivation time of 105 days for the total rice cultivation area. Consequently, the emissions will then be reduced to 515.82 Gg CO_2eq. Set against a baseline value of 535.72 Gg CO_2eq., this is an emission reduction of 3.9 % (19.9 Gg CO_2 eq.).

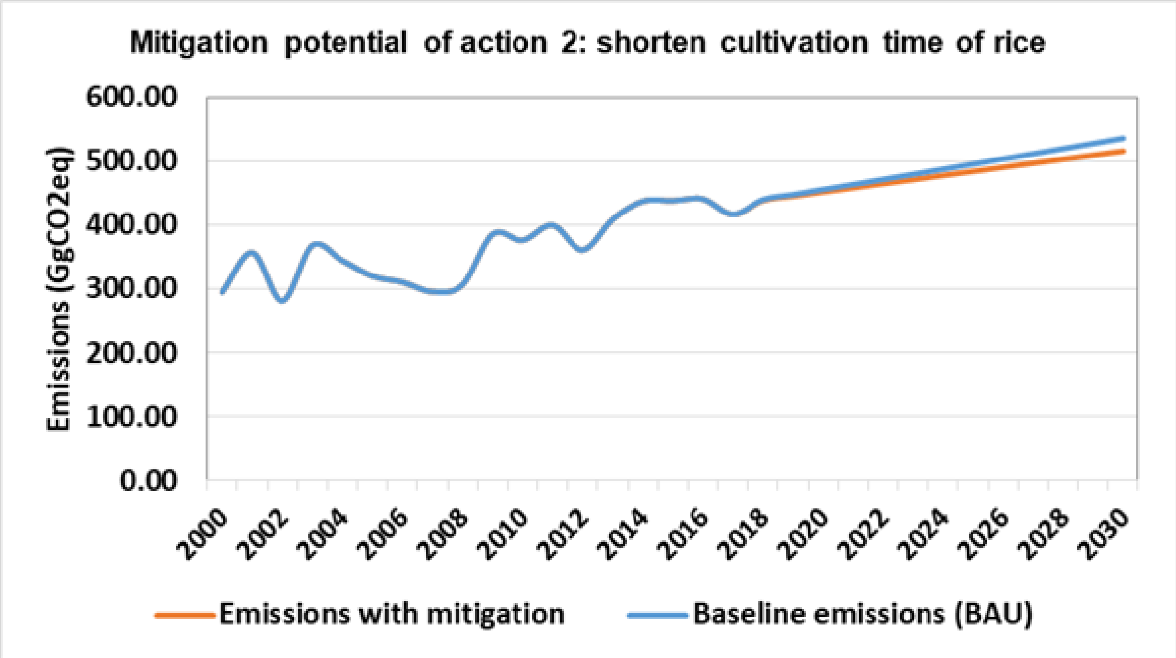


Figure 60 Mitigation scenario2: Shorten cultivation time of rice
Source: Figure adapted from the partial report, Final Mitigation Assessment Report on the Agriculture sector, Samoender, I., February 2023

Mitigation scenario 3: Agriculture – rice cultivation: reduction in fertilizer application

By reducing the urea application in rice cultivation from 400kg/ha to the recommended 250 kg/ha, the mitigation projection in 2030 will be 511.31 $GgCO_2eq$. Set against a BAU value of 535.72 $GgCO_2eq$, this action will have a mitigation potential of 24.41 $GgCO_2eq$, equivalent to a reduction of 4.6%.

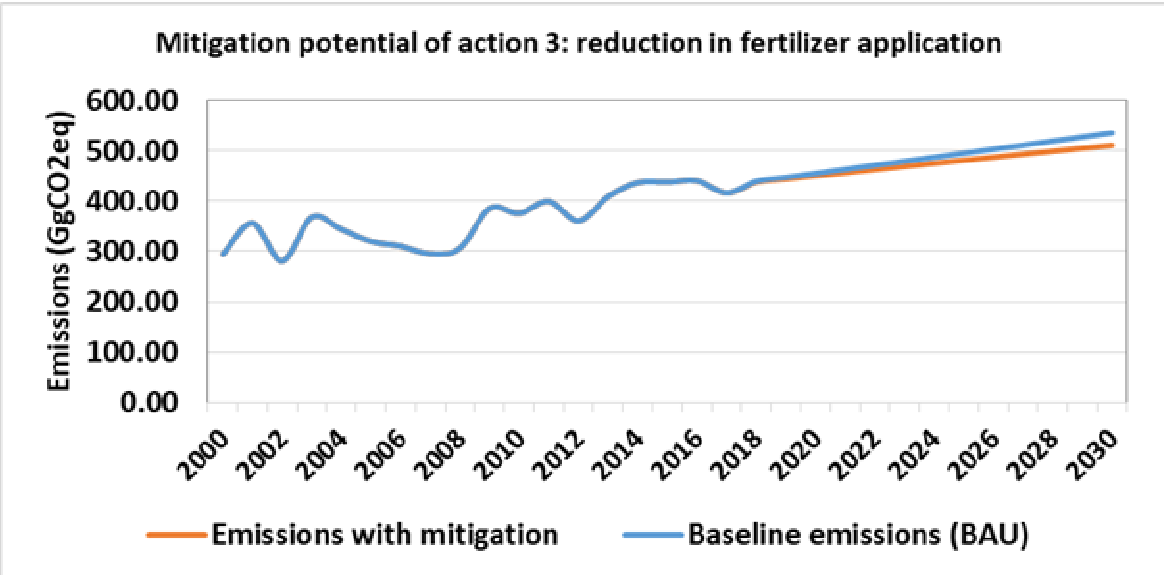


Figure 61 Mitigation scenario 3: Reduction in fertilizer application
Source: Figure adapted from the partial report, Final Mitigation Assessment Report on the Agriculture sector, Samoender, I., February 2023

Mitigation scenario 4: Agriculture – rice cultivation: combined application of scenario 1,2 and 3

When all three mitigation measures (single aeration of paddy fields, shorter cultivation time and reduction in fertilizer application) are implemented at the same time, the emissions in agriculture can be reduced to 357.70 GgCO_2 in 2030, an equivalent of 33.23% compared to the BAU value. The mitigation potential will then be 184.40 GgCO_2eq.

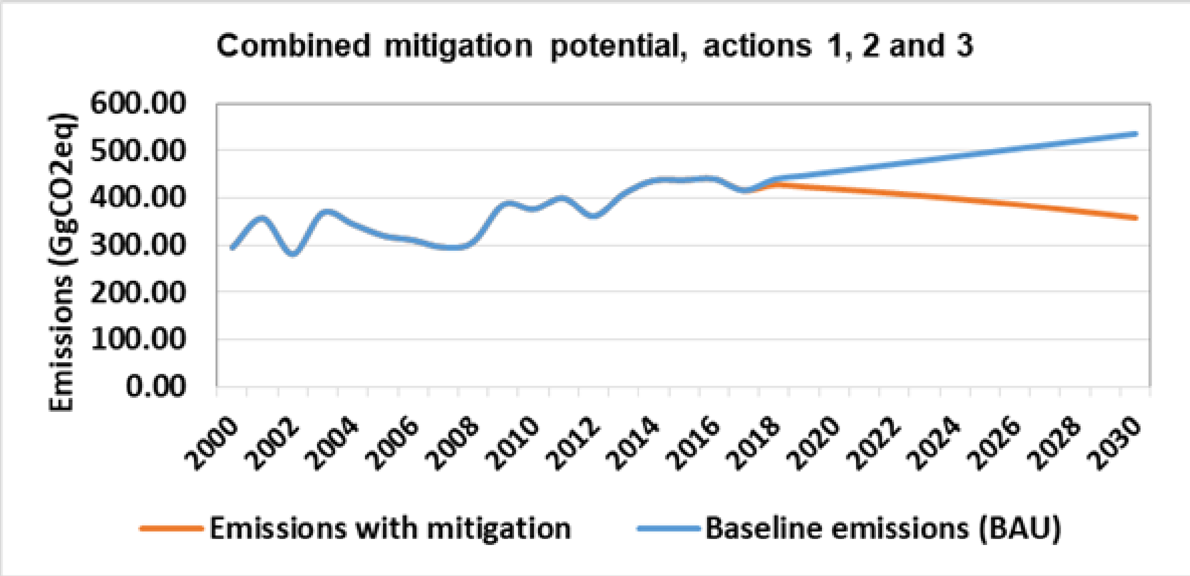


Figure 62 Mitigation scenario 4: Combined mitigation potential of all three (3) measures[24]
Source: Figure adapted from the partial report, Final Mitigation Assessment Report on the Agriculture sector, Samoender, I., February 2023

A summary of the results of the BAU and mitigation scenarios is presented in table 48.

Table 48 Summary of projected GHG emission for 2030 compared to Base year 2008 for BAU and mitigation measures

Mitigation Measures	Emission in Base year 2008 (Gg CO_2 eq.)	Emission Projected in 2030 (Gg CO_2eq.)
BAU	306.74	535.72
Single aeration of paddy		395.63
Shorten cultivation time of		515.82
Synthetic fertilizer baseline		511.31
Mitigation Potential		184.40

Source: Table adapted from the partial report, Final Mitigation Assessment Report on the Agriculture sector, Samoender, I., February 2023

[24] These measures include single aeration of paddy fields, shorten cultivation time and reduction in fertilizer application.

4.6. Forestry Sector: BAU and Mitigation Scenarios for GHG Emissions/ Removals

Suriname's primary old-growth tropical forests are of global importance, not only in terms of forest carbon, but also due to the interconnectedness of biodiversity, forest conservation and climate change (NDC 2020, 2019). The Forestry sector functions as a net sink/ removal. Emissions are largely driven by the land conversion to settlements due to mining (i.e. gold mining), followed by the development of infrastructure and urban areas, while removals are from forest land, due to the large area of forest both managed and unmanaged. Forestry mitigation options refer to those measures and policies that can lead to a reduction in the emission of GHGs and/or increase carbon sequestration in forests, long-term wood products, and other tree vegetation.

Suriname has a well build national policy and legal framework for the forestry sector placing special emphasis on the protection and maintaining of the forests, Sustainable Forest Management (SFM), enhancing forest carbon stock and compensation for ecosystem services (Climate finance). The following national policies, strategies and projects are worth mentioning in table 49 below.

Table 49 National policies, strategies and project related to forestry

National Forest Policies, Strategies and Projects	Description
Regulating policies and laws	Forest Management Act (1992), National Forest Policy (2005), Strategic Action Plan for the Forest Sector, Code of Practice, Environmental Framework Law (2020)
National Development Plan 2017-2021:	The policy related to forestry in this period is focused on: • Increasing the national wood production • Increasing the contribution of non-timber forest products (NTFPs) to the national economy • Complete the REDD+ readiness phase and move on to REDD+ implementation.
National REDD+ Strategy	The REDD+ strategy aims to further stimulate the sustainable management of forests. Specifically, the following measures are included: • Phasing out extensive management and stimulating Reduced Impact Logging, as already implemented by FSC-certified companies • Completing and implementing Practice Guidelines for sustainable logging • Revising forestry levies to stimulate sustainable management (this can possibly be linked to the financial compensation of the REDD+ program) • Increasing the efficiency of local wood processing • Streamlining concession policy, especially of the ministries responsible for mining and logging concessions • Reviewing the issuance policy of concessions and community forests • Revision of the Forest Management Act.
National Determined Contribution (2020)	• Conditional contribution to remain a HFLD country with a forest cover of 93% • Unconditional contribution to encourage Sustainable Forest Management.
Projects to strengthen capacity of the forestry sector to be initiated	• Global Environmental Facility (GEF 7): Sustainable Forest Management Impact Program: Amazon Sustainable Landscapes. • Proposed joint Team Europe Initiative for Guyana – Suriname in the area of Forest Governance (EU-project) • Pilot project "Climate Smart Forestry" (in collaboration with Conservation International) • Forest Product Value Chain Analysis in Suriname".

Source: Table adapted from the partial report, Mitigation Assessment FOLU Report, SBB, December 2022

The GHG inventory was prepared for the period 2000-2017, with the AFOLU sector functioning as a net sink throughout the entire period. A summary of the estimated emissions and removals for the FOLU sector, for the base year 2008, is provided in figure 63. Settlements (2,059 Gg CO_2eq), Wetlands (54 Gg CO_2eq) and other land (49 Gg CO_2eq) together accounted for 12.07% of the absolute values of emissions/ removals, while Forest land (15,057 Gg CO_2eq), Grassland (687 Gg CO_2eq) and Cropland (5 Gg CO_2eq) were a net sink and accounted together for 87.93%.

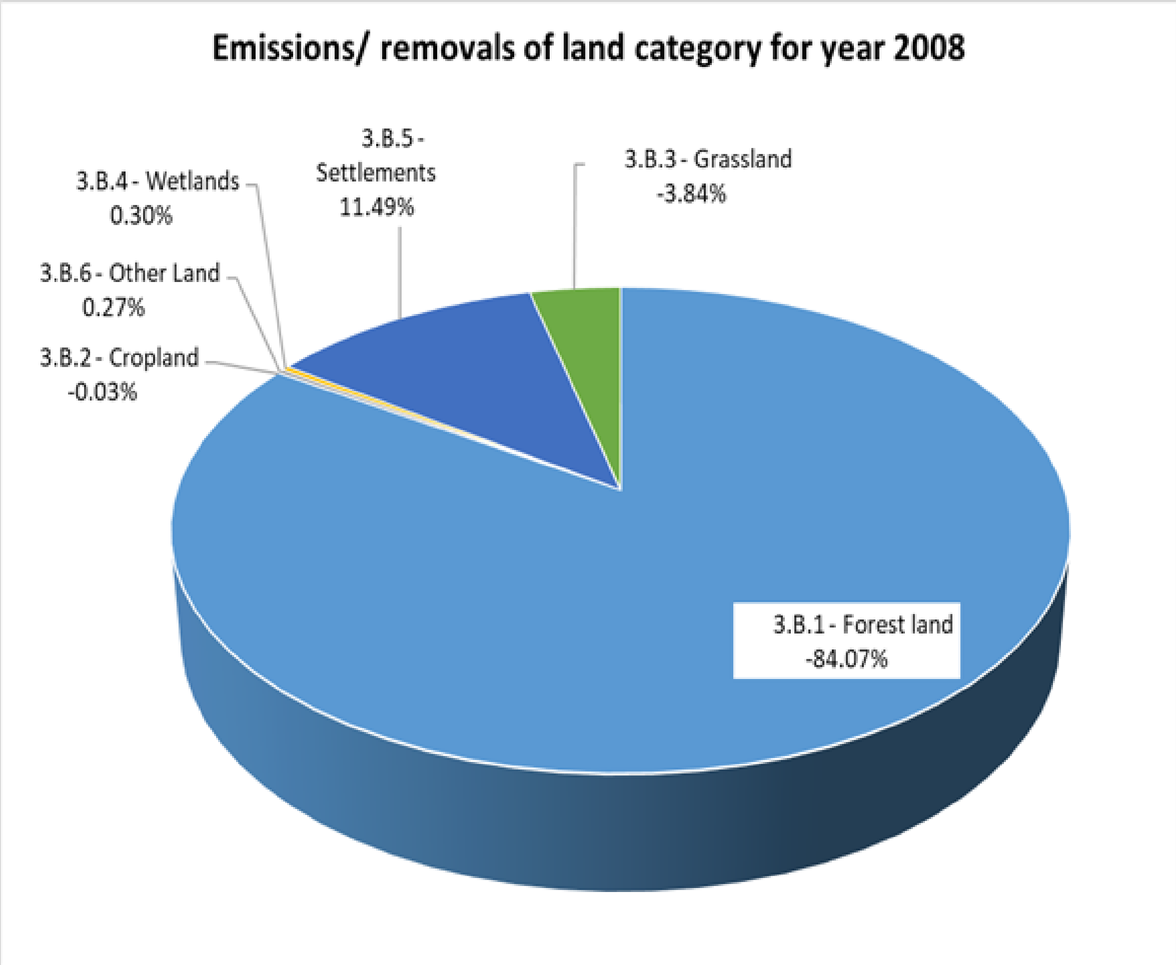


Figure 63 Summary of estimated emissions/ removals from Suriname's forestry and land use components of the AFOLU sector in 2008

Source: Figure adapted from the partial report, Mitigation Assessment FOLU Report, SBB, December 2022

From figure 63, it is obvious that the categories Forest Land acts as the biggest removal, and the category Settlements as the biggest emitter. Currently, the aim is to identify the most potential sub-category within category 'Forest Land' to increase the amount of removals and for category 'Settlements' the most potential sub - category to reduce greenhouse gas emission. From the GHG inventory one can conclude that potential room is available for increasing removals within category 'Forest land remaining Forest land', in particular within the sub - category 'Round wood production' as can be noticed in figure 64.

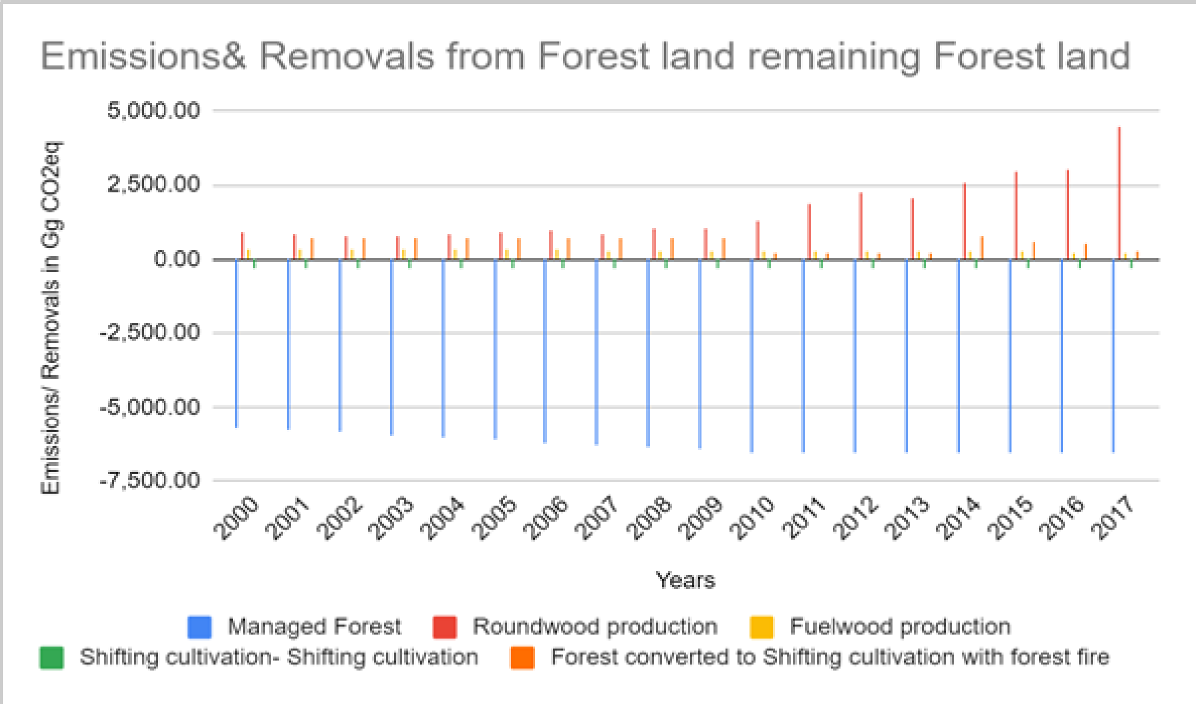


Figure 64 Emissions and removals from Forest land remaining Forest land per sub category
Source: Figure adapted from the partial report, Mitigation Assessment FOLU Report, SBB, December 2022

Mining was the largest driver (69%) of deforestation over the period 2000-2017 (SBB, 2021) and falls under the IPCC category Settlements (SL). The land use category Settlements is the main emission source from FOLU. According to figure 65, all land conversions to Settlements contribute to CO_2 emissions with the land conversion Forest Land (FL) to Settlements (SL) as the main contributor. All other land conversions are not that significant. Trends of the category Settlements strongly depend on the gold mining activities, which are also being influenced by the international gold price. Furthermore, activities regarding infrastructure, as the second main driver of deforestation, also contributes to the behavior of the trend throughout the time series. The contribution to CO_2 emission from the conversion from 'Other land to Settlements' and 'Wetland to Settlements' is zero.

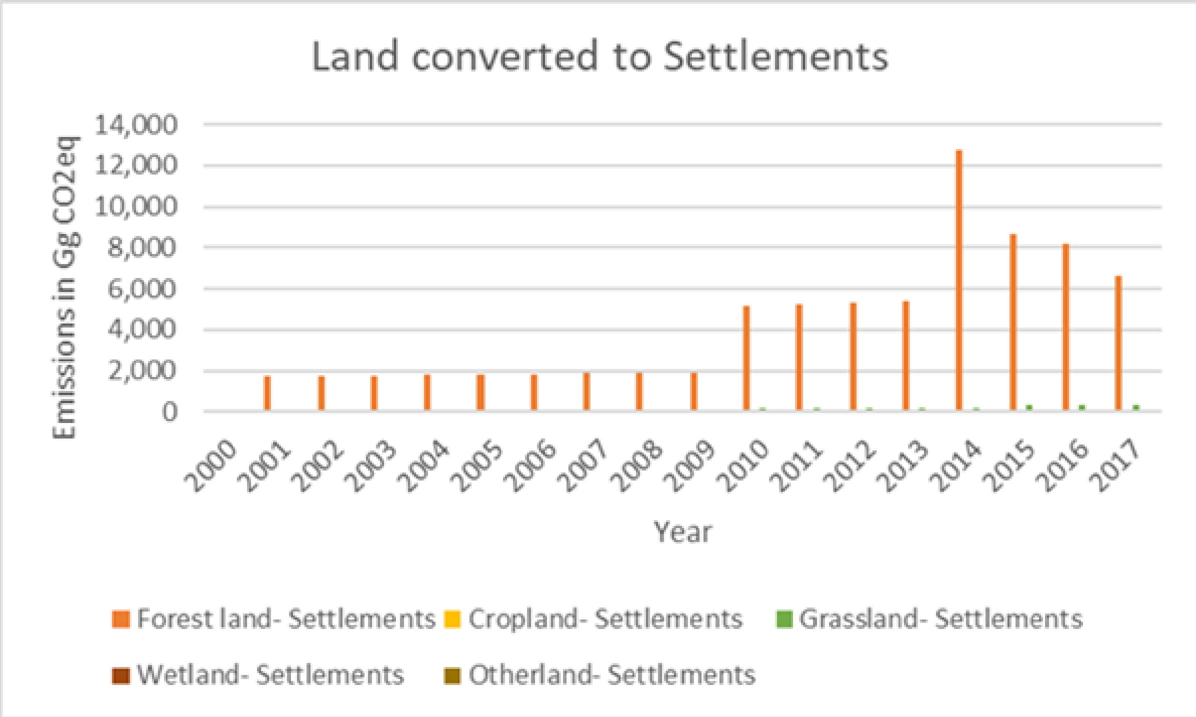


Figure 65 All land conversion to Settlements contributing to CO2 emissions
Source: Figure adapted from the partial report, Mitigation Assessment FOLU Report, SBB, December 2022

4.6.1. Set of Assumptions considered for the Forestry BAU Scenario

The baseline projection is constructed until 2030. All analyses were executed using ArcGIS, QGIS and Microsoft Excel.

4.6.1.1. BAU Scenario Roundwood Production (Forest Land Sector)

Logging in Surname is a major economic activity and is characterized by the selective removal of high-value tree species. Logging results primarily in forest degradation and is the second largest source of carbon emissions after deforestation from gold mining in Suriname (FREL, 2018).

In recent years the levels of degradation from logging activities might have increased, due to (i) the fast-growing timber production in Suriname, (ii) increasing global demand for tropical timber, (iii) insufficient institutional capacity within the forest sector (public and private sector), (iv) urgent need to improve comprehensive operational guidelines and procedures, (v) Limited financial resources in the responsible organizations (public and private sector).

Timber cutting licenses are issued in the northern part of the country from the 4th latitude, the so-called Forestry belt, covering ca. 4.5 million ha. South of the forestry belt, the forest has the status of temporary maintained forest. No timber cutting licenses are issued in this area. Data from November 2022 shows that 1.7 million ha is currently used for logging within the Forestry belt.

The log production in 2019 was 1,069,000 m^3, of which 315,000 m^3 was exported (see figure 66). It is estimated that of the remaining 745,000 m^3, about 420,000 m^3 was locally processed by the sawmill industry in the country and about 334,000 m^3 was in stock mostly to be exported in the next year (SBB, 2020a). The recovery rate of rough sawn wood in sawmills in Suriname is about 45%. When producing export quality sawn wood, the recovery rate decreases to between 25-30% (Landburg, 2017). Within a period of 10 years from 2010-2019, the roundwood production in the country increased to approximately 400%, and the sawn wood production increased to roughly 150%. In the same period, the export of roundwood also increased to just about 500%. Figure 66 shows the trend of the production of industrial wood for the period 2001-2021.

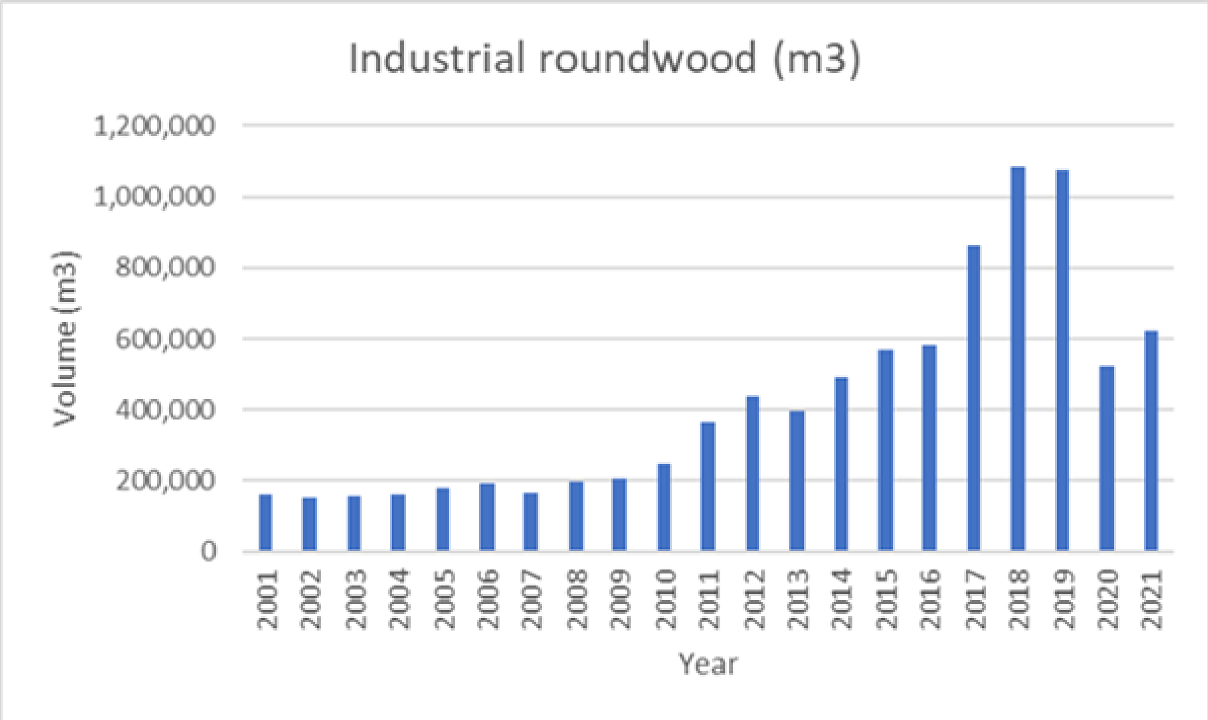


Figure 66 Trend in industrial roundwood production for 2001-2021
Source: Figure adapted from the partial report, Mitigation Assessment FOLU Report, SBB, December 2022

According to forestry experts, the increasing trend of the roundwood production in 2016-2019 can be explained by the increasing demand on roundwood in the Asian market. Apart from that, and according to information obtained from the International Tropical Timber Organization (ITTO) the price for wood was also high in the said period. Therefore, a lot of investments were made in the logging companies during that period.

The downward trend after 2019 is explained by a combination of several factors, such as heavy rainfall leading to bad infrastructure and the limited trade of containers due to the COVID19-circumstances worldwide. The BAU scenario -A0- (figure 67) is constructed based on SBB historical data of round wood production for the period 2008-2021. The uncertainty in the data is estimated at 5%, based on expert knowledge.

Forestry experts stated that the roundwood production is not expected to exceed a volume of 1,000,000 m^3 within the coming 5 years commencing in the year 2021. This expectation is based on the observation of the number of commercial species that still remained in the forest. The baseline was produced, using the maximum expected volume of 1,000,000 m^3 in 2026, combined with the historical data of the period 2008-2021.

A significant increase of roundwood was observed from 2016 to 2019 (figure 67), due to a combination of different factors, such as the increasing demand for roundwood and the high price related to it.

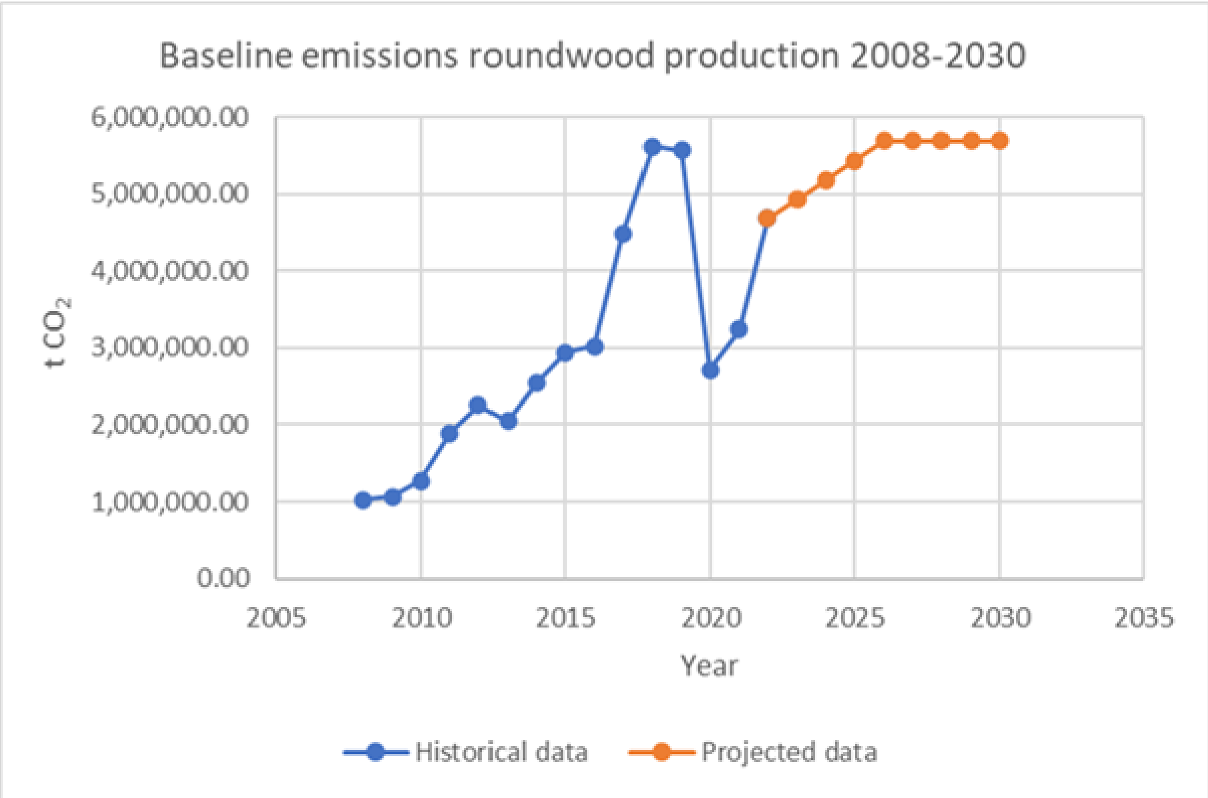


Figure 67 BAU scenario (A0) for category Roundwood production
Source: Figure adapted from the partial report, Mitigation Assessment FOLU Report, SBB, December 2022

4.6.1.2. BAU Scenarios Forest Land to Settlements (OLU Sector)

For the OLU sector, the Land Use Land Cover data is used, which is produced using predominantly free satellite images. For the period 2000-2017 Landsat images are used, compared to the period after 2017, whereby Sentinel 2 images were used. Validation of the data occurred during workshops, district sessions and field checks. This method is extensively described in the Satellite Land Monitoring System (SLMS) technical report (SBB, 2021).

The conversion of forest land to other land uses is seen as forest loss, which is formally described as deforestation. The deforestation for the period 2001-2017 is shown in figure 68**,** which shows an increasing trend, with a peak in 2014. The data produced within the FCMU is available to download on the Gonini geoportal at www.gonini.org.

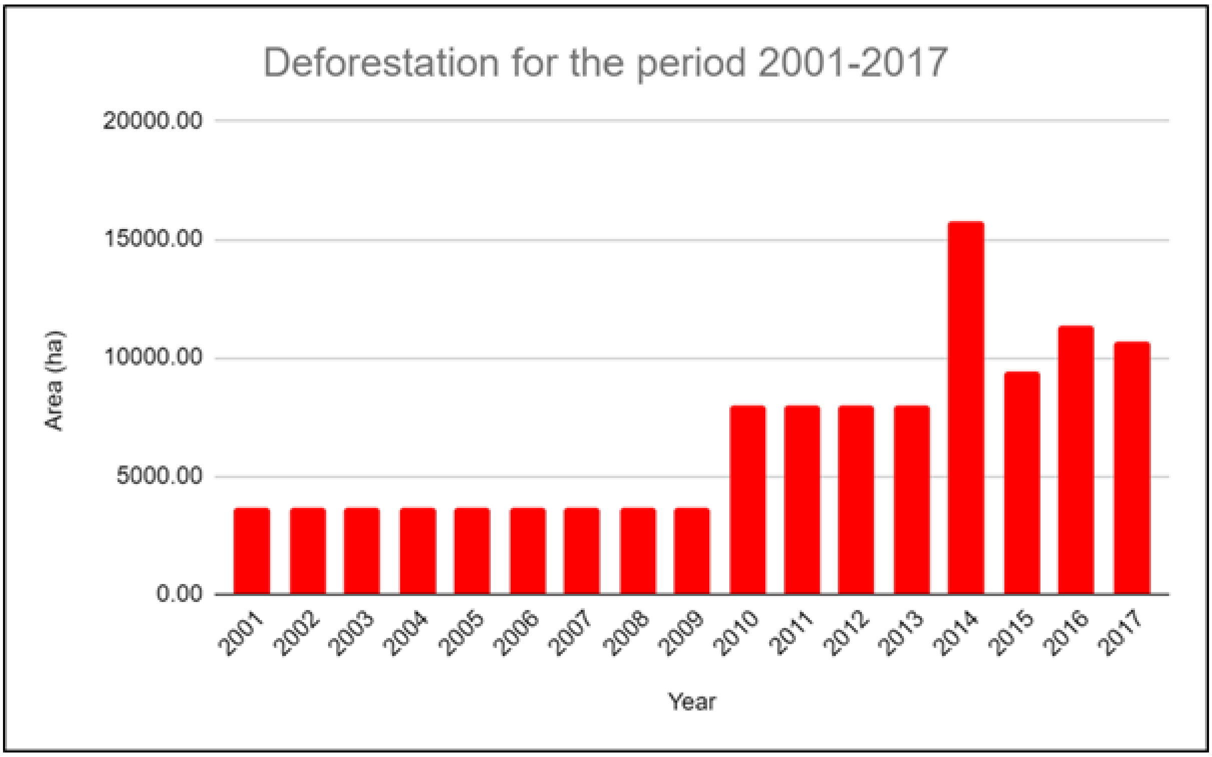


Figure 68 Deforestation trend Forest Land to Settlements over 2001-2017
Source: Figure adapted from the partial report, Mitigation Assessment FOLU Report, SBB, December 2022

For the OLU sector the conversion from Forest Land (FL) to Settlements (SL) is used. According to the trend in this version, presented in figure 68, there was a peak in 2014. The trend after 2014 decreased and was approximately in the same range from 2015 till 2017. For this reason, assumptions are made that the 2014 data may be an outlier that can highly impact the results. For the analysis of the scenarios for the OLU sector, the 2014 data was excluded.

For the OLU sector, the following BUA scenarios are produced:

- Scenario B01: Baseline BAU OLU
- Scenario B02: Baseline maintaining 93% forest cover
- Scenario C0: Baseline for improved management of protected areas

Three baseline scenarios are constructed for the category 'Forest land to Settlements'. The first two BAU Scenarios (Baseline OLU and Baseline maintaining 93% forest cover) are constructed with the aim to forecast the status of the Forestry sector when no measures are being implemented. Unfortunately, no mitigation scenario could be constructed for both of these BAU scenarios, due to a lack of crucial data. As data on protected areas is available, only the mitigation scenario based on Baseline for 'Improved management of protected areas' could be constructed.

Baseline Scenario (1): Baseline OLU

The main contributor of CO_2 emission is the land conversion Forest Land (FL) to Settlements (SL). The baseline for the OLU sector will be generated using this conversion, extracted from the LULC data. This was done for the period 2000-2017. The parameter values shown in table 50 are used to estimate the annual change in carbon stocks under this category Land converted to Settlements in the equation 2.16 cf IPCC Guidelines Vol. 4

Table 50 Parameter values for the conversion Forest Land to Settlements

Land conversion category	Annual change in carbon stocks in biomass in t C/ ha/ yr
Forest Land – Settlements (FL- SL)	-168.96
Forest Land - Settlements (Shifting cultivation - SL)	-52.20
Cropland – Settlements (CL- SL)	-5.00
Grassland – Settlements (GL- SL)	-7.57
Wetland – Settlements (WL- SL)	0.00
Otherland – Settlements (OL- SL)	0.00

Source: Table adapted from the partial report, Mitigation Assessment FOLU Report, SBB, December 2022

The first baseline for OLU is the Business As Usual (BAU) scenario, considering the conversion from Forest Land to Settlements. Figure 69 demonstrates this scenario and shows an increasing trend, which can be explained by gold mining activities and infrastructure development as part of the IPCC category Settlements.

Gold mining is the main driver of deforestation. It has an important role in the economy of Suriname and is not expected to decrease in the future. This scenario is created to give an idea of the emissions, when activities will continue as in the previous years. There was no sufficient data available regarding mitigation plans for the mining sector, which is why there are no projections created for the OLU sector at the moment. However, there is a project "Improving Environmental Management in the Mining Sector of Suriname, with Emphasis on Artisanal and Small-Scale Gold Mining" (EMSAGS) coordinated by NIMOS, where one of the objectives is to study the impact of environmental-friendly mining practices on the forest carbon stock. Unfortunately, there are no results or data available yet to include in a projected scenario.

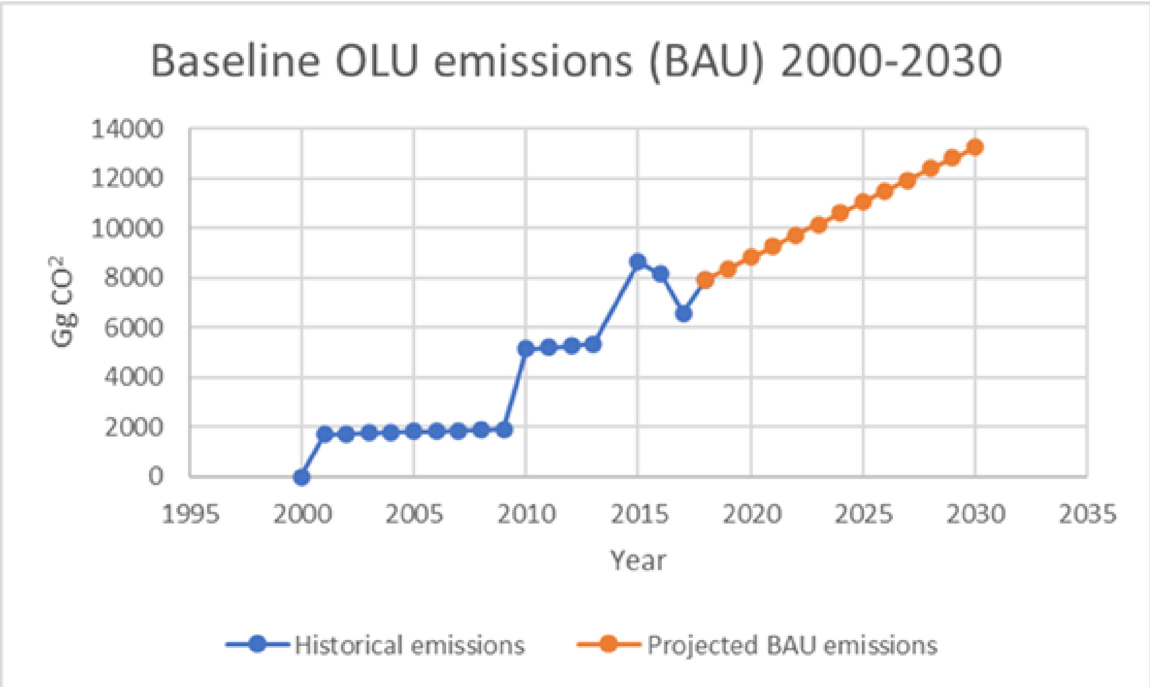


Figure 69 BAU scenario OLU emissions 2000-2030

Source: Figure adapted from the partial report, Mitigation Assessment FOLU Report, SBB, December 2022

Baseline Scenario (2): Baseline OLU maintaining 93% forest cover

In December 2017, during the UNFCCC COP23, the Government of Suriname pledged to maintain its forest cover at 93%, a commitment that will require science and technology, expertise, technical support and above all the necessary financial resources and the political will of the global community expressed in a durable partnership. Most recent forest cover data of 2021, shows a coverage of 92.66% with a deforestation rate of 0.06% annually. Given this information, the forest cover can still be rounded up at 93% in 2023. After 2023 the 93% forest cover will be less if no actions are being taken.

The second baseline for OLU is the baseline considering maintaining 93% forest cover. This is portrayed in figure 70.

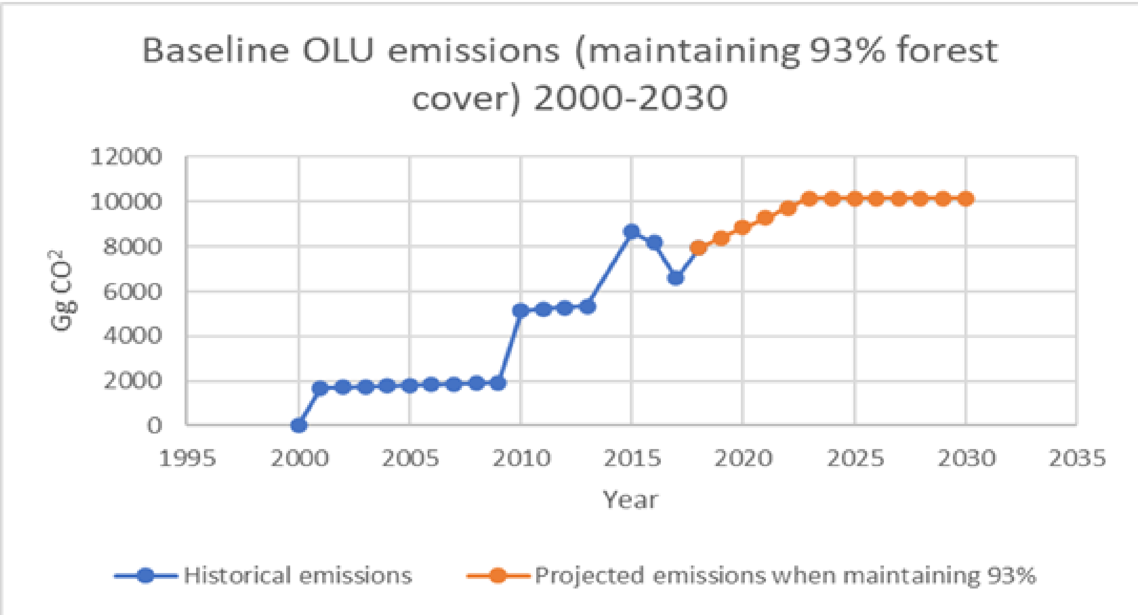


Figure 70 Baseline OLU when 93% forest cover will be maintained
Source: Figure adapted from the partial report, Mitigation Assessment FOLU Report, SBB, December 2022

When considering the maintenance of 93% forest cover, it is important to promote other alternatives for the diversification of economic activities in the country, such as ecotourism or Non-Timber-Forest-Products (NTFPs). This scenario is created to give an idea on the maximum emissions in the coming years when Suriname aims to maintain the 93% forest cover. There was no sufficient data available regarding other economic activities in order to create a projected scenario. If no mitigation actions are taken, the forest cover can already become less than 93% in the year 2024.

Baseline Scenario (3): Baseline for improved management of protected areas
Assumptions and description

Scenario C0 is based on the annual deforestation that occurred in protected areas over the period 2001-2021**.** Figure 71 shows the annual emissions of deforestation in protected areas, where a linear trend has been selected for the projection

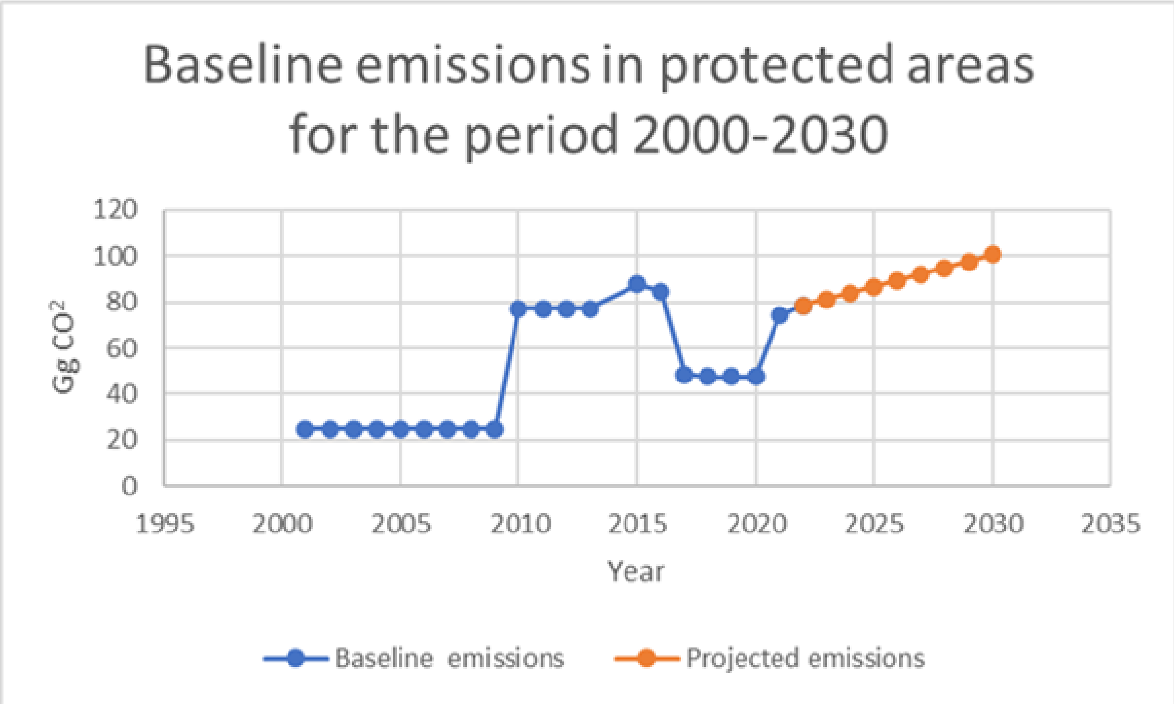


Figure 71 Projected emissions of deforestation in protected areas for 2000-
Source: Figure adapted from the partial report, Mitigation Assessment FOLU Report, SBB, December 2022

4.6.2. Forestry Mitigation Scenarios and the Assumptions Considered

4.6.2.1. Mitigation Scenarios Roundwood Production (Forest Land Sector)

One of the priorities in the NDC 2020 (2019), Recovery Plan 2020-2022, the Multi-Annual Development Plan (MOP) 2022-2026 and the Forest policy, jointly formulated by SBB and the Suriname Business Association (VSB), is to phase out the export of roundwood and to stimulate the export of processed timber products, of which the strengthening of the wood processing industry is an integral part. Strengthening the capacity of wood processing is a crucial step towards the reduction of roundwood export in a thoughtful way. Currently, access to finance is extremely difficult, especially for small and medium enterprises within the forestry sector. This means that they do not have the opportunity to significantly improve and develop their operations. However, with the elaboration focused on a strategy to phase out the export of roundwood, this opportunity may be considered.

Mitigation Scenarios (1): Reducing Roundwood export and promotion of processing wood products

The following key assumptions are considered:

- The implementation of phasing out the export of roundwood was intended to start in 2023;
- The expectation is that this mitigation action can reduce up to 40% of emissions, within 5 years, based on the experience of Gabon;
- During the 1st year, 30% emission reduction will be reached, due to the shift to investments in wood processing instead of harvesting logs;
- The emission reduction in the 2nd and 3rd year will be 40%, due to the ongoing investments in wood processing;
- In the 4th year, wood processing will be in a more advanced phase, leading to an increasing trend of harvested logs, assuming an emission reduction of 30%;
- After the 4th year, the emission reduction will decrease from 20%, 10%, 5% to eventually 0% emission reduction in the following years.

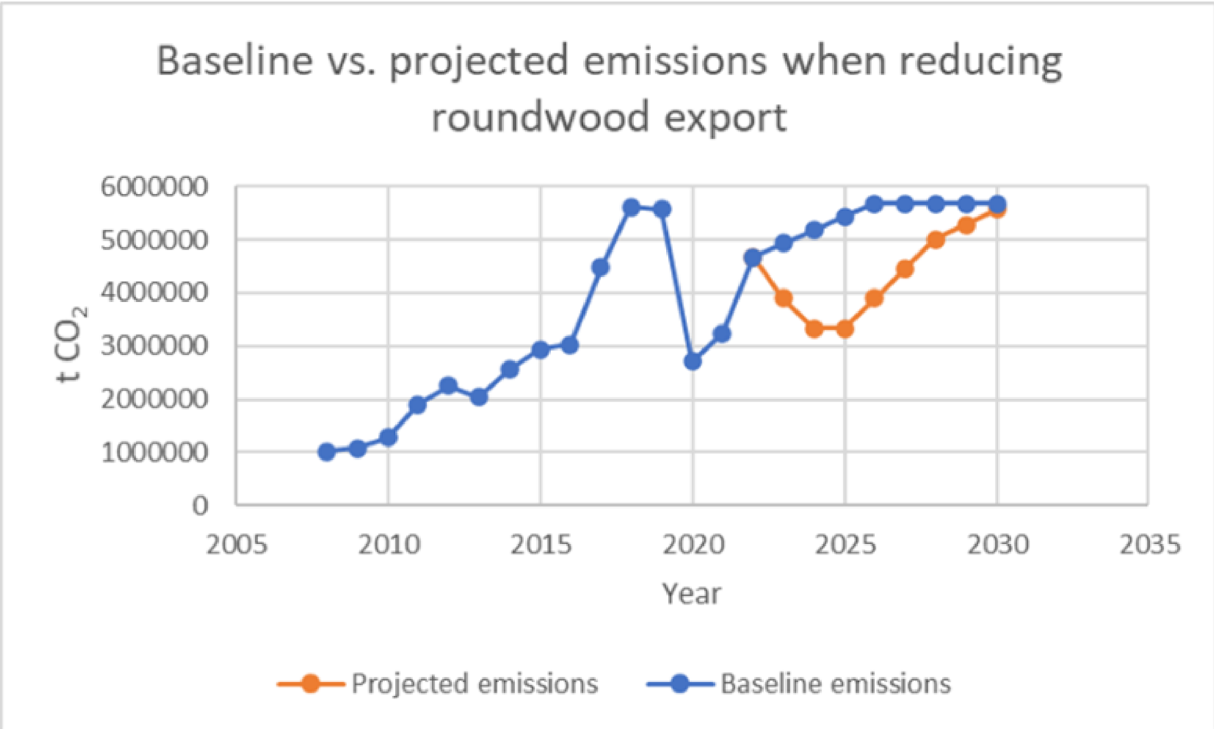


Figure 72 Projected emissions for mitigation measure Reducing Roundwood export and promotion of processes wood products vs the baseline emissions
Source: Figure adapted from the partial report, Mitigation Assessment FOLU Report, SBB, December 2022

Figure 72 as presented above, demonstrates that reduced emissions will be reached, starting at the implementation years. This can be explained by the time and effort that will be invested in wood processing. However, after two years, the wood processing chain will be in a more advanced and operational phase, shifting the focus back to harvesting logs. This will result in less emission reduction in the following years, which can also be seen in figure 72 by the increasing trend from 2026 onwards.

Table 51 shows an overview of the mitigation potential compared to the baseline.

Table 51 Overview of possible emission reductions when reducing roundwood export

Year	Baseline Emissions	Projected Emissions (tCO_2eq)	Mitigation Potential (tCO_2eq)
2023	4,932,207.93	3,896,898.46	1,035,309.47
2024	5,183,294.61	3,340,198.68	1,843,095.93
2025	5,434,381.29	3,340,198.68	2,094,182.61
2026	5,685,467.97	3,896,898.46	1,788,569.51
2027	5,685,467.97	4,453,598.24	1,231,869.73
2028	5,685,467.97	5,010,298.02	675,169.95
2029	5,685,467.97	5,288,647.91	396,820.06
2030	5,685,467.97	5,566,997.80	118,470.17

Source: Table adapted from the partial report, Mitigation Assessment FOLU Report, SBB, December 2022

Mitigation Scenarios (2): Converting forestry-based activities into SFM activities, such as Climate Smart Forestry (CSF)

The following key assumptions are considered:

- The implementation will start in 2023;
- Eligible area of the total forestry belt for CSF is 64%;
- CSF can lead to an emissions reduction of 40%, based on the study of J. Zalman.
- For the first two years, 5% of the operations will be converted to CSF;
- In the third year, 25% of the operations will be converted to CSF;
- In the fourth year, 50% of the operations will be converted to CSF;
- In the fifth year, 64% of the operations will be converted to CSF;
- Maintenance of extraction volumes and practices will occur from 2028 onwards.

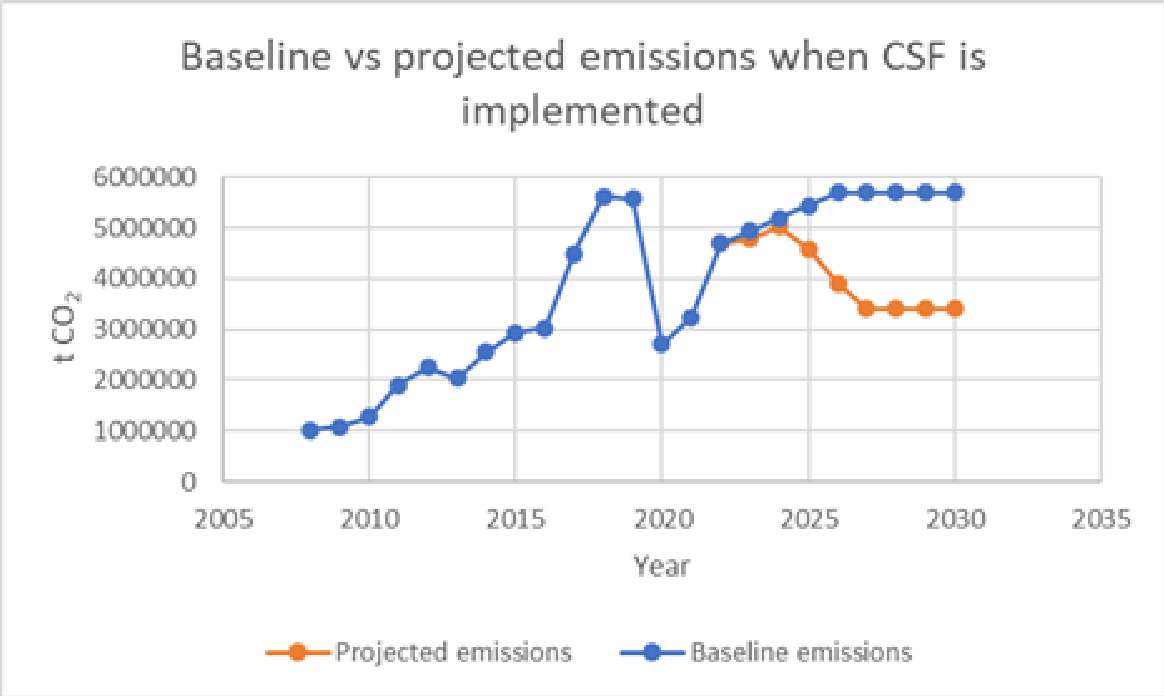


Figure 73 Overview emission reduction compared to the baseline when CSF is executed
Source: Figure adapted from the partial report, Mitigation Assessment FOLU Report, SBB, December 2022

The following table presents the mitigation potential for this scenario, where forestry-based activities are converted into SFM activities, such as Climate Smart Forestry (CSF)

Table 52 Overview of possible emission reductions in converting forestry-based activities into SFM activities

Year	Baseline emissions (tCO_2eq)	Projected emissions (tCO_2eq)	Mitigation Potential (tCO_2eq)
2023	4,932,207.93	4,778,076.43	154,131.50
2024	5,183,294.61	5,021,316.65	161,977.96
2025	5,434,381.29	4,585,259.21	849,122.08
2026	5,685,467.97	3,908,759.23	1,776,708.74
2027	5,685,467.97	3,411,280.78	2,274,187.19
2028	5,685,467.97	3,411,280.78	2,274,187.19
2029	5,685,467.97	3,411,280.78	2,274,187.19
2030	5,685,467.97	3,411,280.78	2,274,187.19

Source: Table adapted from the partial report, Mitigation Assessment FOLU Report, SBB, December 2022

Mitigation Scenario (3): Combining scenario (1) and (2)

The following key assumptions are considered:

- Phasing out the export of roundwood is implemented simultaneously with the CSF program;
- The projected volumes of roundwood production in scenario (1) is used to apply the increased percentages of CSF operations given in scenario (2).

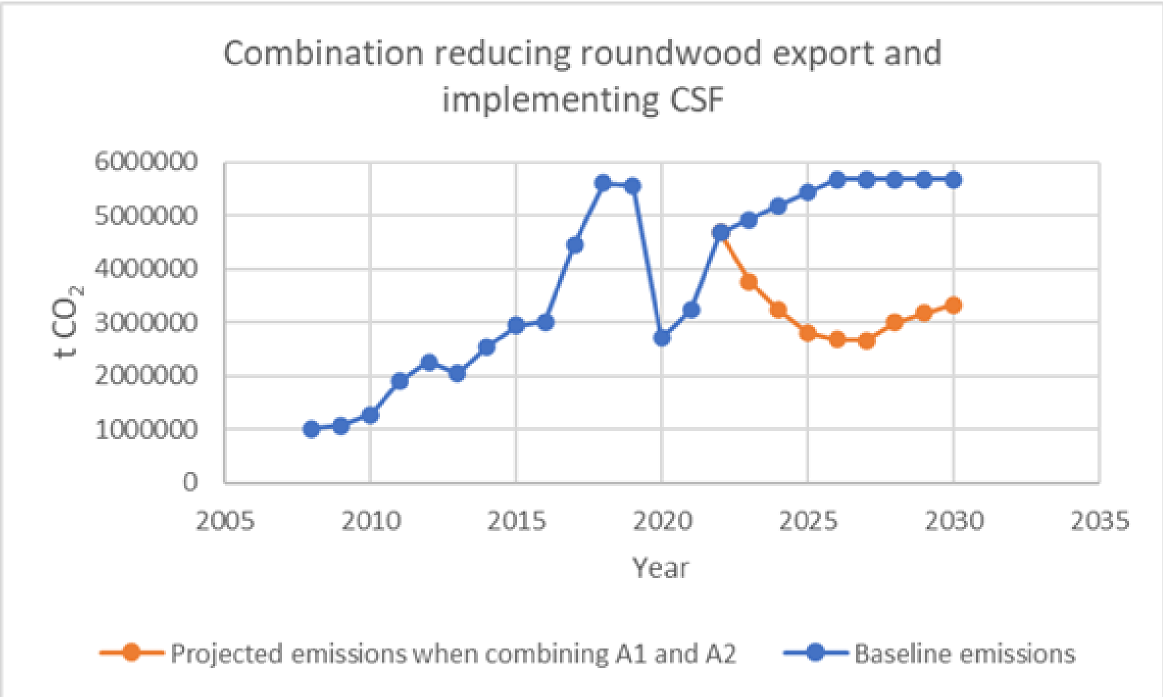


Figure 74 Overview emission reduction compared to the baseline when executing the reduction of roundwood export and implementing CSF simultaneously

Source: Figure adapted from the partial report, Mitigation Assessment FOLU Report, SBB, December 2022

The result of this scenario shows that there will already be a downward trend of the emissions when the reduction of roundwood export and implementation of CSF practices will be simultaneously executed. Eventually, a stable trend will also be reached, when having 40% emission reduction.

Table 53 Overview of possible emission reductions in combining both scenarios

Year	Baseline Emissions	Projected Emissions	Mitigation Potential
2023	4,932,207.93	3,775,120.38	1,157,087.55
2024	5,183,294.61	3,235,817.47	1,947,477.14
2025	5,434,381.29	2,818,292.64	2,616,088.65
2026	5,685,467.97	2,679,117.69	3,006,350.28
2027	5,685,467.97	2,672,158.94	3,013,309.03
2028	5,685,467.97	3,006,178.81	2,679,289.16
2029	5,685,467.97	3,173,188.75	2,512,279.22
2030	5,685,467.97	3,340,198.68	2,345,269.29

Source: Table adapted from the partial report, Mitigation Assessment FOLU Report, SBB, December 2022

4.6.2.2. Mitigation Scenario Improved management of protected areas

OLU Sector

As stated in section 4.6.1.2, due to a lack of crucial data, only the mitigation scenario based on Baseline for 'Improved management of protected areas' could be constructed. In this section the mitigation measure is constructed in order to determine the mitigation potential. This scenario shows the case when improved management will be implemented leading to zero deforestation after two years. Within the two years all control mechanisms should be in place. Figure 75 shows the projected emissions when this mitigation action will be implemented.

Improved management in protected areas can lead to zero deforestation, given the fact that in the first two years of implementing this mitigation action, all control mechanisms will be in place and institutions have been strengthened.

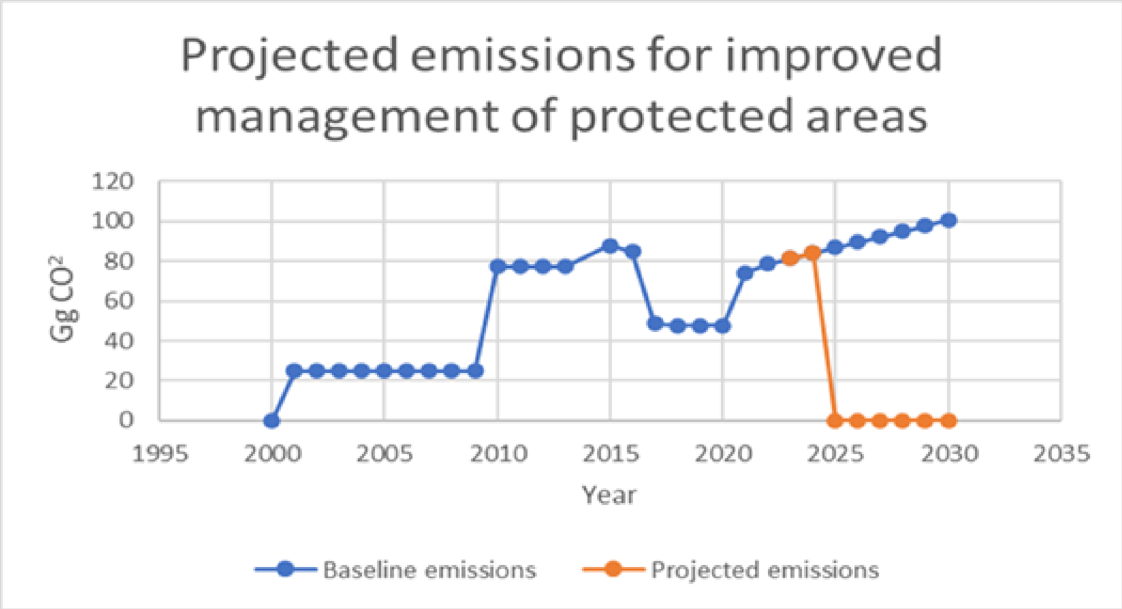


Figure 75 Projected emissions when improving management in protected areas
Source: Figure adapted from the partial report, Mitigation Assessment FOLU Report, SBB, December 2022

4.7. Main results of the Mitigation Assessment

The total summary of all proposed mitigation measures is presented in table 54.

Table 54 Mitigation potential in year 2030 of all proposed measures in the Energy, Agriculture and Forestry sectors (Gg CO2eq)

Sector	Mitigation Measure	Mitigation potential in Gg CO2eq for year 2030
Energy	RE scenario	276.9
	EE scenario	489.0
	Transport	149.6
Agriculture	Single aeration of paddy fields	140.1
	Shorten cultivation time of rice	19.9
	Synthetic fertilizer baseline	24.4
Forestry	Reducing Roundwood export	118.5
	Climate Smart Forestry	2,274.2
	Improved management in protected areas	from 2025 onwards = zero deforestation

Source: Table adapted from the Mitigation Assessment Report, based on the preparatory sectoral Mitigation Assessment Reports drafted by the sectoral experts (Energy, Agriculture and Forestry), Jharap. R., 2023

As noticeable, the Forestry sector has the highest potential to curb emissions, with a total of 2,392.7 Gg CO_2eq, with Climate Smart Forestry (CSF) having the most potential. Measures within the Energy sector, in particular Energy Efficiency measures, are likely to have the most impact on reducing GHG emissions with a mitigation potential of 489 Gg CO_2eq.

Reducing roundwood export and promotion of processing roundwood products can lead to emission reduction at the starting phase. However, after the processing of roundwood products has reached an advanced stage, emissions may increase again, due to the harvesting of logs. When converting the forestry-based activities to SFM activities, the emissions will steadily reduce, based on the number of areas where CSF is operational. The reduction will occur until the maximum reduction of 40% is reached. At this point, the emission reduction shall remain stable, as long as the operations are aligned with CSF practices. Having the two mitigation actions simultaneously carried out in the same year, results in the most emission reduction.

Various mitigation measures within the Energy sector are ongoing or planned, but targets or detailed data of each planned measure are not available. This makes it difficult to make projections for GHG emissions. For example, the targets for the electricity sector are not yet published as the Electricity Sector Plan (ESP) is currently still under construction. Additionally, when the ESP is finished and enforced, the targets will be clear for this sector and the projections can be made with more detailed information/ data, with the expectation that the mitigation potential within the Energy sector can be much higher.

With the proposed mitigation measures for the agriculture sector a mitigation potential of 184.4 Gg CO_2eq could be reached. However, there are some remarks to be placed. The success of the mitigation measure related to water regime (action measure 1) depends heavily on water availability and proper water infrastructure and can be enhanced by the implementation of component I, Irrigation and Drainage of the current ongoing IDB project: Sustainable Agricultural Productivity Program (SU-L1052). This project was launched in Nickerie, in April 2022 and aims at improving the agricultural productivity by investments in infrastructure and management of irrigation and drainage (I&D) systems. Establishment of waterboards to hand over costs of exploitation and maintenance of secondary infrastructure, rehabilitation of primary and secondary infrastructure, management and maintenance of I&D, efficient distribution of water, are the main subcomponents of this project. Even so, conversion to cultivars of shorter cultivation time and reduction in the use of Urea depends on mitigation policy approaches such as R&D and knowledge transfer. Preferential credit schemes and incentives to implement these measures can be particularly relevant for stimulating the adoption of these mitigation measures.

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Chapter 5

Other Information Considered Relevant for the Convention

5 Other Information Considered Relevant for the Convention

5.1. Introduction

Suriname's Third National Communication (NC3) to the United Nations Framework Convention on Climate Change (UNFCCC) is the follow-up of the Second National Communication on Climate Change (NC2), published in 2016. NC3 supports Suriname in improving the quality of information on topics that are in line with UNFCCC decisions, included in the National Communications by Non-Annex I Parties. Chapter 5 (Other Information) focusses on any other information that the Non-Annex I Party considers relevant to the achievement of the objective of the Convention and suitable for inclusion in its communication such as: integrating climate change matters in policy, development and transfer of environmentally sound technologies (ESTs); climate change systematic observation and research on effective responses; education, training and public awareness; capacity building; Information exchange and networking; gender and climate change.

The methodology applied for obtaining information by the experts consisted of desk research, online surveys, inventory of literature and actions taken by stakeholders on disseminating climate change information, and interviews with stakeholders. All the analyzed data was presented and validated in two workshops in 2022. The final partial reports consist of validated results and information, which are summarized in this chapter.

5.2. Steps Taken to Integrate Climate Change into National Policies and Priorities

Integration of Climate Change in Suriname's National Development Priorities

Suriname has come a long way into preparing policies and plans related to climate change. Climate change and its impacts is given increasingly higher priority on the national and regional political agenda. NC2 reported that an integrated climate change policy was still missing and that there were no laws that specifically address climate change issues and commitments to the UNFCCC (NC2, 2016). An important development since NC2 is the passing of the Environmental Framework Act, known as "Milieu Raamwet", in the National Parliament, which took effect from May 2020 (Official Journal of Republic of Suriname, 2020). This Act aims to develop a policy and environmental strategy in the context of the sustainable environmental management in Suriname, creating a balance between economic growth and environmental protection in order to meet the aspirations of the Surinamese people.

The inclusion and consideration of climate change in every priority sector of the recent Multi-annual Development Plan (MOP 2022-2026) for Suriname, is also an important development since the NC2. The Development Plan (OP 2017-2021) addressed the threats climate change imposes to the country in more detail. Suriname aims to attract more and expand its investments that limit CO_2 emissions and other pollution, use energy and other resources more efficiently and minimize the loss of biodiversity and damage to the ecosystem i.e., an approach known as the "Green Economy" (OP2017-2021). In the current Multiannual Development Plan (MOP 2022-2026) climate change issues are not only reflected in the environment section, but also in the economic development (e.g., gas and oil development) of the country (NC2, 2022). The second Nationally Determined Contributions (NDC 2020 (2019)) can be seen as a guiding document for a climate action plan to cut emissions and adapt to climate impacts (Republic of Suriname, 2019). This NDC should be integrated in all national development priorities. Climate change is considered in every strategic action plan for the nature and environment sector, including electricity and drinking water supply, agriculture, forestry, mining, transport, infrastructure, and spatial planning. Furthermore, building financial resilience and investing in preparedness (disaster relief, health care, and social safety nets) are critical to reducing the significant human and economic costs of climate change. Annex II gives an overview of the status of identified projects in NDC 2020 (2019).

To summarize, OP 2022-2026 acknowledges the climate issues and is being considered in various (economic) development plans and strategies, including the number of uncertainties that are closely related to climate change (Republic of Suriname, 2022).

Climate Change Concerns included in the 2020 National Election Campaign Programs of Political Parties

National Elections in Suriname were held in May 2020. Within the NC3 project an inventory was made of the awareness of climate change issues and the approach of policymakers in political party manifestos, and how these topics have been presented to the public. Seventeen (17) political parties participated in the National Election (Araya, 2020), of which only five (5) political parties (namely NDP, VHP and NPS, STREI, PALU), had written election manifestos, and briefly addressed the environment including the issue of climate change.

In 2022, the Government, formed by the political parties VHP, PL, ABOP and NPS, drafted a Coalition Agreement 2020-2025, expressing their commitment referring to joint cooperation cq collaboration, known as "*REGEERAKKOORD 2020-2025 - Samen werken aan een duurzame toekomst voor Suriname" (VHP-ABOP-NPS-PL, 2020*). In this document the parties agreed to pay particular attention to the impacts of climate change, as Suriname in general, but more specifically the Surinamese coast, is known to be one of the vulnerable areas.

Framework for Climate Change Policy

In recent years, Suriname has made great progress in preparing key policy documents relevant to climate change mitigation and adaptation. An overview of some relevant climate change policy documents, published between 2018 and March 2023, are presented in table 55.

A roadmap was drafted (as depicted in figure 76), which included climate change related polices drafted after the NC2 publication. This roadmap is based on all the initiatives and policy documents starting from the year 2016 and presents an overview of all the existing climate change plans and future activities needed to meet the country's targets and obligations as mentioned in the NDC 2020 (2019) towards 2030.

Table 55 Relevant policy documents related to climate change mitigation and adaptation

	Project / Plan /Document	Focus Areas / Remarks
1	**National Climate Change Policy, Strategy and Action Plan for Suriname (NCCPSAP) 2014-2021 consisting of a: a. National Climate Change Policy consistent with Suriname's National Development Plan (2012-2016); b. National Climate Change Strategy; c. National Climate Change Action Plan.**	The NCCPSAP was prepared for the period 2014-2021 and since its publication, a number of new climate change-related documents were produced, and legal and institutional changes have occurred. At present there is a draft roadmap established with the aim to update the existing Plan. It is important to consider these changes, when updating NCCPSAP.
2	**The Nationally Appropriate Mitigation Action (NAMA) formulated in 2019.**	Facilitates the adoption and provision of reliable access to affordable renewable energy solutions in the interior, while accelerating the reduction in greenhouse gas (GHG) emissions and significantly contributing to strides in sustainable and inclusive growth and development. The proposed lifespan of the NAMA is 20 years (2020-2040), including the implementation phase, which will take place in the first five years.
3	**Suriname National Adaptation Plan (NAP 2019-2029)**	Enables Suriname to conduct comprehensive medium and long-term climate adaptation planning. It is a flexible approach that builds on the country's existing adaptation activities and mainstreams climate change into national decision-making, development planning, policies, and programs.
4	**Reducing Emissions from Deforestation and forest Degradation, REDD+ strategy**	Three key pillars: a) Stakeholder engagement and capacity building; b) National REDD+ strategy for sustainable development; c) Implementation and tools among others forest monitoring. REDD+ aims to reduce greenhouse gas emissions as a result of deforestation and forest degradation, as well as conservation, sustainable management of forests and increasing carbon storage in forests. It is therefore considered one of the instruments for sustainable development in the last and most recent National Development Plan (2017-2021/2022-2026) of Suriname.

	Project / Plan /Document	Focus Areas / Remarks
5	**National Mangrove Strategy Suriname 2019 (NMS)**	The National Mangrove Strategy (NMS) promotes the strengthening of the legal framework (including enforcement) and introduces adaptation technologies to support the sustainable and effective management and monitoring of mangrove ecosystems. This includes building institutional capacities
6	**The Nationally Determined Contributions NDC 2020 (2019)**	Suriname is committed to maintain its forest coverage, promote the participation of renewable energy in the national energy mix, and to enhance climate resilience. NDC is focused on the sectors forests (maintaining high forest cover low deforestation rate, through enhanced efforts to promote sustainable forest management) and renewable energy (drafting a National Energy Plan and an Electricity Bill, initiatives planned for solar energy for communities in the interior in Suriname, including micro-hydro power projects).
7	**The Forest Reference Emission Level (FREL-1 and FREL-2)**	Setting forest reference emission levels (FRELs) is one of the first steps countries need to take to benefit from REDD+. As a key component of national forest monitoring systems, FRELs provide a baseline against which emission reductions can be measured, and subsequent results-based payments be made.
8	**Multiannual Development Plan 2017-2021 and Multiannual Development Plan 2022-2026**	The Multi - annual Development Plan (OP 2017-2021) addresses the threats climate change imposes to the country in more detail. This continues in the subsequent Development Plan (OP 2022-2026). OP 2017-2021 has set the focus for Suriname to attract and promote investments that limit CO2 emissions and other pollution, use energy and other resources more efficiently and minimize the loss of biodiversity and damage to the ecosystem i.e., an approach known as the Green Economy". The Multi- annual Development Plan (OP 2022-2026) reflects climate change issue, not only in the environment section but also in the economic development (e.g., gas and oil development) of the country.

	Project / Plan /Document	Focus Areas / Remarks
9	**Sector adaptation strategy and action plan (SASAP) for water resources in Suriname:**	The SASAP provides actors in the water resources sector, including Government bodies as well as non-governmental stakeholders, with a structured plan for integrating adaptation in the sector, as well as a set of concept notes to be elaborated on to enable funds to be secured for implementation of priority actions. In addition, SASAP addresses the gender issue by placing gender equality and social inclusion at the center of actions in the water resources sector by implementing a gender-responsive approach.

Source: Table compiled information adapted from Wortel, V. (2022): partial report 1 titled Climate change integrated in national policies

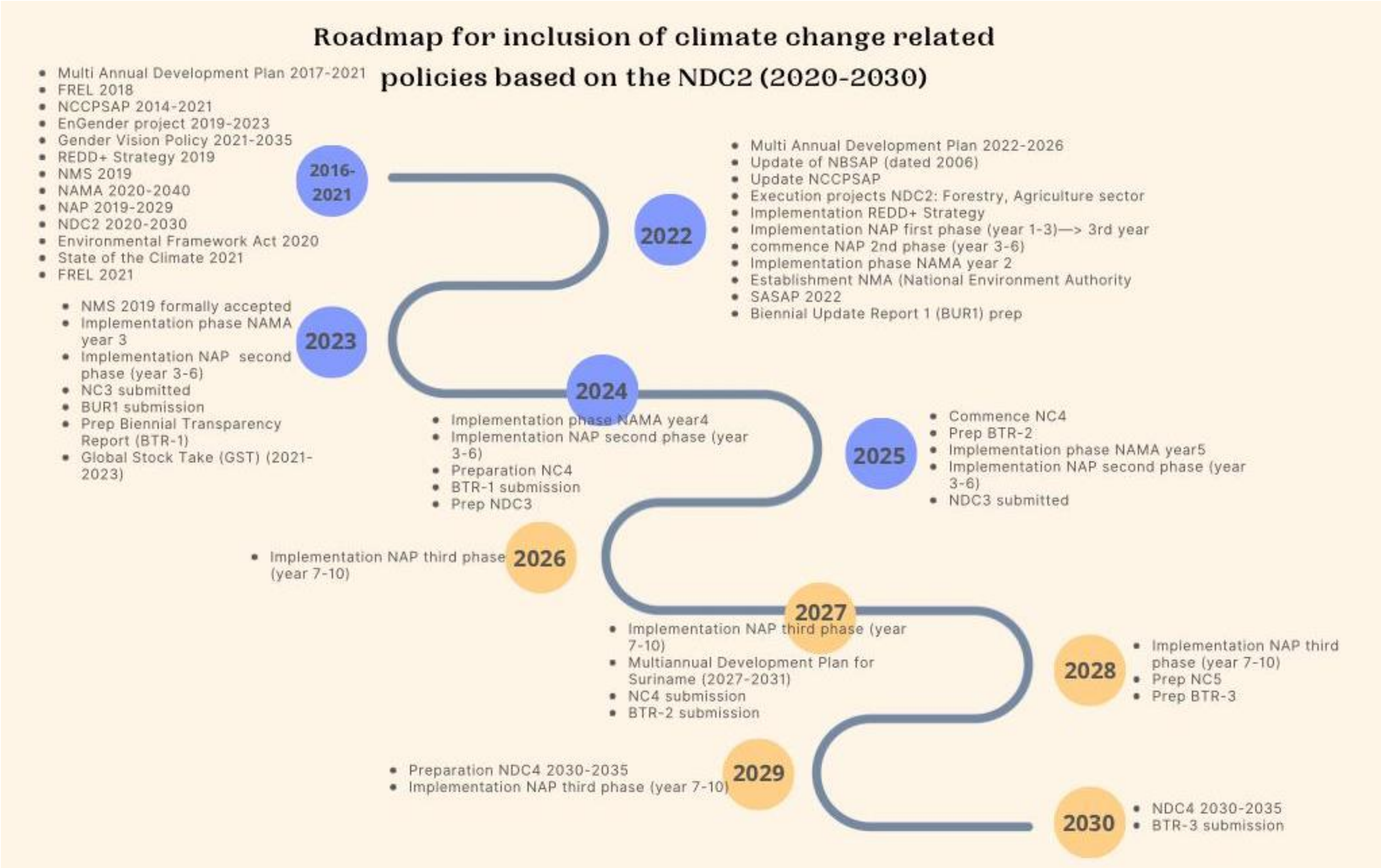

Figure 76 Roadmap for inclusion of climate change related policies based on NDC 2020 (2019)
Source: Figure drafted by Wortel, V. 2022. Retrieved from partial report: Climate Change research, climate change integrated in national policy, Information sharing, and networking. PART 1: CLIMATE CHANGE INTEGRATED IN NATIONAL POLICY, September, 2022

5.3. Development and Transfer of Environmentally Sound Technologies (ESTs)

Efforts to reduce humanity's harmful influence on the natural world and the global environment have pushed major challenges like climate change to the top of many Governments' political agendas. In addition to policy and governance, a new generation of technologies is assisting humanity to fine-tune the delicate balance between the developed and natural worlds.

As stated in NC2 (2016), several projects and strategies for adaptation and mitigation have included technology transfer. Restoration of mangroves, construction of climate-resilient infrastructure, the 'Reduced Impact Logging (RIL) system', the use of cutting-edge data logging and the Early Warning Systems are just a few examples of how technology transfer plays a crucial part in adaptation efforts. Energy efficiency, renewable energy, and developing low-carbon and energy-generating technologies are increasingly emphasized in mitigation project technologies.

Technology Transfer and Technology Needs Assessment (TNA)

The Global Competitiveness Report 2013 - 2014 from the World Economic Forum (WEF, 2013) has presented data showing that technology and innovation in Suriname are lagging behind the situation in other countries at similar stages of development (ranking 101st for technological readiness and 125th for innovation out of 148 countries). Areas in need of improvement include the availability of the latest technologies, firm level technology absorption, and foreign direct investment (FDI) as well as technology transfer.

NC2 (2016) argued that Suriname can play an active role in climate change issues, when it has the capacity to understand, use and replicate the technology. Capacity building generates competence, improves the effectiveness of the institutions working in the context of climate change, and among other things, promotes a favorable environment for implementing climate change projects.

The 2019 TNA report identified and prioritized those technologies for Suriname that contribute to climate adaptation and mitigation goals, while meeting their national goals and priorities for sustainable development. The focus was on those technology needs that can support the country to avert the risks and impacts of climate change and to reduce national GHG emissions. Looking at the future projection of GHG emissions, only five sectors were assessed in the NC2, namely: Infrastructure, Energy, Housing, Mining and Agriculture and Sustainable Forest Management. Due to a wide range of technologies that can benefit the country, the Sector Working Group (SWG) has used a participatory approach to capture the vision, success criteria and best practices across the sectors. The Infrastructure and housing, water management and agriculture technologies sectors are already prioritized for Suriname according to the TNA, which is depicted in table 56.

Table 56 Overview of the prioritized technology according to TNA (2019)

Sector	Technology
Water management	Water resource mapping Water harvesting and storage Water modeling
Agriculture	Integrated Farming system Improving irrigation efficiency Climate resilient crop varieties and livestock breeds
Infrastructure and housing	Forest specific land use planning Energy efficient building designs

Source: Technology Needs Assessment Report Identification and Prioritization of technologies for Suriname related to climate change, November 2019 - UNEP

EST Practices in Suriname

An online survey was conducted among Surinamese companies, institutions and organizations to collect more information about their knowledge, awareness and the development of and access to ESTs. This evaluation was based on the classification between vendors and users of various technologies on energy, waste reduction and pollution control (with an Environmental Management System and/ or Energy Management Systems). The tables 56 and 57 present a summary of the identified ESTs practices and objectives by the companies and other stakeholders.

Table 57 Overview of the identified EST practices per sector

Sector	EST Practice
Warehouse	• Solar water heaters • Solar energy systems
Shipping	• Solar passenger bus • Energy efficient equipment (crane and reach stacker)
Mining	• Wastewater management • Solar energy • Land use management • Solid and Hazardous waste management
Industry	• Translucent sheets in the building to reduce energy for lights • Air filters to reduce powder spill • Wastewater management plan • Monitoring plan for waste • Reuse of packaging
Food processing	• Biofuel production and use
Energy and Communication	• Efficient usage of machine (fuel management) • Water and energy management • E Top Up

Source: Table adapted from Helstone, A. (2022). Retrieved from the partial report: Development and transfer of Environmentally Sound Technologies (ESTs)

Table 58 Overview of the objectives on EST per sector

Sector	Objectives on EST Practice
Warehouse	• Reduce of the usage of HCFK cool gas • Introduction of CO_2- fridge systems
Tourism	• Green Key award • Electric Tour bus
Forestry	• Reduced Impact Logging
Industry	• Sequential batch reactor • PH buffering and micro screening in the wastewater management
Food processing	• The emission of GHG is reduced by particulate filters which captures and stores exhaust soot (some refer to them as soot traps) in order to reduce emissions from diesel cars • Management plan to reduce water and energy usage • Reduce, Reuse and recycle policy for waste • Wastewater management with a biological process, based on protection of aquatic ecosystems; • Wastewater management with a biological process, based on protection of aquatic ecosystems
Energy and Communication	• Solar panel for green energy

Source: Table adapted from Helstone, A. (2022). Retrieved from the partial report: Development and transfer of Environmentally Sound Technologies (ESTs)

The implementation of ESTs by the companies are based on decisions made by legislation, Corporate Social Responsibility (CSR), company and SDG policy, and ISO certification of the company, contrary to the other stakeholders, whose focus for committing to ESTs was set on organizational policy and the concept of CSR. An example of a project in collaboration with the Government and a semi-government company is illustrated below.

Energy Efficiency Awareness Project (2013 – 2020)

In terms of energy efficiency, the public and commercial sectors have taken initiatives (e.g., introduction of LED lightning), but technology adoption has fallen behind. The awareness campaign of the Government and the state electricity company (EBS) did not yield the desired result. During the period 2013 -2020, six (6) projects were funded by the IDB, while the GEF funded two (2) projects for development of sustainable energy in Suriname.

Some barriers were identified regarding the adoption or transfer of ESTs (as displayed in table 59. A roadmap was developed (see table 57) regarding EST activities in Suriname, pending the preparation of the next National Communication.

Table 59 Overview of barriers on adaptation and or transfer of ESTs with recommended actions to be taken

Barrier	Description of identified barriers	Recommended actions to be taken
Knowledge	• Capacity of institutions is limited – human resources; knowledge & skills – expertise is limited or lacking on specialized technology: • Implementation of ESTs by companies can be defined as a technological change, in which inputs are transformed in the enterprises based on the availability of knowledge, skills and information to reach an output, after understanding the change process	• A Science Technology Institution (STI) can support the companies in the process of selection and implementation of an EST. The setup of the STI can be supported by a platform that is structured by Government policy and legislation on ESTs, technological development and vision for Suriname, and Private Public partnership. • The transfer of knowledge of EST will lead to adoption by users and vendors of the ESTs. The engagement of the users and providers will be an important task for the STI.
Dissemination of information	• Data and technical capacity is limited. Inadequacy of information and decision support tools represents a significant challenge. • Lacking (or limited access to) of systems for collecting, synthesizing and feeding back information and knowledge on ESTs. Structural data and information sharing arrangements are very limited. • The educational and research Institutes in Suriname Anton de Kom Universiteit van Suriname (AdeKUS), PolyTechnic College Suriname (PTC), Natuur Technisch Instituut Suriname (NATIN), Lagere Technische School (LTS) do not have a specific programme or Agenda	• Agencies and institutions have been identified by the companies to assist in the development and implementation process of the ESTs such as: NIMOS, Directorate for Environment, Anton de Kom University of Suriname, ASFA, VSB, KKF, Akmos, NGO / CSO, Environmental Activists organization. • More exchange of information is needed – partnerships, project cooperation, networking etc. should be initiated or developed and maintained.

Barrier	Description of identified barriers	Recommended actions to be taken
	on Technological Development and ESTs.	

Cooperation Partnerships and mechanisms for technology transfer	• Limited coordination of activities by the government, the private sector and citizens.
	• Insufficient budget for investments and recurrent costs
	• Non-structured organization of information change:
	  ○ Stakeholders from the government and civil society organizations such as: NIMOS, ASFA, KKF, VSB, are informing their stakeholders on a regular basis.
	  ○ Dissemination of information about ESTs to other target groups is done through providing of service, public relation and grants on adhoc basis.
		• The importance of developing partnerships to enable technology transfer, and promotes alternative financing sources for climate compatible development – set up of a coordinating unit (e.g climate finance coordination unit)
		
		• The companies' ability on implementation of corporate social responsibility policy will depend on finance, availability of human capacity and information and priority of government policy on ESTs.
		
		• Awareness raising by companies on the advantage of ESTs are dependent on their personal capacity and sharing of experiences on ESTs that already is implemented between companies.

Policy frameworks	• Low Public awareness of and political attention. • The legislation and policy programme on technological development and ESTs is absent in the policy programme of the government of Suriname. • Suriname lacks policy on CSR and effective implementation of environmental law.	• Transformation of departments of the ADEKUS into Scientific Technological Institutes based on legislation can assist the companies in Suriname to implement ESTs in their system.

Source: Table adapted from Helstone, A. (2022). Retrieved from the partial report: Development and transfer of Environmentally Sound Technologies (ESTs)

Table 60 Proposed structure for next NC on ESTs in Suriname within 3-4 years

Objective	Platform for Science Technology Institute on ESTs		
Goal	**Activities**	**Output**	**Responsible actors**
1. EST in National Legislation and Action Plans	• Incorporation of ESTs in the environmental framework act • Development of an EST action plan	• Selected EST is incorporated in the environmental framework. • EST action plan for Suriname has been developed.	NIMOS, ROM, EZOTI, CSO
2. EST Priority Agenda 2060	• Implementation, monitoring and evaluation of the TNA prioritized technology • Monitoring and dissemination of the ESTs companies and organizations already practise	• Yearly progress reports	ROM, EZOTI
3. Transfer of Knowledge action plan	• Develop an action plan based on bottom-up approach on the ability, willingness and engagement of companies and institutes to adapt ESTs	• Action plan on ESTs adaptation transformed in a national agenda	Public, Private Partnership

Source: Table adapted from Helstone, A. (2022). Retrieved from the partial report: Development and transfer of Environmentally Sound Technologies (ESTs)

5.4. Climate Change Research and Systematic Observation and Research on Effective Responses

Climate change is the defining issue of our time, from shifting weather patterns that affect nearly every aspect of people's lives, from food sources to rising sea levels that increase the risk of catastrophic flooding and more. The impacts of climate change are global and Suriname too, cannot escape these ramifications. It is crucial to understand how the climate is changing to mitigate and adapt to these impacts.

Research and systematic observations help to understand climate change to prepare for the future; by studying the climate, tools are developed that can assist with predicting future scenarios to ensure our livelihoods, guide policy, and support biodiversity conservation efforts. In this context, Parties could provide information on their participation in, and contribution to, activities undertaken, on a global, national, regional, and sub-regional basis in the areas of climate change research and systematic observations, as well as in global change research networks (UNFCCC, 2003).

Climate Change Research

The (scientific) research in Suriname is mainly project driven and is at present more focused on estimating carbon stocks (less on other aspects of Greenhouse Gasses and climate change), considering the implementation of the Suriname REDD+ program and Suriname's commitment to reporting to the UNFCCC. Project driven (research) activities are a limitation as follow-up (research) activities are not guaranteed. (Research) Programs are funded through projects, but for sustainability should be streamlined with the climate change policy and plans of the Ministry of Spatial Planning and Environment (ROM). Through this Ministry, access to funding is available for implementing long-term (research) activities. Direct involvement of NGO's, such as Conservation International Suriname (CI-S), UNDP Suriname, Tropenbos International Suriname (TBI-S), World Wide Fund for Nature Guianas (WWF), Green Heritage Fund Suriname, MAFOSUR, in implementing (research) projects is noticeable, compared to their role in the past where they were mainly a facilitating and funding agency. The ongoing climate change work, including research, contributes to informing the climate change strategy and policy development in the country. Tables 61 and 62 respectively provide an overview of the projects involving climate change research and published scientific literature.

Table 61 Overview of the projects involved with climate change research

Projects		Description
1	**Building with Nature project (2015-2016)**	A one-year project funded by Friends of Green Suriname and Conservation International-Suriname. This project was carried out at the coastal area Weg naar Zee (one of the most vulnerable coastal areas in Suriname), by AdeKUS, the department of Infrastructure and the Sustainable Management of Natural Resources (SMNR) department from the Faculty of Technology. The focus of the project was on rehabilitating degraded mangrove areas and working towards adaptation measures against climate change i.e., establishing Sediment Trapping Units (STUs).
2	**The Global Climate Change Alliance (GCCA+) Suriname Adaptation Project**	This project was based on strengthening climate change adaptation capacities. This project was enabled to enhance the knowledge and capacity of Government staff, support research and studies in support of water management, mangrove monitoring, rehabilitation, and conservation. Furthermore, the project has contributed to drafting of policy documents and increased livelihood for beekeepers, farmers, and reduction of pet bottles in water ways through collection of household plastic bottles. Many local partners, Government agencies, research institutes and NGO's, benefitted from this project (UNDP Suriname, 2020).
3	**The Suriname REDD+ Program**	The REDD+ Program is coordinated by NIMOS and the technical coordination lies mainly within the competence of SBB. Apart from policy documents concerning REDD+, also many (research) projects have been implemented, resulted from this Program, such as (a) The National REDD+ Strategy (2019); (b) Validation of pantropical and national allometric models for determination of Tree Biomass and Volume study (2018-2020) (Wortel et.al, 2020); (c) Dissemination and sustaining of Marchall kreek Agroforestry initiative (2019-2021) (Bihari, 2021)
4	**The Working Landscape Program (2019-2023)**	The Program is coordinated by Tropenbos International Suriname and will contribute to the mitigation and adaptation of Climate Change, improved livelihoods, and environmental integrity by promoting climate smart forested landscapes. This program is executed in communities situated in the Boven-Suriname river area. CELOS is working in close collaboration with Tropenbos Suriname to achieve the objectives set in this program

	Projects	Description
5	**Human interference in the tropical rain forest ecosystem Program (1975-present)**	This program was a joint venture between the Wageningen University (Netherlands) and CELOS and commenced in 1978. The general objective was the evaluation of the consequences of human interference on the potential productivity of the ecosystem, on its environment and on its capacity for sustained timber production. Through this project one of the oldest Sustainable forest management systems (SFM) in the world was developed, simply called the CELOS Management System (CMS) (Hendrison et.al., 2011).
6	**Climate Smart Forestry**	The launch of the Climate Smart Forestry Project took place in August 2021. Conservation International- Suriname (CI-S) together with NIMOS and SBB are collaborating to set up a verified Climate Smart Forestry (CSF) standard, that can contribute to national emissions reductions. CSF includes a number of logging best practices to prevent degradation in highly biodiverse tropical forests (Conservation International Suriname, n.d.). Technical progress was made with the design of a CSF pilot and funds have been released through Conservation International to invest in a CSF pilot in the Bigi Poika and Matawai community forest and a private concession
7	**Enhancing resilience of the coastal ecosystem using natural infrastructure project (2021)**	This project is executed by the Ministry of Spatial Planning and Environment (ROM) in collaboration with the AdeKUS and is funded by the Amazone Cooperation Treaty Organization (ACTO). This project aims to increase the resilience of the coast through the construction of units to collect sediment and repair damage to mangrove forests over a length of 2 km.
8	**Community Resilience Building in the Caribbean (CRB) Project**	Canada Red Cross (CRC) contracted three (3) National Societies (NS) in Belize, St. Vincent and the Grenadines, and Suriname (Suriname Red Cross Society (SRCS)) to implement the Community Resilience Building Caribbean region Project (CRB). The implementation targeted 17 communities, of which 7 in Suriname, 3 in Saint Vincent and the Grenadines and 7 communities in Belize. The overall objective of the CRB project was to increase the resilience of these communities by applying a gender-responsive approach to community disaster risk management and climate change adaptation (Community Resilience Building (CRB) Caribbean Region Program, n.d.). Communities were trained in the implementation of community resilience plans, the design of writing, executing, and managing micro projects for Climate Change Adaptation (CCA) and the creation of formal gender strategies for each National Society (NS). An important

Projects		Description
9		output of the project was setting up of the Community Early Warning System (CEWS). To ensure that the CEWS were properly set up, SRCS collaborated with various organizations, such as the Anton de Kom University of Suriname (ADEK), the Maritime Authority of Suriname (MAS) and the Meteorological Service of Suriname (MDS) to provide training courses and sessions.
9	**Evolving from shifting agriculture towards agroforestry systems in Suriname: food security from sustainable production**	This project was formulated and initiated in 2018, by the Government of Brazil through the Brazilian Cooperation Agency (South-South Technical Cooperation) and the Government of Suriname (coordinated by the Ministry of Foreign Affairs). The technical implementation institutions for Suriname are the Ministry of Agriculture, Husbandry and Fisheries (LVV), Ministry of Regional Development (RO), and CELOS. It was supposed to be a 24-month project but was unfortunately put on hold due to the COVID-19 pandemic, therefor the project commenced in 2022. The main goals of this project are to establish a capacity building program focusing on agricultural production within an agroforestry system
11	**IICA Climate Change, Natural Resource and Risk Management program**	The Inter-American Institute for Cooperation on Agriculture (IICA) has a program concerning climate change and since 2018 about 6 projects/activities took place in Suriname (IICA, n.d.): 1. Promoting Sustainable Livelihoods through the Utilization of Permaculture for Mangrove Rehabilitation in Coastal Communities in Suriname; 2. Services to Facilitate the Promotion of Perm Apiculture and Perm Agriculture for Climate Resilience Agriculture in Suriname.; 3. Climate Change, Natural Resources and Management of Production Risks in Surinam: System of Rice Intensification (SRI).; 4. Services to facilitate consultation and training towards improved Agricultural Disaster Risk Management in Suriname; 5.Establishment of Pilot for Improving Sanitation for Indigenous Communities in the Hinterland of Suriname; 6. Use of the Green Climate Fund (GCF) Readiness mechanism for Eastern Caribbean States (ECS) in the Caribbean Region.
12	**The EnGenDER Project**	The Enabling Gender-Responsive Disaster Recovery, Climate and Environmental Resilience in the Caribbean (EnGenDER) Project is funded by Global Affairs Canada and the United Kingdom Foreign, Commonwealth and Development Office, which is led by the United Nations Development Programme (UNDP) and jointly implemented by UN Women, World Food Programme (WFP) and the Caribbean Disaster Emergency Management Agency (CDEMA). The aim of the project is to identify and address any gaps to ensure equal access to disaster risk resilience, climate change and environment solutions for women, men,

	Projects	Description
		boys, and girls in nine beneficiary Caribbean countries, including Suriname. The four priority sectors selected by the National Decision-Making Mechanism for Suriname under EnGenDER are agriculture, water, energy, and forestry (UNDP, 2019; Bowen, 2021). The EnGenDER Project also enabled the development of a Gender Vision Policy document (2021-2035) for the Ministry of Home Affairs (Bureau Gender Affairs (BGA)).

Source: Compiled information adapted from Wortel, V. (2022): partial report 2 titled Systematic Observation and Research

Table 62 Scientific literature publications on climate change in Suriname 2015-2021

Authors	Title of Publication and source	Sponsors/ collaborators	Relevance	Specific area
ForestPlots.net *et.al. 2021*	Taking the pulse of Earth's tropical forests using networks of highly distributed plots, *Biological Conservation*, Volume 260, 2021, 108849, ISSN 0006-3207	ForestPlots.net, University of Leeds	Conservation of biodiversity and ecosystem services	Management and conservation of Permanent Sample Plots
Sullivan, M., Lewis, S. L, *et.al. 2020*	Long-term thermal sensitivity of Earth's tropical forests. *Science*. 368. 869-874	ForestPlots.net, University of Leeds	Global Climate Change	Forest Carbon, climate adaptation potential
Piponiot, C., Rutishauser, E., *et.al.* 2019	Optimal strategies for ecosystem services provision in Amazonian production forests. *Environ. Res. Lett.* 14 124090	CIRAD, Tropical Managed Forest Observatory (TmFO)	Sustainable Forest Management (SFM)	Ecosystem services in tropical production forests
Piponiot, C., Rödig, E., *et.al.,*2019	Can timber provision from Amazonian production forests be sustainable? *Environ. Res.Lett.* 14 064014	CIRAD, Tropical Managed Forest Observatory (TmFO)	Sustainable Forest Management (SFM)	Sustainable Forest Management (SFM), timber logging
Roopsind, A., Wortel, V., *et.al.,* 2017	Quantifying uncertainty about forest recovery 32- years after selective logging in Suriname. *Forest Ecology and Management* 391: 26-255	CELOS, University of Florida (USA), University of Hamburg (Germany)	Sustainable Forest Management (SFM)	Sustainable Forest Management (SFM), Forest recovery (biomass/ carbon stocks, tree commercial volume)
Jingjing Liang,Thomas W. Crowther, *et.al.,* 2016	Positive biodiversity-productivity relationship predominant in global forests. Science 354: Issue 6309	Global Forest Biodiversity Initiative (GFBI)	(Tree) biodiversity, ecosystem services	Biodiversity, ecosystem productivity

Authors	Title of Publication and source	Sponsors/ collaborators	Relevance	Specific area
Rutishauser, E., Hérault, B.,*et.al.*, 2015	Rapid tree carbon stock recovery in managed Amazonian forests. Curr. Biol. 25, R787–R788.	CIRAD, Tropical Managed Forest Observatory (TmFO)	Sustainable Forest Management (SFM), carbon stock recovery	Sustainable Forest Management (SFM), carbon stock recovery

Source: Compiled information adapted from Wortel, V. (2022): partial report 2 titled Systematic Observation and Research

Climate Change Systematic Observation

Suriname improved her systematic observation and monitoring infrastructure. For decades the Meteorological Services Department (MSD) was considered the main agency reporting on meteorological data; currently there are other agencies and organizations in place that can be included in this infrastructure. Table 63 provides an overview of institutes involved with climate systematic observation and data collection for research purposes and policy.

Table 63 Overview of the organizations involved in climate change systematic observation

Institute / Organization	Remarks
Meteorological Service of Suriname (MDS)	The Meteorological Service of Suriname (MDS), as an integral part of the Ministry of Public Works, is the leading Governmental authority in providing the nation with climate-based data derived from systematic and accurate monitoring and data collection and analysis. The Service maintains and manages all meteorological data of the country. They are responsible for all weather forecasts and meteorological data for Suriname.
National Forest Monitoring System (NFMS)	The National Forest Monitoring System (NFMS) was set up in the course of 2016 as part of the REDD+ program in Suriname (REDD+ Suriname, n.d.). The NFMS consists of six components (REDD+ Suriname, n.d.): (1.) Satellite Land Monitoring System (SLMS); (2.) Near Real Time monitoring (NRTM); (3.) Sustainable Forestry Information System (SFISS); (4.) Involving communities in forest monitoring (CBM); (5.) National Forest Inventory (NFI) and (6.) Reporting
The Maritime Authority in Suriname (MAS)	The Maritime Authority Suriname (MAS) has the task to: (1) guarantee a safe and efficient passage of sea-going vessels to and from Suriname, based on internationally accepted standards and rules and in accordance with the ratified conventions by Suriname; (2) Regulatory compliance monitoring shipping and shipping traffic.
The Hydraulic Research Division (WLA)	The Hydraulic Research Division (WLA) of the Ministry of Public Works had a hydrometric basic network consisting of only 18 operating stations in the coastal area. Coverage for the coastal area can be estimated at 50% and no coverage for the interior regions.
Suriname Water Resources Information System (SWRIS)	SWRIS is an Information System that is a web-based scientific framework with water-related information on Suriname (water portal). It is open to public. The main goal is to promote and foster human resources development (knowledge and techniques) on integrated water resources management (IWRM) in Suriname focused on sustainable use of water resources ("Background SWRIS project", n.d.).

The CELOS KABO Tree Database part of the Tropical managed Forests Observatory (TMFO) and the ForestPlot.Net network	The CELOS KABO Tree Database consist of data collected from their long-term sustainable forest management experiment (40+ years old) i.e., tree data collection over the years, from Permanent Sample Plots (PSP).

Source: Compiled information adapted from Wortel, V. (2022): partial report 2 titled Systematic Observation and Research

5.5. Information Exchange and Networking

Information and networking are an integral part of the process of preparing national communications and other activities relating to the implementation of the Convention (UNFCCC, 2003).

Information Sharing

With each national reporting, Suriname has improved its information sharing infrastructure. There are currently four (4) data and information platforms i.e., SWRIS, GONINI, KOPI, DONDRU available and open to everyone, including the public/civil society, private sector, Government, NGOs, and Academia (see table 64). Suriname is part of major international treaties and networks regarding climate change, however some improvements are needed on the national level. Clear, concise and sound agreements between the Government of Suriname (GOS) and institutions working in the field of climate change are necessary regarding the data, information and capacity needs of both parties. Activities should be streamlined to avoid conflicting situations (e.g., same activities are carried out by different institutions or agencies, funds are misallocated).

Networking

Suriname participates in several international climate change initiatives and in organizations which aim to enhance knowledge and to act on climate change issues. Suriname participates in the ‘Energy and Climate Partnership of the Americas (ECPA) initiative, to promote regional energy cooperation through different strategies and actions for achieving a cleaner, safer energy future. The ECPA focuses on energy efficiency, renewable energy, cleaner and more efficient use of fossil fuels, energy poverty, and infrastructure, regional energy integration and energy research and innovation. Inter-American and regional institutions, such as the Organization of American States (OAS) and the IDB, multilateral development banks such as the World Bank, private sector, civil society, and academia, are supporting ECPA. With the support of partners such as the IDB and the Government of the Republic of India, Suriname has begun to install mini solar power grids in several villages in the interior (ECPA, 2022).

Table 64 Overview of the data and information platforms active on climate change

Website name	Organization (s)	Year	Description of the website
Suriname Water Resources Information System (SWRIS) **https://www.swris.sr/**	AdeKUS/GCCA+ the United Nations Development Programme (UNDP)	2009 /2017	Is an information center for the collection and distribution of water data to promote the conservation of aquatic resources in Suriname. SWRIS is an Information System that is a web-based scientific framework with water-related information on Suriname (water portal) and is open to public. Promotes and fosters human resources development (knowledge and techniques) on integrated water resources management (IWRM) in Suriname focused on sustainable use of water resources. This water portal has structured information on water resource development and management, policies, data management infrastructure and systematic observation, of the various Ministries; Is transparent, and user-friendly for the different stakeholders. Through this water portal, the websites of the partners (MDS, SWM, AdeKUS, WLA, MAS) can be accessed, where other relevant information is available then water related information alone.
GONINI **https://gonini.org/**	Foundation for Forest Management and Production Control (SBB), an agency of the Ministry of Land Policy and Forest Management (GBB)	2016	Is an online database with geographic forest related information about Suriname; Has expanded into a National Land Monitoring System of Suriname.
KOPI **https://kopi.sbb.sr/**	SBB		All statistical data, produced within the framework of the National Forest Monitoring System (NFMS) can be viewed.

Website name	Organization (s)	Year	Description of the website
DONDRU **https://dondru.sr/**	ROM and NIMOS	2022	A knowledge database managed by NIMOS for cluster-related data and information about climate change in Suriname with the objective to publish official and formal environmental data and information for national policy and planning.
Ministry of ROM **https://minrom.sr/**	ROM	2022	Information is available concerning the various policy areas (including climate change) and environmental projects the Ministry is involved in.
Suriname Red Cross (Het Surinaamse Rode Kruis) & **National Disaster Agency (Nationaal Coördinatie Centrum voor Rampen Beheersing, NCCR)** **https://gov.sr/thema/nccr-en-noodfonds/**	Suriname Red Cross/ NCCR		Both organizations work together in (marginal) communities, sharing knowledge, organize training to promote and build community resilience against the effects of climate change (disaster management). The Suriname Red Cross has a website and publishes an annual Newsletter. The NCCR is part of the Ministry of Defense and has a coordinating role where different departments like the fire brigade, police, the army, and medical service, are organized in times of disaster or calamities to work in an efficient and organized manner. The NCCR is proactively present in society by providing information, education, and training on how to act in the event of calamities and incidents.

Source: Compiled information adapted from Wortel, V. (2022): partial report 3 titled PART 3: INFORMATION SHARING AND NETWORKING

Suriname, as a member of the Caribbean Community Climate Change Centre (CCCCC), participates in the board of Directors since 2012 for a consecutive period of three years. At present the chair of the board is a representative of the Commonwealth of Jamaica. The Ministry of Spatial Planning and Environment is representing the GOS in the board of CCCCC. As a member, Suriname can participate in regional projects related to climate change and have access to information that will support the country to make responsible and informed decisions on climate change mitigation and adaptation (CCCCC, n.d.).

Furthermore, Suriname is member (signed in 1978) of the Amazon Cooperation Treaty Organization (ACTO), which gives access to various (information and expertise) networks, capacity building courses, and funding for (research) projects. It is an intergovernmental organization formed by the eight Amazonian countries: Bolivia, Brazil, Colombia, Ecuador, Guyana, Peru, Suriname, and Venezuela (ACTO, n.d.). The most recent ACTO projects related to climate change in Suriname include: (i) Advancing a "Blue Forests for Blue Economy" approach in Suriname project and (ii) Enhancing resilience of the coastal ecosystem using natural infrastructure (Government of Suriname, n.d.).

In June 2020, the second phase of the Global Climate Change Alliance Plus Initiative (GCCA+) *Resilience building through integrated water resource management, sustainable use, and coastal ecosystems management*, funded by the European Union (EU) and implemented by the UNDP, commenced, and will continue until September 2023. The general objective is to support Suriname in coping with the main effects of climate change. The specific objectives include (GCCA+, n.d.): (I) Increased resilience of coastal communities in Nickerie and Coronie districts against the threat of sea level rise; (II) Improved national governance in the areas of integrated water resource management and integrated coastal zone management.
In the first phase of the GCCA+ initiative, institutes like WLA, MDS and MAS, received a lot of support in the area of capacity building. This support will continue in the second phase of GCCA+ (UNDP Suriname, 2020).

Much overlooked (research) networks are the ones linked to the Centre for Agricultural Research in Suriname (CELOS). The Forest Management department of CELOS is responsible for the vegetation protocol and research in important long-term sustainable forest management experiment. Through this experiment, CELOS became officially part of the global network, like the Tropical managed Forests Observatory (TmFO) Network, studying the long-term effects of logging and climate change on tropical forest ecosystems, subsequently investigating the response of tropical forests to logging in terms of biomass dynamic (forests as carbon sink), timber volume recovery and changes in species composition over time. These results will provide a strong basis for policymakers and forest practitioners to build up new guidance towards sustainable forest management and tropical forests preservation. TmFO is coordinated and supported by the

Centre de Coopération Internationale en Recherche Agronomique pour le Développement (French Agricultural Research Centre for International Development), CIRAD, an open network, consisting mainly of scientists, research organizations and universities working in managed tropical rainforest around the world (TmFO, n.d.).

The KABO Database is also part of ForestPlot.Net. A network that focuses on the tropics and works to understand the life of trees and ecosystems. Especially since tropical forests are the heart and lungs of the planet, housing species, regulating the climate, and supporting people. Data from over 6000 permanent sample plots (PSPs) in 62 countries are stored through ForestPlot.Net and used to monitor tropical forests considering their response and resilience to climate change. The results are published in peer-reviewed scientific journals (ForestPlots.net, n.d.).

5.6. Information on Education, Training and Public Awareness

Although Suriname has a relatively small contribution to global carbon emissions and retains much carbon, due to its large forest area, the country is already experiencing the impacts of global climate change. Climate change is also a threat to the traditional way of life, so adapting to the changes is a prerequisite. Educating youth concerning the aspects of climate change is essential and taking actions to protect our future is necessary.

Awareness and Training

A stakeholder analysis (as depicted in figure 77 showed that several stakeholders such as: non-governmental organizations (NGOs), governmental organizations (GOs) and civil society organizations (CSOs), were active in the field of awareness and training in recent years.

These organizations have produced around 100 different outputs, ranging from written and audio materials, such as brochures, newspaper articles, books, posters, factsheets, policy documents, briefing papers and radio programs, videos, online and TV media productions, field activities, competitions, workshops and a board game. Most of these materials are presented in Dutch, but a few are in languages spoken by Indigenous and Tribal Peoples (ITP).

Suriname has no formal climate literacy standard. Yet, after an assessment of the organization’s output, it can be stated that: a) 50% of the information and awareness output did not include any of the seven essential principles of climate science; b) 50% had information on at least one of the seven principles; c) most of the products did not directly relate to the principles of climate science but did relate to some aspect of sustainable development.

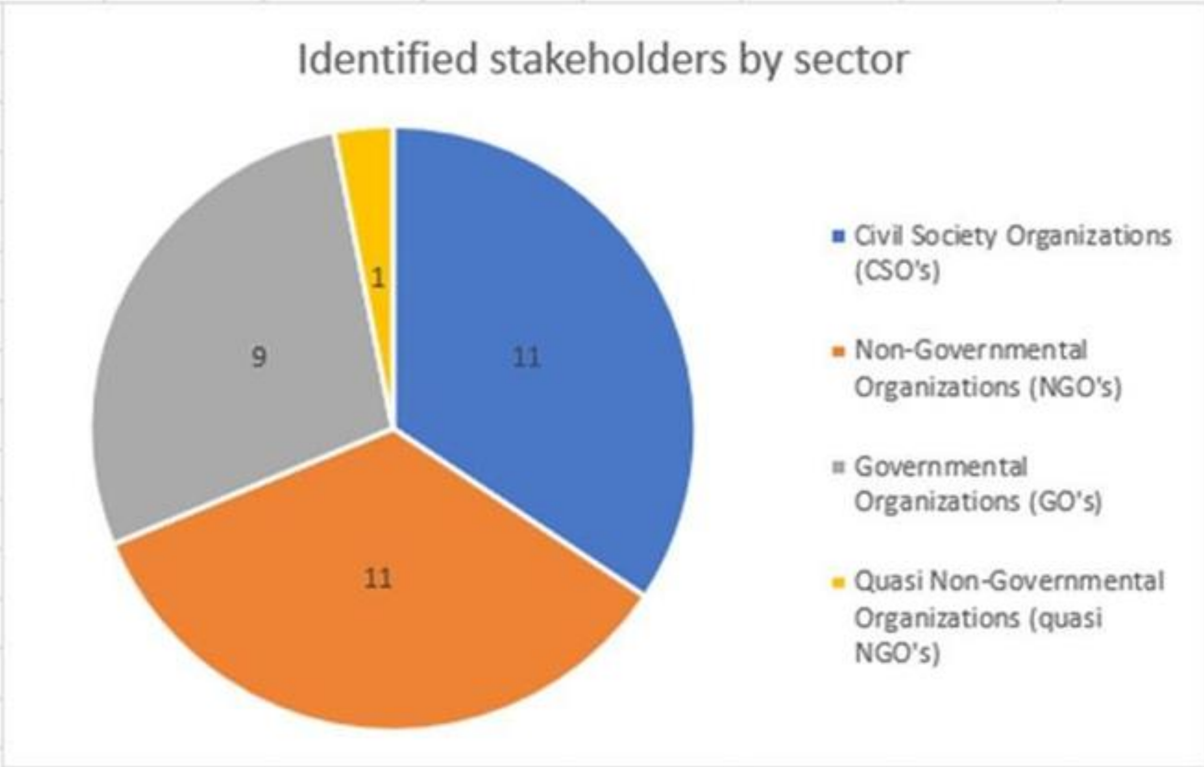

Figure 77 Identified stakeholders by sector
Source: Figure adapted from the partial report drafted by Pool, M. and Dipowirono, V. from the Green Heritage Fund, August 2022

Education on Climate Change

According to the National Climate Change Policy, Strategy and Action Plan (NCCPSAP) for Suriname 2014- 2021, the climate change objectives of the Ministry of Education, Science and Culture (MINOWC), should mainly focus on environmental awareness in the diverse educational institutions, such as early childhood or pre- primary, primary , secondary, tertiary and vocational education institutions, with the prime objective to provide relevant information, which would be beneficial for current and future generations in their respond to climate change matters. Furthermore, the NCCPSAP states that MINOWC has developed curricula with material provided by the former Ministry of Labour, Technological Development and Environment, and NIMOS. The curricula include environmental awareness projects (including climate change) that were implemented at various primary schools.

The Advanced Teacher Training Institute (IOL) also incorporated climate change in its curricula, through several modules (i.e., ecology, environmental science and botany, biodiversity management). In dealing with the standard contents, the students are confronted with the causes and consequences of climate change. Additionally, students complete the respective modules with a small research project (literature and field research), which they present to their fellow classmates. In this way, the students can broaden their knowledge and scope on climate change related issues, which are required to be included in their research.

Furthermore, experts are invited to give guest lectures on specific topics relating to the subject, such as the threats of climate change for certain animal or plant species.

The Anton de Kom University of Suriname (AdeKUS) offers a two-year Master of Science program in Sustainable Management of Natural Resources (SMNR) since 2009. This Master's program provides education and research on seven themes: land and water management, renewable energy, mineral resources, biodiversity, sustainable agriculture, sustainable forestry, and natural products.

Since 1 November 2020, the Faculty of Social Sciences of the Anton de Kom University of Suriname (AdeKUS), in collaboration with the Flemish Inter-University Council (VLIR), has presented a three-year Master's course in Education and Research for Sustainable Development (MERSD). The MERSD program is an academic program that aims to train development specialists. Therefore, the course provides the students with scientific knowledge, insight, skills, and attitudes that enable them to independently formulate, analyze, and implement policies in concrete situations. The MERSD program is a research-oriented Master's program that focuses on people who can unify themselves with the concept of Education for Sustainable Development (ESD). They learn to develop knowledge and skills for the benefit of sustainable development at all levels: personal, social, national, and global. This program is centered around four pillars: people's participation, community development, poverty reduction and entrepreneurship.

National Action Plan for Climate Change Awareness, Education and Training

A broad section of the stakeholders, participated actively to formulate a national climate action plan for awareness, education and training under the NC3 project. The stakeholders jointly assisted to prepare actions in order to implement climate change awareness, education and training activities. This national action plan builds on previous work and values already developed materials. It supports various stakeholders to improve the work already done.

The National Action Plan for Climate Change Awareness, Education and Training contains several actions that are applied to raise awareness concerning climate change among the different groups (youth and tribal communities). The various activities must ensure that people and communities are prepared to make adjustments in how they use natural resources so that it ultimately leads to a sustainable community, that considers the phenomenon of climate change in its development. The developed national action plan can support policy makers to turn their visions into reality and increase organizational efficiency and accountability. The following activities are prioritized in the action plan:
(i) Implement climate change documentaries for youth in different local languages; (ii) Make short videos and news articles that contribute towards

increasing Suriname's contribution internationally; (iii) Setting up a climate change group platform to strengthen cooperation between Ministries, organizations and institutes involved in climate change, among others.
Within the framework of the NC3 project these activities are being implemented in cooperation with the Directorate for Environment of the Ministry of Spatial Planning and Environment. Therefore, it is also essential to develop an action plan for funding and implementation. The Directorate for Environment will also inform the relevant parties c.q. actors to facilitate climate change awareness, education, and training campaigns. A crucial element in this plan is organizing regular consultations with the stakeholders (organizations). Especially for the ITP, considering this is an opportunity to get involved in activities relating to climate change e.g., creating climate change communication materials to be used for awareness, education, and training of citizens, especially youth and tribal communities.

5.7. Capacity Building

Suriname has a relatively small population and workforce, making capacity building extremely crucial. It is very important to offer institutions and individuals sufficient opportunities to build their capacity in a smart way. The strategy within the NC3 project is to work towards a permanent structure for national reporting, as capacity building and training, to build the knowledge in the country, and enable self-implementation in the future is very important.

Capacity Building Initiatives

Since NC2 to date, Suriname has established several efforts and plans with regards to capacity building and training status and needs. A list of these efforts, as far as traceable, is presented in table 65. With these efforts, Suriname has demonstrated to have a strong focus on capacity building in order to play an active role in climate change issues, as it generates competence, improves the effectiveness of the institutions that work within the context of climate change and promotes an enabling environment. Capacity building is increasingly embedded in most activities (e.g., studies, project etc.) related to climate change issues. For example: Recent and future changes in climate in Suriname have been and are being explored using a combination of observations and climate model projections mostly executed by the Anton de Kom University of Suriname (AdekUS) in collaboration with other universities such as from the Caribbean, Belgium (KULeuven) and South Africa. The GOS also carried out several studies containing measures to mitigate climate change, as well as measures to facilitate adequate adaptation to climate change. Different institutions such the General Bureau for Statistics (ABS), Meteorological Services, CELOS, MAS, conservation NGO's such as WWF, Conservation International, Tropenbos, and Amazon Conservation Team, have been involved in conducting and implementing these studies as well as other specific studies and projects either in cooperation or on an individual level to build the local capacity and fill in the local training needs as much as needed.

Table 65 Overview of projects and plans addressing capacity building and training efforts since NC2 (2016)

Project/ Plan/ Documents	Year	Description	Remarks
National Climate Change Policy, Strategy and Action Plan for Suriname	2014-2021	Training of national technical capacity for leading and implementing Suriname's climate change mitigation and adaptation actions. The plan lists a number of capacity building priorities: ● Interdepartmental cooperation, mandates and responsibilities with respect to climate change governance; ● Comprehensive national research on social, environmental and economic baselines, climate science, vulnerability, impacts and risk management; ● The enactment of the Environmental Framework Act which addresses integration of climate change across multiple planning themes; ● Amendment of existing sectoral legislation or draft laws to incorporate climate change considerations.	Partially implemented through NC2 and other climate change related projects such as NDC's.
National Development Plan	2017-2021	The strengthening of developmental capacity.	Partially implemented through sectorial projects
Suriname REDD+ readiness Project	2018	Strengthening of Suriname's technical, institutional, political and financial capacities.	Finished. Status of implementation not known.
Forest Reference Emission Level	2018	Building of capacity on calculations of carbon dioxide for the forests.	Ongoing
National REDD+ Strategy of Suriname	2019	Capacity building and training for the reduction of greenhouse gas emissions as a result of deforestation and forest degradation, as well as conservation, sustainable management of forests and increasing carbon storage in forests through broader stakeholder participation, strengthening of research institutions in forest monitoring, training of operators.	Finished. Status of implementation not known.

Project/ Plan/ Documents	Year	Description	Remarks
IWRM Action Plan, Capacity Building for Integrated Water Resource Management in Suriname; GCCA+ Project.	2019	A situational analysis of Integrated Water Resource Management in Suriname. Support provided to the Ministry of Natural Resources.	1. IWRM implementation based on action plan, currently in execution within the Water Department of the Ministry of Natural Resources. 2. Water quality data collection with support from WLA of the Min of PB in support of Draft Surface water legislation development.
Technology Needs Assessments (TNA)	2019	Building of capacity and training for the identification, prioritization and diffusion of environmentally sound technologies for mitigation and adaptation to climate change focusing on Agriculture, Water Management and Infrastructure & Housing.	Finished. Status of implementation not known.
Nationally Determined Contribution (NDC)	2019	Sectorial programs on capacity building and institutional strengthening.	Ongoing
National Adaptation Plan	2019-2029	Strengthen the capacity to invest in climate change mitigation and adaptation technologies.	Ongoing
National Development Plan	2022-2026	Focusses on the strengthening and capacity building of institutions, development of local content (through a local content office) and making funds available under the 2030 agenda.	Ongoing

Source: Compiled from the partial report "Training and Capacity Building Plan with regards to Climate Change by Somwaru, L. and Koendjbihari, S. (2022)

Capacity Building Through Training

In NC2 the following gaps were identified: (i) Knowledge related to having specific expertise in climate change and related topics; (ii) Creation of techniques and technologies to address climate change mitigation and adaptation; (iii) Setting up a proper data collection and information network. Data collection and information sharing are identified as basic requirements for proper climate change and related analysis.

Anno 2023, the availability of in-house capacity to carry out projects/ activities related to NC3 is very limited and comparable for all sectors, especially in the Government, semi-government, and private sector. These capacities include the approach and interpretation of climate change policy and project development, data collection from the other sectors and performing climate change related measurements for GHGs and CO_2. Environmentalists and project managers are also available within the different sectors. The differences in available capacities amongst the different sectors are related to the availability of specific expertise such as waste management, social specialists, meteorologists, foresters, sea level rise experts, agronomists, and geologist amongst a few others. These specific areas of expertise are scarce in all sectors.

The key priority areas in NC3 where gaps have been identified are (i) with regard to specific training: specific technical and environmental training to improve in-house skills to understand the process of climate change and work towards climate mitigation and adaptation; (ii) with regard to data collection and processing systems: creation and improvement of data collection and processing systems covering material, tools and equipment (data and information networks).

Based on the identified gaps and with the support of the capacity building process of the UNFCCC, a framework is developed.

Training and Capacity Building Plan

A three-year training and capacity building plan is presented in table 66. This is determined based on the time until the next NC reporting will have to be done. The plan is developed to meet national and UNFCCC requirements and is based on bridging the previously identified gaps in capacity, namely gaps in knowledge, gaps in setting up a proper data collection and information network and gaps in creation of techniques and technologies to address climate change mitigation and adaptation (Status Report Training and Capacity Building, April 2022).
The plan contains sectoral training and capacity building plans as per framework of the UNFCCC on a systemic, organizational/institutional, and individual level, outlining the scope, indicators and training requirements for each sector and level (see table 66). The training requirements are among others leadership skills, policy development, project management, time management and specific training

such as UNFCCC obligations, CC data collection and database management, climate technologies, finance, and economics.

Financing Opportunities

Capacity development plans should not be executed independently but should be integrated with existing national strategies and plans. Knowing that the developed training and capacity building plan is part of a more comprehensive NC report, it was difficult to provide exact budgets. Another constraint in this regard was the poor response of stakeholders involved in climate finance and economics, which led to incomplete information on reservations of budgets for capacity building within larger projects. As such financing opportunities on international, regional, and national levels have been sought, but could not be further detailed.

Therefore, as finances will be required to implement this plan, financing opportunities on international, regional, and local levels have been sought and recommended. These include potential funding organizations such as the Green Climate Fund (GCF), UNDP, IDB and the Suriname Conservation Foundation (SCF) to mention a few.

Table 66 Training and capacity building for each identified capacity levels and sector

Capacity level	Sector	Capacity theme	Proposed specific training
Systemic level	Government	1. Leadership and ownership 2. CC Policies & Strategies 3. Cross Cutting	1. Management skills 2. UNFCCC obligations 3. Policy development, analysis and evaluation 4. CC communication and behavioral change skills
	Semi-government (EBS, MAS, SBB, NIMOS, Meteorological Services, ABS, Plan Bureau etc.…)	1. Leadership and ownership 2. CC Policies & Strategies 3. Cross Cutting	1. UNFCCC obligations 2. Policy development, analysis and evaluation 3. CC communication and behavioral change skills 4. Market based mechanisms, development of standards, monitoring and assessments 5. Climate finance and economics 6. CC data collection and database management 7. ICT and cybersecurity 8. Cross sectoral communication
	Private Sector (Agricultural Sector, VSH, State Oil, IAM Gold, Newmont etc...)	1. Leadership and ownership 2. CC policies	1. CC communication and behavioral change skills 2. CC data collection and database management 3. Cross sectoral communication
	NGO's (UNDP, VSB, ACT etc...))	1. Leadership and ownership 2. CC policies	1. CC communication and behavioral change skills 2. CC data collection and database management 3. Cross sectoral communication
	Other (experts etc…)	1. Leadership and ownership 2. CC policies	1. CC communication and behavioral change skills 2. CC data collection and database management 3. Cross sectoral communication
Institutional level	Government	1. Leadership and ownership	1. UNFCCC obligations 2. Market based mechanisms, development of standards, monitoring and assessments

Capacity level	Sector	Capacity theme	Proposed specific training
		2. CC policies and strategies 3. Mitigation 4. Adaptation 5. Cross cutting - Monitoring/ evaluation	3. Climate technologies, finance and economics 4. CC communication and behavioral change skills
	Semi-government (EBS, MAS, SBB, NIMOS, Meteorological Services, ABS, Plan Bureau etc.…)	1. Leadership and ownership 2. CC policies and strategies 3. Mitigation 4. Adaptation 5. Monitoring/ evaluation	1. UNFCCC obligations 2. Market based mechanisms, development of standards, monitoring and assessments 3. Climate technologies, finance and economics
	Private Sector (Agricultural Sector, VSH, State Oil, IAM Gold, Newmont etc...)	1. Leadership and ownership 2. Mitigation 3. Adaptation 4. Cross cutting	1. UNFCCC obligations
	NGO's (UNDP, VSB, ACT etc...))	1. Leadership and ownership 2. CC policies and strategies 3. Mitigation	1. UNFCCC obligations 2. CC data collection and database management 3. Climate technologies, finance and economics 4. Market based mechanisms, development of standards, monitoring and assessments 5. CC communication and behavioral change skills
	Other (experts etc…)	1. CC policies and strategies 2. Mitigation 3. Adaptation	1. UNFCCC obligations 2. CC data collection and database management 3. Climate technologies, finance and economics 4. Market based mechanisms, development of standards, monitoring and assessments 5. CC communication and behavioral change skills

Capacity level	Sector	Capacity theme	Proposed specific training
Individual level	Government	1. Leadership and ownership 2. CC policies 3. Mitigation 4. Adaptation	1. CC data collection 2. Climate technologies 3. Mechanisms for monitoring and assessments 4. CC communication and behavioral change skills
	Semi-government (EBS, MAS, SBB, NIMOS, Meteorological Services, ABS, Plan Bureau etc.…)	1. Leadership and ownership 2. CC policies 3. Mitigation 5. Adaptation	6. CC data collection 1. Climate technologies 2. Mechanisms for monitoring and assessments 3. CC communication and behavioral change skills
	Private Sector (Agricultural Sector, VSH, State Oil, IAM Gold, Newmont etc...)	1. Leadership and ownership 2. CC policies 3. Mitigation 4. Adaptation	1. CC data collection 4. Climate technologies 5. Mechanisms for monitoring and assessments
	NGO's (UNDP, VSB, ACT etc...))	1. Leadership and ownership 2. CC policies 3. Mitigation 4. Adaptation	1. CC data collection 2. Climate technologies 3. Mechanisms for monitoring and assessments 4. CC communication and behavioral change skills
	Other (experts etc…)	1. Leadership and ownership 2. CC policies 3. Mitigation 4. Adaptation	1. CC data collection 2. Climate technologies 3. Mechanisms for monitoring and assessments 4. CC communication and behavioral change skills

Source: Compiled from the partial report "Training and Capacity Building Plan with regards to Climate Change by Somwaru, L. and Koendjbihari, S. (2022)

5.8. Gender and Climate Change

This section focuses on the differences in gender roles and the impacts of climate change between different groups, as well as specific conditions for indigenous and tribal peoples (ITP) living inland, in relation to gender and climate change, as well as education, awareness and training for ITP included.

The inclusion of this thematic section in the national reporting reflects a growing awareness of the relationship between gender roles and the vulnerability of men and women to the impact of climate change, in this case with particular focus on communities in the interior of Suriname. The roles and responsibilities ascribed to women and men in a society impact their respective dependence on their natural environment, shape their capacity to adapt to a changing climate, and lead to specific knowledge of how to influence their environment.

It is evident to state that when inequalities between men and women no longer exists, and their specific abilities and knowledge pertaining to climate change matters is enhanced, their full potential to contribute to the fight against this global phenomenon can be unlocked. Women's agency has been woefully neglected in the past, due to mitigation measures. There is growing recognition that climate change projects become more successful, sustainable, and equitable by empowering women to actively participate in reducing emissions and strengthening community resilience. Women are involved in helping their communities and families to adapt to environmental changes every day all over the world, but their potential to contribute to (for example) reducing GHG emissions is often overlooked. In the past, academic work and development cooperation has focused chiefly on the role of women in adaptation and has only recently turned to their role in mitigating the impacts of climate change. In short, social factors should be taken into account when responding to climate change in order to produce more sustainable outcomes. For this National Communication the role of women in three (3) sectors will be described, namely: forestry use, agriculture and mining.

Forest Use

The vast majority of the forest is located in the Interior, which is home to approximately 15% of the population—mostly indigenous peoples (4%) and maroon tribes (11%). Local community forest use and traditional uses are considered under the policy goal related to non-timber forest products. Both women and men use the forest for agriculture, medicinal plants, fruit and stove wood. Men are more involved as owners and laborers in the timber industry, and women are more entrepreneurs in the production, marketing and sales of non-timber forest products. Both women and men will feel the impact of forest fires, deforestation, floods and drought.

The deliberate inclusion of women in consultation, dialogue, research, awareness-raising, and training is a key recommendation arising from initiatives already implemented. The National Forest Policy of Suriname (2006, cited in CANARI, 2020) aims to achieve sustainable forest management through increasing benefits of forests, particularly for indigenous and maroon communities, giving consideration for the culture, values, and traditions of these populations. The National REDD+ Strategy of Suriname seeks to ensure sustainable forest management in order to maintain its commitment to the UNFCCC's REDD+ mechanism. Four strategic lines have been identified, namely: ensuring high forest cover and low deforestation to receive compensation under REDD+ mechanism, forest governance, land use planning and forest research and conservation. One of the requirements of the REDD+ strategy and REDD+ Readiness projects (financed by the World Bank) is to involve all stakeholders including women and vulnerable groups (CANARI, 2020).

Local coordinating mechanisms also exist with indigenous and maroon communities to allow for engagement in forestry-related projects and discussions. One example is the Association of "Saamaka" (maroon) Tribal Leaders (Vereniging Saamaka Gezagsdragers). There is also a Logger's association, Sawmillers union and Platform Logging Sector Suriname. There was previously a Ministerial advisory committee for the forestry sector but, this committee is currently not active.

Although not a part of the main forestry policy and strategies in Suriname, gender is an integral part of the REDD+ process. A gender expert ensured that gender-specific recommendations were integrated into the National REDD+ Strategy, the SESA report and the resulting Environmental and Social Management Framework (ESMF) (NIMOS, 2020).

Agriculture

Women comprise of the majority of small-scale farmers within the interior of Suriname. Suriname's Fifth Agricultural Census indicates that there are more women farmers in the interior per district (2,367 on average, average age 41 years) than in the coastal area (1,167 on average, average age 50 years) (LVV, n.d., cited in Factor, 2021). The majority of small farmers in the interior are women, for whom farming is often the only source of income (shifting cultivators). Shifting cultivators (mostly women) have no off-farm work, often have many children to care for and experience a lack of support from men (Flerkens & Jorritsma, 2010). They face the most negative impacts of e.g., flooding and failure of crops, as the men who engage in farming, usually only do so part-time. In 2009 the United Nations Development Program (UNDP) examined the impacts of climate change on agriculture and housing in two indigenous communities after the 2006 flooding (UNDP, 2009a, cited in Factor 2021). The study shows that women were more vulnerable than men to the negative impacts of the flood, since men have other possibilities to earn a living in comparison to women. In the coastal areas, men are mostly employed as field laborers in medium- and large-scale agricultural businesses, while women do the processing and administrative work (CANARI, 2020).

Limited access to (micro-) credit remains a key challenge. Land in coastal areas is mostly owned by men, while land ownership is arranged through communal land tenure in the interior in indigenous communities. Although there may be some cultural issues, it is possible for women to “own” land within their village, passed down through a traditional system. However, usually women would not have formal proof of ownership, which makes it difficult to access loans (CANARI, 2020). In the agriculture sector, indigenous communities can face challenges accessing loans.

The National Master Plan for Agriculture Development in Suriname (2015) of the Ministry of Agriculture, Animal Husbandry and Fisheries focuses on 10 priority areas (Derlagen et al. 2017, cited in CANARI, 2021). This Master Plan aims to improve local economy through agriculture production by reducing imports and promoting exports, whilst also seeking the welfare of the population through sustainable agriculture. One of the proposals of the Master Plan seeks to strengthen extension services as well as create a designated body for small farmers and cooperatives through establishing a special Chamber. The Master Plan also identifies the need for creating agriculture employment opportunities for young people and women through technological advancements and use of advanced farming models in the sector. There is also an Agricultural Disaster Risk Management Plan which aims to include gender sensitivity at all stages of planning and implementation (CANARI, 2020).

Initiatives to train women (and men) farmers in new agricultural techniques, agroforestry and climate-smart agriculture are some of the ways to increase their resilience to the impacts of climate change. In terms of agriculture, the first tribal and rural women’s agriculture cooperative ‘Wi Uma fu Sranan’ was launched in 2016 and supports employment opportunities for women and access to extension services through partnerships with the Government. With the support of the Ministry of Agriculture, Animal Husbandry and Fisheries and the United Nations Development Fund, the BGA inventoried female-led agriculture organizations and implemented training in plant propagation techniques for unemployed women as part of phase one of Economic Empower of Rural Women project in District Nickerie (Ministry of Home Affairs, 2019, cited in CANARI, 2020).

The IaDB-financed project ‘Strengthening Female Entrepreneurship in Brokopondo, Wanica, Sipaliwini and Marowijne’ (IaDB, n.d.) supported training activities by agricultural cooperative “Wi Uma Fu Sranan” for 700 women from Kapasikele and other villages in good agricultural practices, including the use of modern technologies with an integrated crop processing model that coordinates variety selection, planting density, and mechanization, among other operations. In addition, the project also concentrated on the support of a smaller group of women who have received a Global Gap certification for their farms. This certification is one requirement to be able to export their cassava. They plan to export it either in its natural state, or as an intermediate input to cassava-based products such as cassava bread or cassava porridge (IaDB, n.d.). Although this project has experienced delays due to COVID-19, the organization continued its work, also winning an IaDB Development Superheroes Award in 2020 (IaDB, 2020).

Tropenbos Suriname (2020) also supported the establishment of an agricultural cooperative and training in agroforestry in the village of Pikin Slee, in collaboration with "Wi Uma Fu Sranan" and others. They purposely included both men and women, giving them equal access to the supplies necessary to work in the fields. This agroforestry approach resulted in increased food security, increased productivity, and more diversity in vegetation (trees for timber, organic material for mulching). Surplus products are sold, and the income generated is used to finance the sustainable development of the village.

The farmers received technical assistance via demonstration units in the Weg naar Zee area, through the project "Reducing Farmer Vulnerability to Climate Change Impacts through the Promotion of Climate Smart Agriculture Technologies in Suriname from 2017 to 2019, supported during the first cycle of the Global Climate Change Suriname Adaptation Project (2016-2019), the Inter-American Institute of Cooperation on Agricultural (IICA). During this project, the farmers learned and practiced climate-smart agriculture technologies to cope with extreme weather events and deterioration of the soil due to saltwater intrusion. Special attention was given to the inclusion of female farmers to participate in the training opportunities both in Suriname and abroad (UNDP, 2021).

Mining

The majority of workers (and business owners) in this sector are men, many of whom leave their family and/or partners to work in the mines for extended periods of time. Few women are active in the mining sector, mostly as service providers or sex workers. A study in 2021 by Heemskerk, Jacobs, and Pratley (2021) suggests that the percentage of women present in Suriname mining areas is between 16% and 24%. In terms of occupation, however, there are significant differences between women and men. Women primarily work in the mining service economy (approx. 95%) and occasionally as operation / equipment owners, but they are not involved as actual mine workers in the mining pit.

There are numerous conflicts between mining companies, miners, and local communities, often revolving around mining rights, access to land, and payments to local authorities. A gendered health risk due to mining is mercury pollution, resulting in direct effects for the men working in the sector and indirect effects on women, as mercury exposure results in more adverse birth outcomes. This increases the burden of unpaid care work on women, and will be further exacerbated by flooding, drought, and deforestation.

The mercury accumulates in fish, the main protein source for the Interior population. Studies by Gokoel, Zijlmans & Abdoel Wahid (2020) have found mercury levels above the EU and US EPA standard for human consumption in collected piscivorous fish. High levels of mercury were also found in hair samples of women living in the interior. In addition, a pilot study showed high levels in the hair of pregnant women and their newborns from Paramaribo, the capital city. As there is no gold mining in Paramaribo, this finding may be related to occupational exposure to mercury (Gokoel, Zijlmans & Abdoel Wahid, 2020).

In a 2020 study, mercury exposure by pregnant women was demonstrated to have a significant impact on preterm birth (Gokoel, Zijlmans & Abdoel Wahid, 2020). Few studies on mercury exposure and mercury contamination have included men, but those that did, also found significant levels of mercury in the blood and hair of men working and / or living in mining areas (Legg, Ouboter & Wright 2015).

Noteworthy, initiatives have taken place for the introduction of mercury-free technologies and livelihood training for women. A community-led initiative which can potentially decrease the gender-related health risks (mainly related to mercury use) of mining for the Wayana indigenous peoples (especially women and children) in the South of Suriname, is the project 'Towards food sovereignty for the Wayana in Suriname through Sustainable Fish Farming' by the Mulokot Foundation, in cooperation with ProBios and Fins and Leaves (Mulokot Foundation 2019). Gender is explicitly mainstreamed in the seven-year EMSAGS project ("Improving environmental management in the mining sector of Suriname, with emphasis on Gold mining" (EMSAGS)) (UNDP Suriname, 2018). As per UNDP requirements, the project preparation team conducted a thorough gender analysis to support the design of the project. As a result, a gender action plan was designed. In this project, gender disaggregated indicators and targets have been formulated where relevant in order to consider gender issues throughout the implementation and to monitor the impact of activities on women.

Initiatives and Opportunities

In 2019, Suriname adopted its National Adaptation Plan (NAP). The objective of this plan is to mainstream climate change into national decision-making, development planning, policies, and programs. Strategic priority 5 of the NAP (2019) is 'Climate Adaptation that respects Surinamese society and culture and reduces gender and social inequities'. Furthermore, the Government also listed adaptation measures and indicative outputs that are relevant to issues of gender and ITP in this document (2019), as shown in the following table.

Table 67 NAP 2019-2029 Adaptation measures and indicative outputs relevant to gender and ITP

Adaptation measure	Indicative outputs
Encourage deeper participation including leadership roles for vulnerable communities/ groups/ populations including indigenous communities, economically challenged classes, elderly, youth, disabled and others. Early 'buy-in' will assist with planning and later local, sub-national and sectoral implementation	Greater visibility of women's organizations such as women organizations (*Stg. Nationale Vrouwen Beweging*), NGOs (NGO Forum), Maroon representatives (KAMPOS), indigenous (VIDS, Sanomaro Esa) and others. Strengthen formal legal and institutional avenues for women to access natural resources and leverage such natural resources for direct economic gain and increased quality of life.
Undertake group specific vulnerability assessments and analyses to identify the particular vulnerabilities of target groups and tailor adaptation plans for their needs.	Encourage more messaging and language focused on gender mainstreaming and gender sensitivity to climate change or consideration of differential perspectives and impacts by gender in government programming, public awareness material and communications. Livelihood vulnerability reports that target vulnerable groups including, the elderly, children, indigenous and the disenfranchised who will likely experience climate change impacts differently and require special consideration in efforts to build climate resilience

Source: National Adaptation Plan 2019 – 2029 (2019) (as described in the partial report titled "Gender & Climate Change (with focus on Suriname's Indigenous & Tribal Peoples) by Bhattacharji, R. August 2022)

Other climate change related policy documents and plans, such as Suriname Nationally Determined Contribution (NDC) and Nationally Appropriate Mitigation Actions (NAMA) have little information on or are lacking in mentioning gender equality considerations. Suriname's NDC mentions that gender impact is one of the criteria used in the assessment of NDC policies and measures (NDC 2020, 2019). However, there is no further mention or subsequent elaboration of this in the remaining text of the document.

In 2015, the Ministry of Labour, Technological Development and Environment published the NCCPSAP 2014-2021. This Plan implements Suriname's 2012-2016 Environmental Policy and is aimed at reducing the country's vulnerability through the implementation of climate resilience measures in the coastal area as well as in the interior while bringing development through sustainable and clean technology. Gender is mentioned in one proposed measure / action (Ministry of Labour, Technological Development and Environment, 2015), namely the development and trial of agricultural, livestock and fishing techniques that build resilience to a variable and changing climate in a participatory way (gender-specific and according to FPIC).

The NAP also states the importance to provide emergency relief information and how it is to be accessed (beforehand, during, and after a disaster) to all members of the community or to all residents of eventual emergency camps: women, men and children. This may require door-to-door visits to people with mobility problems, as well as the separate consultation of men and women and the planning of community gatherings at times suitable for both men and women. Gender bias in investment policy during the reconstruction phase may also hamper the recovery of women. The establishment of relief funds for employment projects for women can support the economic recovery of women.

Gender training leading to the development of a Gender Strategy for the National Society is another important part of the CRB program. The process involved online training sessions for leadership, staff and volunteers in gender and gender analysis. The final step is the development of a Gender Strategy for the National Society including a gender DRR analysis of the context, risks and vulnerabilities of specific groups.

Another key initiative is the Enabling Gender-Responsive Disaster Recovery, Climate and Environmental Resilience in the Caribbean (EnGenDER) Project, funded by Global Affairs Canada and the United Kingdom Foreign, Commonwealth and Development Office, which is led by the United Nations Development Programme (UNDP) and jointly implemented by UN Women, World Food Programme (WFP) and the Caribbean Disaster Emergency Management Agency (CDEMA). The project aims to identify and address any gaps to ensure equal access to disaster risk resilience, climate change and environment solutions for women, men, boys, and girls in nine beneficiary Caribbean countries, including

Suriname. The four priority sectors selected by the National Decision-Making Mechanism for Suriname under EnGenDER are agriculture, water, energy and forestry (UN Women MCO Caribbean, 2022).

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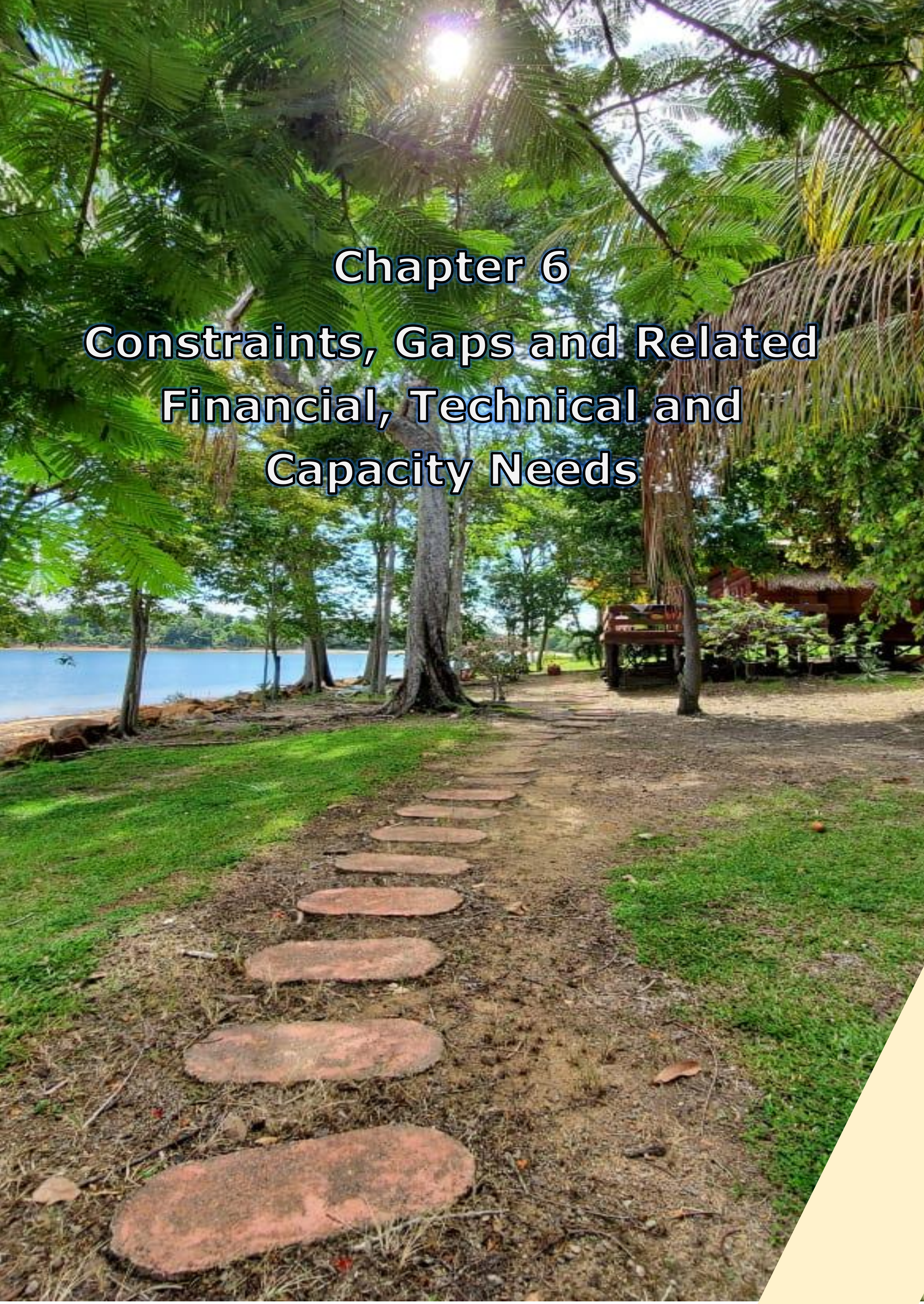
Chapter 6

Constraints, Gaps and Related Financial, Technical and Capacity Needs



6 Constraints, Gaps and Related Financial, Technical and Capacity Needs

6.1. Introduction

As a HFLD country, Suriname aims for long-term sustainable development, whilst preserving its 93% of forest cover that acts as a sink for the country's total greenhouse gas (GHG) emissions. This leads to numerous challenges when taking into account the small population residing in the coastal area, a low deforestation rate and the upcoming oil and gas industry. In addition, the country has a weak governmental structure, a weak legal and regulatory framework and capacities across all institutions need strengthening.

The process of developing the Suriname Third National Communication (NC3) to the UNFCCC has revealed a number of gaps and constraints which needs to be addressed, in order to ensure the successful implementation of future National Communications and other reporting systems, including the Biennial Transparency Reports (BTRs). Apart from these gaps and constraints, this report also points out specifically the gaps, constraints and needs in terms of financial and technical support and capacity building (other than those mentioned in para. 45-50 of decision 17/CP.8, UNFCCC) that will enable Suriname to advance its sustainable development including the challenges related to climate change.

The chapter ´Constraints, gaps and related financial, technical, and capacity needs' covers the reporting of financial and technical information under several areas which are elaborated on in figure 78, in an attempt to identify gaps and constraints, financial and technical needs required to implement mitigation and adaptation measures in response to climate change.

Figure 78 presents the information that is collected and analyzed to conduct the Constraints and Gaps assessment for the area's financial resources and technical support, Proposed projects for Financing, Adaptation assessment Technology Transfer and Capacity Building needs. Based on the available resources and information gathered, emphasis is placed on the red colored and yellow-colored boxes.

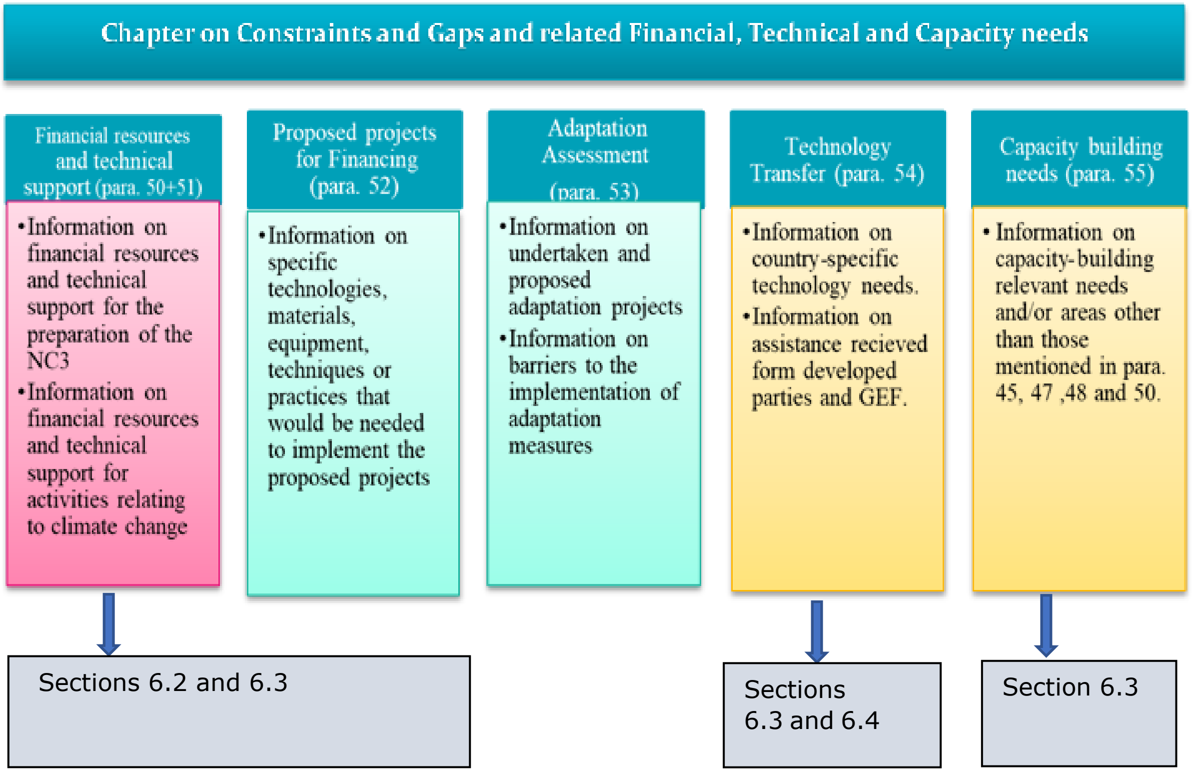


Figure 78 Applied methodology and information
Source: Figure drafted by Jharap, R. 2023. Retrieved from partial report: Final report on Constraints and Gaps and related financial, technical and capacity needs – Including Workshop report on the findings and discussion with stakeholders

6.2. Constraints, Gaps, and Needs Related to Reporting

The Ministry of Spatial Planning and Environment (ROM), acting as the National Focal Point (NFP) for the UNFCCC in Suriname, is responsible for preparing the NC3, including the GHG Inventory. With reference to the time of preparing the NC2, mainly training and capacity building initiatives have taken place since, such as the strengthening of developmental capacity, strengthening of Suriname's technical, institutional, political and financial capacities and building of capacity on calculations of carbon dioxide for the forests. Additional information can be obtained from the 'Status Report Training and Capacity Building' under the NC3 project. Despite these initiatives, still, challenges exist, especially with regard to the GHG inventory and the Mitigation and Vulnerability Assessments. Hence, the need for support in terms of capacity building is very high, taking into account that many experts involved in preparing the NC3 were not familiar with the UNFCCC guidelines in preparing national communications. Therefore, ROM nominated relevant experts[25] to be included in the UNFCCC roster of experts to

[25] A total number of 17 experts are currently nominated to the UNFCCC roster of Experts

contribute to a number of processes mandated by the COP, CMP, CMA and the subsidiary bodies.
For the preparation of NC3 independent national consultants have been contracted, and collaboration was sought with the Foundation for Forest Management and Production Control (SBB) as lead actor for the AFOLU sector in collaboration with the Ministry of Agriculture, Animal Husbandry and Fisheries (LVV). Both institutions are involved in preparing the GHG inventory as well as conducting the mitigation assessment.

Due to limited knowledge and experience in preparing GHG inventories as well as in conducting mitigation and adaptation assessments, both the sectoral experts as well as a number of institutions were exposed to various capacity building programmes provided by the UNFCCC. As previously stated, the experts responsible for the GHG inventory had limited knowledge in performing the inventory and as such training from the GHG Management Institute was provided to these experts. Furthermore, a national training on GHG Inventory and IPCC software program was provided virtually through the Global Support Programme (GSP). This national capacity building programme reached more than 60 stakeholders (including the experts responsible for the GHGI process) from government institutions, NGOs, ADEK University and the main data providers from the private sector. The inventory process revealed a number of challenges related to unavailability, inaccessibility and inconsistency of activity data and emission factors. Table 68 depicts the main constraints and gaps and related needs with regard to reporting on the GHG inventory.

The lack of expertise on techniques for mitigation analysis and quantification of GHG emission reduction stood out when performing the Mitigation Assessment. Also, the need for an applicable tool for the assessment was evident. Even though the energy sector was assessed with the LEAP modelling tool, and both the Agriculture as well as the Forestry sector were modelled in an excel-based programme, detailed analysis was challenging, due to limited experience in using these tools. To overcome these gaps and constraints, capacity building on mitigation analysis and quantification of GHG emission should be maintained.

Table 68 Gaps and constraints that exist in performing the GHG inventory under the NC3 project

Gaps and Constraints	Needs
Limited awareness on the side of data providers in the GHG inventory process and in administrating the related data for the GHG inventory.	• Increase awareness of data providers regarding the GHG inventory process. • Build human and institutional capacity to gather primary data and develop EFs. • Provide continuous data collection for GHG Emission Inventory by all sectors according to the 2006 IPCC guidelines.
Limited stakeholder engagement	• Support and increase stakeholder engagement on GHG inventory development with a transparent and participatory process (e.g., a Stakeholders Engagement Plan).
Lack of emission factors to better represent national circumstances and provide for more accurate estimates even if this has started to be addressed for some key categories.	• Enhance the capacity of researchers and relevant stakeholders as well as provide better laboratory facilities or collaborate with national and regional institutions and labs on determination of country specific emission factors. • Related funds are needed to provide the missing data e.g., national emission factors which will advance the used methodology at tier 2 level.
GHGI process has not been institutionalized	• Establish an institution/agency with the responsibility for collection of specific Activity Data needed for the estimation of emissions according to the IPCC on an annual basis.

Source: Jharap, R. 2023. Retrieved from the partial report: Final report on Constraints and Gaps and related financial, technical and capacity needs – Including Workshop report on the findings and discussion with stakeholders

The Vulnerability Assessment forms an important part towards adaptation planning. The assessment experienced some organizational challenges and lacked an overall vulnerability assessment framework. The relevant experts lacked sufficient support and guidance in understanding the vulnerability assessment procedure and methodology, thus capacity building on these aspects is urgently needed. Furthermore, the assessment relied on secondary information with regards to climate scenarios performed under the Suriname State of the Climate report (2020), but for future vulnerability assessments, it is advisable and preferred to invest in climate change vulnerability assessments and adaptation tools.

6.3. Technical and Capacity Constraints, Gaps and Needs

6.3.1. Current Situation

The Government of Suriname pursues strengthening its resilience against the effects of climate change, maintaining the carbon stock, reducing emissions while sustainably developing the economy, and limiting impacts and adaptation costs. Vital steps are being taken with the ongoing process of updating the NCCPSAP 2014-2021, including mainstreaming climate change adaptation and mitigation, and the adoption of both the NAP and the NDC 2020 (2019), introducing a more systematic approach to addressing both mitigation and adaptation.

Past decade, various climate change related projects with extensive capacity building components have been conducted and/or are still ongoing. One of those projects is the REDD+ project, implemented by the UNDP, making it possible for the country to have a strong MRV system for monitoring deforestation and forest degradation managed by the National Forest Monitoring System (NFMS) Unit at SBB. This unit is now equipped with several local staff with a sound knowledge on GIS and remote sensing, interlinked with local knowledge on land use and forestry. The GCCA+ project also contributed to capacity development by strengthening the capacities at the national meteorological service and installing new stations. Moreover, LVV is tackling climate change adaptation by improving technical and technological capacities and developing climate-smart agricultural technologies.

6.3.2. Inclusion of Indigenous and Tribal Peoples (ITP)

The Interior of the country inhabits the more vulnerable stakeholders, namely the Indigenous and Tribal Peoples (ITP), as they depend on the environment for their daily provision. Means of subsistence include, but are not limited to, fishing, hunting, logging, agriculture, and the harvesting of non-timber forest products (NTFPs). Threats to ITP in Suriname range from lack of legal recognition of land rights, loss of traditional knowledge transmission, and the intrusion of extractive industries. The ITP have a vulnerable position, not only due to climate change impacts, but also due to developments in extractive industries, such as (gold) mining. Mining, as the main driver of deforestation, forms a threat to the carbon sink capacity of the forest, causes pollution and destruction of the ITP habitat resulting in involuntary resettlement and internal conflicts. Legal protection of the collective rights of the ITP to their traditional living and user areas under the Suriname legal system is limited, leading to frequent tensions between these groups and for example mining operators and logging companies.

To increase the awareness and capacities of ITP, various initiatives have been implemented, for example, the REDD+ project regarding training by SBB on community forestry, SFISS and other themes. Other training for ITP were executed by NIMOS (apart from information sharing, consultation and validation). Projects listed in Annex III also contribute to the strengthening of knowledge and capacities of the ITP in climate change related issues.

The GOS recognizes the vulnerable position of the ITP as they are most effected by climate change effects, while at the same time they have solutions the world can learn from. Thus, the inclusiveness of ITP in the process of combating the effects of climate change is of utmost importance. The GOS needs support in strengthening their relationship with the ITP, for example, by providing technical and financial means when consulting ITP communities. Furthermore, ITP are in need of increased awareness on issues related to climate change and even more important to increase their knowledge and capacities in participating in project development and decision-making processes.

6.3.3. Constraints, Gaps and Needs

Despite various interventions, institutional strengthening and overall capacity development kept on being key points considered by the Government. The enabling framework requires, for instance, strong institutions, high-level expertise and knowledge, laws, and regulations, which the country is currently lacking.

Suriname has a rather small academic population, making it difficult to build up a pool of experts on climate change related matters. With the limited technical capacity available, many hurdles and gaps exist in designing, implementing, and monitoring climate change projects. The fragile state of institutional framework makes the situation more challenging; furthermore, mandates with regard to the public administration roles are unclear, even though there is a NCCPSAP for the period 2014-2021.

With the Environmental Framework Act (2020), approved by Parliament, a huge step has been set in the right direction. This framework Act contains rules and procedures for sustainable environmental management in Suriname and aims to develop a national environmental strategy and planning for sustainable development under a coordinated approach. It provides access to environmental information, the participation of different stakeholders in environmental policies and environmental justice, such as the detection, prosecution, and trial of environmental offenses.

The main stakeholders that play a crucial role for climate change mitigation and adaptation are: Ministry of Natural Resources (with regards to the energy sector), Ministry of Public Works and Ministry of Transport, Communication and Tourism (regarding the waste sector and transport sector), Ministry of Agriculture, Animal Husbandry and Fisheries (with regards to the agriculture sector) and Ministry of Land Policy and Forest Management including SBB (regarding the forestry sector). The Directorate Environment of the Ministry of Spatial Planning and Environment is crucial as the coordinating entity for environment and climate change related issues. The Ministry of Finance and Planning is also important as the main Government entity overlooking the financial inputs and outflows at national level. Participatory involvement of these institutions together with local NGOs, CSOs and the private sector is crucial. However, the limited knowledge, skills and awareness of climate change issues among the national stakeholders often complicate decision-making processes. Common objectives and clear roles for each of the stakeholders as well as close cooperation and understanding among others are needed to be efficient and successful.

Furthermore, technological gaps comprise an important bottleneck in the country's efforts at mitigation and adaptation to climate change. Despite current initiatives on introducing technologies to adapt to the effects of climate change, the GOS recognizes the lack in appropriate technologies and financial resources to implement adaptation and mitigation actions. The current ongoing TNA has identified a number of technologies within the sectors Agriculture, Water and Housing and Infrastructure. Some of the proposed technologies are water modelling tools (to develop and implement Early Warning Systems, based on climate forecasting and hydro modeling), water resource mapping (to assess the quality and quantity of available water resources), improved irrigation efficiency, integrated farming systems, climate resilient crop varieties, energy efficient modelling tools and Land Use Planning knowledge and database system. Taking the country's resource constraints, fragile institutional framework, and economic system into consideration, intensive (technical) capacity building and financial support is needed.

The following table summarizes the main issues and needs/recommendations in addition to recommendations from various climate change related projects such as the REDD+ project and the GCCA+ project.

Table 69 Overview of main technical and capacity issues and needs

Issues	Needs
Climate activities in Suriname involve different ministries and local authorities.	Clear definition of roles and responsibilities in starting new climate change projects is necessary from design to monitoring and evaluation of the project.
Climate change projects should also be supported by local NGOs working with local beneficiaries above all in the Interior districts.	Stronger involvement and support of different districts and local organizations is required. Good stakeholder engagement is also a requirement to guarantee a successful implementation.
Lack of a long-term sustainable development strategy, taking into consideration its 93% forest cover and the promising oil and gas industry.	Development of a Green Development Vision and Action Plan.
Lack of a National Land Use Planning system.	Harmonization of Planning and Development with Spatial Planning.

Issues	Needs
Weak relationship between Government and ITP.	Government support to increase ITP capacities and engagement, thus enhancing the inclusiveness of ITP.
Lack of climate finance expertise.	Invest in Climate Finance expertise to improve the access to climate finance.
Lack of appropriate technologies and tools to implement adaptation and mitigation actions.	Support in sufficient technical human resources and adequate financial resources.
Lack of climate change related data and transparency.	Continue building capacities on national databases and MRV regarding climate change projects.

Source: Jharap, R. 2023. Retrieved from the partial report: Final report on Constraints and Gaps and related financial, technical and capacity needs – Including Workshop report on the findings and discussion with stakeholders

6.4. Financial Constraints, Gaps and Needs

6.4.1. General

One of the biggest challenges Suriname faces is to maintain a very low level in GHG emissions compared to the world. Therefore, the country must leverage resources to build climate resilience, while also reducing GHG emissions and striving to become a low carbon society. Climate finance plays a central role in enabling transitions to a low-carbon, climate resilient economy. The NAP also emphasizes that climate finance presents an opportunity to potentially leverage additional resources for investments and utilize a wide variety of new and innovative financing models, for which both the public and private sector can join forces to pool finances and share skills, expertise and approaches.

As a Small Island Developing State (SIDS), Suriname struggles with building its resilience against climate hazards as well as decreasing its vulnerability. At the same time, Suriname is a HFLD developing country with an impressive ability to act as a carbon sink country. In 2019, Suriname together with other HFLD developing countries, adopted 'The Krutu of Paramaribo' declaration[26] on mobilizing climate financing to share the challenges faced using existing methods of climate finance access. However, the country's activities in mobilizing climate finance are still in a preliminary phase. With the recently developed 'Suriname NDC Investment Plan', expectations are that the country's ability in mobilizing climate finance will enhance.

[26] The Declaration takes into account the role of forest management in achieving the Sustainable Development Goals (SDGs) and calls on the international community to better align financial frameworks and mechanisms to address the needs of HFLD countries to increase sustainable forest management financing.

6.4.2. Overview of Climate Finance in the Country

In 2019, Suriname submitted its second Nationally Determined Contribution (NDC) for the period 2020-2030. One of the key priorities in the NDC 2020 (2019) is to outline a cost-effective pathway to decarbonization of sustainable economic development, maintaining the integrity of natural forest acting as a carbon sink, and strengthening resilience so as to enable adaptation and mitigation action. The NDC Investment Plan (2022) elaborates on a climate finance analysis, based on data retrieved from the Organization for Economic Co-operation and Development (OECD) Development Assistance Committee (DAC). The analysis shows that in the period 2000-2020, Suriname received commitments of around USD 279 million in total from OECD contributors through debt instruments (i.e., loans, comprising 69% of the total – USD 195 million), while grants comprised of 31% USD 84 million) (GOS, 2022).

The energy sector received the most finance in Suriname between 2000 and 2019, with approximately USD 60.4 million (23% of total commitments), followed by Agriculture, Forestry & Fishing, with USD 51 million (18% of total commitments). The third biggest sector was General Environment Protection, with USD 38 million (14% of total commitments) (GOS, 2022). The Investment Plan also indicates that between 2000 and 2020, adaptation activities received USD 143 million and mitigation activities received USD 148 million in Suriname (figure 79). Additionally, USD 13 million was allocated for activities with both adaptation and mitigation benefits, although the same activity could also be marked for either adaptation or mitigation individually. As this entails a risk for double counting, the three categories presented in the figure below cannot be aggregated. Total climate finance can therefore be computed as "adaptation" + "mitigation" -" overlap" (GOS, 2022).

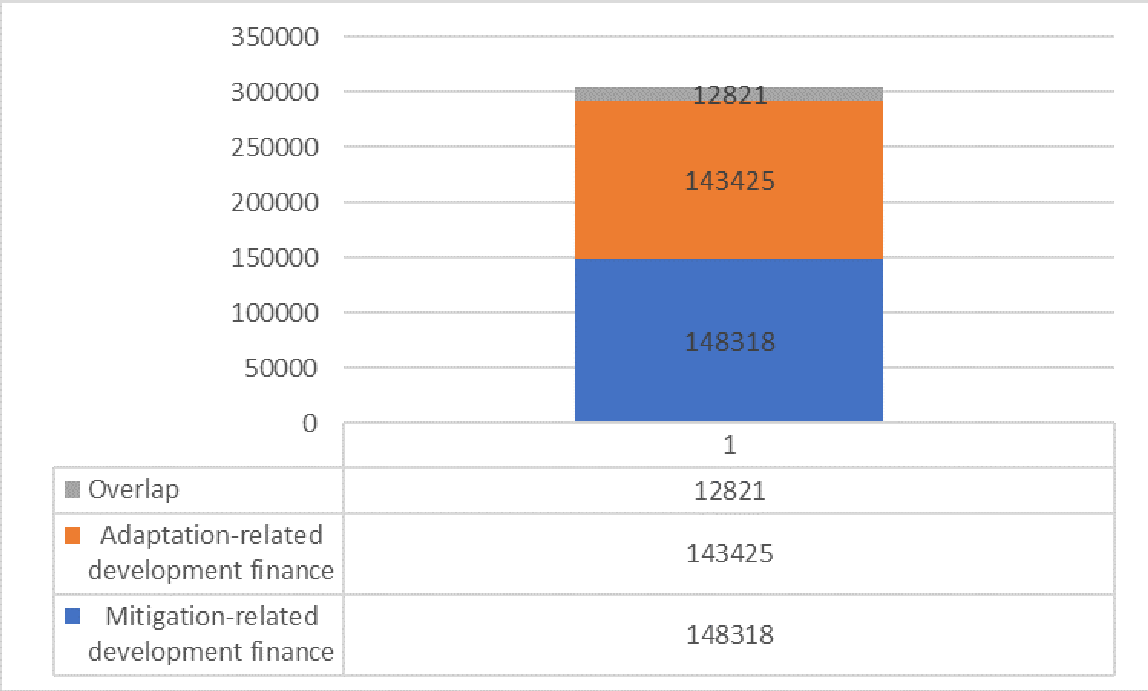


Figure 79 Climate finance flows from OECD contributors to Suriname by activity type, 2003-2020 (in current USDx1.000) (GOS, 2022)
Source: Figure adapted from NDC Investment Plan, 2022 – as cited in the report drafted by Jharap, R. 2023. Partial report: Final report on Constraints and Gaps and related financial, technical and capacity needs – Including Workshop report on the findings and discussion with stakeholders

Annex III provides a list of donor funded projects, providing financial, technical and capacity building support. As can be noticed in Annex III, besides the IDB, the largest share of funding comes from the Global Environmental Facility (GEF), which funded 8 projects in the Environment and Natural Resources portfolio. Bilateral donors include the Japanese, Dutch, USA and British Governments, and the multilateral donor to be the European Union (EU).

6.4.3. Constraints, Gaps and Needs regarding Climate Finance

Suriname, as a SIDS country, is in urgent need for external financial support to build resilience within both the social and economic systems and the natural environment on which the country depends. The current climate finance landscape is complex and fragmented, making the process of accessing different sources of climate finance extremely challenging.

One of the biggest gaps regarding climate finance, according to the NDC Investment Plan (2022), is the absence of a national level coordination system on climate finance, that could influence the lack of data overall, and in some cases the uniformity and the lack of technical compatibility of the data. The Investment Plan also points out the human and technical capacity constraints in meeting donors' proposal standards and reporting requirements, as another challenge. Each fund or donor has its own requirements, modalities, and operational priorities that can be difficult to master for government institutions, CSOs and other relevant stakeholders.

When taken into consideration the financial landscape in the country, climate investments are constrained by a number of challenges, particularly related to financial resources within Suriname, such as a limited scope for debt finance and restricted fiscal space, and declining aid flows (GOS, 2022). The major challenge that the Government faces is the persistent gap between revenues and expenditures that has been growing over the years, culminating with the current situation of a budget deficit of almost 20% of GDP (GOS, 2022).

According to the gap analysis report of the Suriname Banking and Financial Sector, conducted by UNEP-Finance Initiative (2022), the local financial institutions and investors need capacity strengthening to deal with sustainability-related issues. Despite the advances of the Environmental Framework Act, there is no specific policy that requires the financial sector to focus on environmental, social or climate risk management. The lack of integrating sustainability aspects in the banking and financial sector was linked to minimal awareness of their importance in these sectors. However, the Government is willing to work collaboratively to close the gap as it understands its importance when unlocking international finance flows (UNDP, 2022).

To fill in the gaps regarding climate finance, the GOS started preparing a Sustainable Financing Roadmap under the SDG Joint Programme (UNDP, 2020) with the UN in Suriname. This Joint Programme aims to assist Suriname in reaching the targets within all pillars stated in the National Development Plan, with a particular focus on Pillar 4: Utilization and Protection of the Environment. This Joint Programme responds to specific national objectives and priorities in Suriname. It is aligned with Suriname's National Development Plan 2017-2021 and the NDC 2020 (2019). This initiative will be built on the REDD+ activities, past and on-going in the country, and on a gender-responsive National Adaptation Plan and Targeted Scenario Analysis within the extractive industries and other forest related value chains. The Joint Program also aims, to raise new and additional financial resources from all sources. In collaboration with expanding partners and cooperation in the fields of science and technology, it strives to implement sustainable forest management strategies and other environmentally friendly solutions related to the other Suriname NDC priorities. The roadmap should facilitate Suriname's transition towards a diversified economy, based on more sustainable practices and technologies. Sub-sectors of focus are for deforestation; Artisanal and Small-Scale Miners, and for forest degradation and conservation; Forestry, horticulture (including non-timber forest products) and Indigenous and Tribal Peoples shifting cultivation practices.

Another project targeting climate finance is the ongoing Green Climate Fund (GCF) readiness project[27], which is implemented by the FAO. Under this project a financial plan combined with an implementation plan will be developed for each of the proposed measures in the enhanced NDC covering the sectors electricity, road transport, agriculture and forests, industry and waste. In addition, the project will support Suriname to develop an investment plan to seek climate finance related to their forest resources and to equip institutions and individuals with the necessary technical skills. The project intends to address insufficient technical capacity at the level of the National Designated Authority (NDA), ROM, as well as key Ministries such as the Ministry of Land Policy and Forest Management, and the National Institute for Environment and Development in Suriname (to be transitioned to the National Environment Authority) to coordinate and implement addressing climate change impacts in relation to gender.

The GCF readiness project also aims at setting up a climate finance interdisciplinary task force that could lead the coordination of climate financing access for Suriname, whether this would be related to REDD+ or other initiatives. This task force is supposed to be led by ROM with support from various other relevant Ministries such as the Ministry of Land Policy and Forest Management.

[27] Strengthening of climate change finance planning processes to enable implementation, monitoring and reporting of climate actions in Suriname.

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Lessons Learned and Way Forward

Lessons Learned and Experiences from the Preparation of the Third National Communications (NC3)

During the preparation of this NC3 report, the working groups had to overcome a number of obstacles, including limited data availability, a lack of technical expertise, and coordinating a large number of institutions. The chapter Constraints and gaps and other related financial, technical and capacity needs, includes these experiences. A summary will be provided on the lessons learned and recommendations made, which will undoubtedly be beneficial for the drafting c.q compiling of the upcoming national reports, focused on effective and sustainable preparation and development.

1. *Gap between the development of Second and Third National Communications:*

The Second National Communication (SNC) was released in 2016 and the Third National Communication (NC3) will be published in 2023, which is a significant gap. The period of seven years between the two reporting products is a bit extensive. The gap of reporting occurred, due to internal changes that took place on the organizational level, namely a change in political and on Government level, which caused some delay in the commencement of the NC3 project.

2. *Unexpected disasters and situation:*

As part of the global community, Suriname was affected by the COVID-19 pandemic, causing grave effects to the social, economic and health sectors. The project was extended as result of the setback experienced by the Government institutions, private sector, etc. Relevant actors had to adjust their way of working during the period of the pandemic. Devaluation of the local currency occurred as result of the country's ongoing economic crisis, which also had an effect on the exchange rate. The Surinamese Government changed its policy on payments in local currency, which caused local experts to cease working, due to dissatisfaction of the changed payment component. This shift also had an enormous effect on the project because fewer financial resources were spent.

3. *Ownership of reporting on climate change:*

ROM is a relatively new Ministry, and as such the institutionalization process for national reporting to the UNFCCC is still to progress to the desired levels within the Government, despite the initial excellent initiatives taken by the focal point on climate change within several Ministries.

4. *Data collection and gathering information:*

The team of experts was challenged to obtain information and data from institutions, private companies and stakeholders in the interior (e.g., ITP). The

COVID-19 pandemic has taught us some valuable lessons with regard to the use of technology to our advantage, such as organizing virtual meetings, trainings and workshops.

5. *Limited availability of specialized experts:*

The expert pool of specialized local experts in Suriname is limited and the available experts not always possess the necessary skills and experience to execute the assessments within the NC. Furthermore, the time allocated for procurement of these specialized experts had an influence on the execution and/or delivery of the national reporting.

Way Forward

The following remarks are crucial indicators for future references (Preparatory and execution phase national reports):

- The Ministry of ROM should take the lead coordination in collaboration with other Ministries, institutions, private companies, organizations (NGO, Internationals) on climate change monitoring and implementing strategies as recommended in NC3. It is recommended that the appointed NC4 team will make significant efforts to convince Ministries to include climate reporting in their yearly work plans or policy plans. Furthermore, requests could be made for climate reporting from the Ministries, with the aim to achieve a long-term sustainable outlook on climate reporting.
- ROM needs to consider the appointment of a permanent internal team, as well as have focal points at the various line Ministries involved in climate change policy, to also be part of the reporting team for the various components. Subsequently, discussions with institutions, the private sector, etc. should be taken into positive consideration, in order to make arrangements on the provision of relevant data and information.
- If needed, ROM can also facilitate training activities for their technical staff and of other Ministries, as well as other data providers on the aspects that require information, such as training on the use of the IPCC software for a specific sector. Also provide the local experts that were involved in NC3, as well as the previous NCs, with refresher courses, to ensure that the quality of future NCs will be improved.
- To ensure data accessibility for future reporting, all information and data gathered during NC3 and the following reports, should be archived on a central database, such as Dondru.
- Partnership between ROM and the various relevant stakeholders is of great interest, in order to facilitate widespread dissemination of the importance of national reporting, as well as to create the desired awareness among policymakers so the latter can factor the impacts of climate change into future climate policy planning.

- Facilitation of the ITP to closely involve them in climate change activities regarding e.g., creating climate change communication materials for awareness, education, and training of citizens especially tailored for youth and tribal communities.

Annex I Overview of the Legislative and Institutional Framework

Acts and Legislations	Description regarding Land use Planning Scheme
Planning Act (1973) and the Urban Planning Act (1972)	Set out a strategic framework for zoning and land use planning. The legislative regime for land management consists of mainly fragmented pieces of legislation regulating the issuance of land and use of natural resources. As a result, different pieces of legislation provide different Government bodies with responsibilities for planning. There is a lack of structured coordination between relevant government agencies in the land allocation process. Although there is an outdated Planning act and Urban Planning act that require zoning, zoning plans do not exist. As such, this has led to uncontrolled development as well as development in high-risk areas.
Act on Regional Bodies (2002) and the Building Act (2002)	Based for and works on land use planning.
Forest Management Act	Designates different types of forest, which should be in conformity with national and regional plans.
Mining Act	Provides for designating areas for small scale mining.
Hindrance Act	Provides for designating streets, neighborhoods, towns and cities where certain facilities are not allowed to be established.
Nature Conservation Act	Provides for establishing nature reserves.
Land use Planning Institutions	
Objectives and tasks: **Policy related to land use, land management as well as spatial planning are scattered across different Ministries and Government agencies. Under the current Government, spatial planning and land use falls under the competence of the Ministry of Spatial Planning and Environment, while land management falls within the portfolio of the Ministry of Land Policy and Forest Management. Planning is to be implemented in collaboration with the Ministries of Regional Development and Sport (ROS), Public Works (OW), Natural Resources (NH) and Finance and Planning, among others.**	
Ministry of Spatial Planning and Environment	Has a leading role in the development and implementation of effective policy to guarantee an environment that is spatially ordered and where health, well-being and sustainable development remain crucial elements

Ministry of Land Policy and Forest Management	Must ensure the following regarding land management:[28] • Sound spatial planning, in collaboration with the Ministry of Regional Development, the Ministry of Public Works, the Ministry of Finance and Planning and the Ministry of Natural Resources; • Allocation of land, in collaboration with the relevant Ministries, where necessary in an interdepartmental context; • Controlling the lawful and efficient use of allocated land, where necessary in an interdepartmental context.
Ministry of Public Works	With regards to spatial planning this Ministry has the following task: • Formulating and implementing policy, taking care of the planning and development of architectural and civil engineering works and facilities for the general benefit. • Ensuring proper access to and design of the residential areas as part of spatial planning and mobility planning. • Preparation and construction of dry and wet civil engineering works and possibly other infrastructural facilities for the benefit of the State; • Preparation and construction of housing, educational institutions, health facilities, police stations and markets among others in cooperation with the relevant Ministries; • Construction, maintenance and management of public spaces such as parks, squares, public gardens, green areas and government sites; • Provide for primary, secondary, and tertiary drainage and integral water management of urban and extra-urban areas including flood defenses along the coast and rivers.
Institute for Land Registration and Land Information System	The Land Registration and Land Information System Institute (MI-GLIS) is charged with the management of Land Registration and Land Information Systems and was established by the Land Registration and Land Information System Act, referred to as the GLIS Act. The purpose of MI-GLIS is to promote legal certainty with regard to registered property in legal transactions, economic transactions and in administrative transactions between citizens and public authorities
Foundation for Forest Management and Production Control	The Foundation for Forest Management and Forest Control (SBB) was established on 22 August 1998 by the Minister of Natural Resources, who was then responsible for the management of the Surinamese forest. The aim of the SBB is to promote sustainable, optimal use of Suriname's forests.
Planning Office Suriname	The Planning Office Suriname (SPS) was founded in 1951 with the aim of formulating, coordinating, monitoring, and adjusting development plans that should lead to the promotion of prosperity in Suriname. In 1973 the Planning Act was proclaimed, which monitors the functioning of the Planning Bureau. The office is responsible for national planning and comprises of three planning departments: economy, society and environment.

Source: Table was drafted by Sitaram-Tjin A Soe, F. in the partial report: Vulnerability Assessment and Adaptation Measures – Cross-cutting sectors, 2023

[28] https://gov.sr/ministeries/ministerie-van-grondbeleid-en-bosbeheer/over-ons/

Annex II Status of the NDC 2020 (2019) Projects per Sector

	Name	Lead MDA	Duration	Start / End	Location	Objective	(Related) Project(s)	Status	Remarks
Energy	Demonstrate sustainable business models	Ministry of Natural Resources (MNR) and Department for Rural Energy Supply (DEV)	5 years	2020-2025	>200 villages situated in the hinterland (exact location TBD)	Promote renewable energy (RE) access by move to the sustainable electrification of +200 villages in the interior by the replacement of existing use of diesel by solar supply and solar/hybrid systems. Projected Funding needed: USD 80 million	1. Electrification project[29] 'Support to Improve the Sustainability of the Electricity Service' (February 2022-2023) start in the villages Gingeston, Pambooko, Makonde, Abenaston, Kajapaatie, Jawjaw, Lespaansie, Adawai, Gunsi, Nieuw Aurora. **(M)** 2. Directorate of Technological innovation will draw a plan for the rollout of solar panels, start of the Project 'Promotion of Energy Efficiency and Distributed Generation in Suriname'[30] The project plan of the Directorate Technological Innovation has the following 3 components: stimulating the use of solar panels in Suriname, stimulating energy efficiency in buildings in Suriname and capacity strengthening for both	Implementation	1A. 2015: finance by EU Caribbean Investment Facility (CIF) Euro 5 mil. 2018: co-finance IDB funding USD2.25 mil. 1B. Executing entity: National Energy company Suriname (NVEBS), Ministry of Natural Resources. 2A. 2022: finance by IDB USD250.000 2B. Executing entity: Ministry of Economic Affairs, Entrepreneurship and Technological Innovation 3A. Executing Agency: The EBS and the Ministry of Natural Resources (MNH) IADB funding USD30,000,000

[29] https://solarmagazine.nl/nieuws-zonne-energie/i26482/suriname-geeft-startschot-voor-aanleg-10-mini-grids-op-zonne-energie
[30] https://www.iadb.org/en/project/SU-T1147

	Name	Lead MDA	Duration	Start / End	Location	Objective	(Related) Project(s)	Status	Remarks
							matters. **(M)** 3. Project 'Consolidating a Sustainable Energy Sector' (2021-) **(M)**		
Energy	Public- private partnerships (PPPs)	Ministry of Finance Ministry of Natural Resources (MNR)	10 years	2020-2030	National	Provide incentives for investors by encouraging an investment- friendly environment through risk mitigation by a Guarantee Fund. Projected Funding needed: USD 100 million	**(M/A)**		
Energy	Policy and regulatory framework	Ministry for Natural Resources (NH) in coordination with NIMOS	5 years	TBD	National	Implementation of the Electricity Authority Suriname (sector regulator) and the development of the Renewable Energy Act and the Rural Electricity Act Projected Funding needed: USD 5.5 million	1. Project 'Consolidating a Sustainable Energy Sector' (2021- present) **(M/A)**	Implem entation	1A. Executing Agency: The EBS and the Ministry of Natural Resources (MNH) IADB funding USD30,000,000

	Name	Lead MDA	Duration	Start / End	Location	Objective	(Related) Project(s)	Status	Remarks
Energy	Energy efficiency – Subsidy and fiscal reform	Ministry for Natural Resources (NH) Ministry of Finance	10 years	2020 to 2030	National	Promote energy efficiency (EE) and energy conservation through energy savings equipment (energy efficient appliances) by providing them to customers at reduced prices; including equipment labelling and performance standards. Projected Funding needed: USD 200 million	1.Project Type: Technical Cooperation 'EcoMicro-Southern Commercial Bank- Green Finance for MSMEs and Low-Income Households'[31] To build climate resilience of MSMEs and low-income households in Suriname, through new green finance that enables the acquisition of RE/EE technologies and implementation of adaptation methodologies. **(M)**	Impleme ntation	1A. Approval date: December'22. 1B. Executing Agency is unknown USD180,000
Energy	Energy Efficiency standards	Ministry for Natural Resources (NH)	5 years	2020-2025	National	Introducing EE standards by developing legislation (amendment of Electricity Act) and set up a dedicated organization for implementation. Projected Funding needed: USD 50 million	1. Project Type: Technical Cooperation[32] 'Support the development of solar floating photovoltaic energy in Suriname', in which the beneficiaries are the GOS and the State Oil Company **(M)**	Impleme ntation	1A. Approval date July 2021. The duration of this project is 24 months 1B. Executing Agency: Inter-American Development Bank (IADB) USD300,000
Trans port	Improve public transport	Ministry of Public Works, Transport, and Communication (MPWTC) Road Authority	5 years	2020-2025	Regional / TBD	Improve the public transport system, including adding separate bus lanes, public bus hubs outside the	1. Project 'Improving Transport Logistics and Competitiveness in	Impleme ntation	1. Executing Agency: The Ministry of Public Works, Transport and Communications (MPWT&C) IADB financing, USD$45,000,000

[31] https://www.iadb.org/en/project/SU-T1145
[32] https://idbdocs.iadb.org/wsdocs/getdocument.aspx?docnum=EZSHARE-975627404-21

	Name	Lead MDA	Duration	Start / End	Location	Objective	(Related) Project(s)	Status	Remarks
		Suriname (WAS)				city center and shuttle bus inside the city center Projected Funding needed: USD 3 million	Suriname'[33] (2019-present) **(M)**		
Transport	Introduce emissions and age limits for vehicles	Ministry of Public Works, Transport, and Communication Road Authority Suriname (WAS)	5 years	2020-2025	National	Introduce a low or no emissions limits to exhaust gases/emissions from public and private vehicles such as cars, trucks, buses, and other vehicles. Limit the age of used vehicles for import to >5 years old (Foreign Motor Vehicle Import Requirements) Projected Funding needed: USD 1 million	**(M)**		
Transport	Improve traffic management, planning & Infrastructure	Ministry of Public Works, Transport, and Communication (MPWTC) Road Authority Suriname (WAS)	4 years	2022-2026	National	Improve traffic management, planning combined with urban planning. Projected Funding needed: USD 3 million	Does not take place on a project basis. The activities are part of the regular activities of the responsible departments 1.Project 'Improving Transport Logistics and Competitiveness in Suriname' (2019-present) **(M)**	Implementation	1.Executing Agency: The Ministry of Public Works, Transport and Communications (MPWT&C) IADB financing, USD$45,000,000

[33] https://www.iadb.org/en/project/SU-L1057

	Name	Lead MDA	Duration	Start / End	Location	Objective	(Related) Project(s)	Status	Remarks
Transport	Increase public green	Ministry of Public Works, Transport, Communication (MPWTC) Road Authority Suriname (WAS) Ministry of Finance	10 years	2020-2030	National	Increase public roads and walkways of Suriname by enhancing the “green component” as well as green terraces and parks (Green City) Projected Funding needed: USD 2 million	Does not take place on a project basis. The activities are part of the regular activities of the responsible departments **(M/A)**	Implementation	
Transport	Improve road conditions	Ministry of Public Works, Transport and Communication (MPWTC) Road Authority Suriname (WAS)	10 years	2020-2030	Approx. 12 kms of road (exact location to be determined)	The objective of this project is to rehabilitate main roads, protect roads from flooding and decrease travel time and increase safety. Projected Funding needed: USD 40 million	A number of projects were completed in 2021 and others are still ongoing **(A)**	Implementation	
Forestry	Support alternative livelihoods and diversification of the economy in the interior	Ministry of Physical Planning, Land and Forest Management (MPPLFM)	10 years	2020-2030	National	Increase the contribution of forests to the economy and welfare by providing alternative livelihoods that contribute to diversification, using the opportunities provided by nature, while at the same time protecting the	**(M/A)**		

	Name	Lead MDA	Duration	Start / End	Location	Objective	(Related) Project(s)	Status	Remarks
						environment, and Increasing the well-being of Suriname citizens. Projected Funding needed: USD 35 million			
Fores try	Enforcement, control, and monitoring forests	Ministry of Physical Planning, Land and Forest Management (MPPLFM)	10 years	2020-2030	National	Ensure sufficient capacities exist to implement the necessary forest monitoring, control and enforcement activities and strengthening forest regulatory and supervisory institutions. Projected Funding needed: USD 71 million	1. Project: 'Community Conservation of Mangroves'[34] the objective of this project is to engage, train and empower rural communities in conservation and sustainable management of mangrove ecosystems in Suriname. **(A)** 2. GCCA+-2 (UNDP) Project 'Strengthening Mangrove Monitoring System (2021-2023) **(M/A)**	1. Impleme ntation 2.Imple mentatio n	1.A Approval date: November 2020. Duration project is 21 months 1.B Executing Agency: Green Heritage Fund Suriname USD 150,000 2.A. Executing Agency: The Foundation for Forest Management and Production Control (SBB) together with the Centre for Agricultural Research in Suriname (CELOS) USD250,000
Fores try	Promotion of Sustainable Forest Management	Ministry of Physical Planning, Land and Forest Management (MPPLFM)	10 years	2020-2030	National	To maintain forest resources, while increasing the contribution of those resources to economic development in a sustainable manner.	1. Project 'Promoting Sustainable Forest Management'[35][36] (Feb'22-Feb'24) **(M)** 2. Project 'Reduced Impact Logging (RIL-C), Climate Smart Forestry' piloting RIL-C in Suriname (2021-2024) **(M)**	Impleme ntation Impleme ntation	1A. Executing Agency: The Foundation for Forest Management and Production Control (SBB) USD300,000 2.A Executing Agency: CI-Suriname together with the Foundation for Forest Management and Production Control

[34] https://idbdocs.iadb.org/wsdocs/getdocument.aspx?docnum=EZSHARE-452987730-3
[35] https://www.iadb.org/en/project/SU-T1130
[36] https://idbdocs.iadb.org/wsdocs/getdocument.aspx?docnum=EZSHARE-2056220512-8840

	Name	Lead MDA	Duration	Start / End	Location	Objective	(Related) Project(s)	Status	Remarks
						Projected Funding needed: USD 70 million	3. Project 'Strengthening capacity in general and in SBB in particular to make Suriname REDD+ Ready' (2019-2021) **(M/A)**	Closed	(SBB) 3A. Executing Agency: NIMOS together with The Foundation for Forest Management and Production Control (SBB)
Fores try	Promotion of sustainable practices in other land use sectors	Ministry of Physical Planning, Land and Forest Management (MPPLFM)	10 years	2020-2030	National	Improve institutional arrangements through laws and regulations for the purpose of promoting sustainable practices in other land use sectors. Projected Funding needed: USD 16 million	**M**		
Fores try	Protected areas	Ministry of Physical Planning, Land and Forest Management (MPPLFM)	10 years	2020-2030	National	Increase the coverage of protected areas and provide for their protection Projected Funding needed: USD 17 million	1. Submitted to Global Environment Funds, GEF-7; Project ' Strengthening management of protected and productive landscapes in the Surinamese Amazon' (2021-2026) **(M)**	Impleme ntation	1A. Executing Agency: Ministry of Physical Planning, Land and Forest Management (MPPLFM) and the Foundation for Forest Management and Production Control (SBB) □ USD.4,900,000
Agri culture	Introduce national land use planning	Ministry of Agriculture, Animal Husbandry and Fisheries (MAAHF)	2 years	2020-2022	National	Adopt land-use planning that protects natural resources. Projected Funding needed:	**(M)**		

	Name	Lead MDA	Duration	Start / End	Location	Objective	(Related) Project(s)	Status	Remarks
						USD 1 million			
Agri culture	Identify, trial, and introduce more permanent agricultural systems to replace the traditional shifting cultivation	Ministry of Agriculture, Animal Husbandry and Fisheries (MAAHF)	4 years	2020-2024	National	Existing systems from other relevant sources will be evaluated for introduction is Suriname. Selected systems will first be tried in pilot schemes, and when successful, be introduced to farmers. Projected Funding needed: USD 0.5 million	1. Project 'Evolving from shifting agriculture towards agroforestry systems in Suriname: food security from sustainable production'(2022-present, was supposed to start 2018, but was halted because of COVID-19) **(M/A)**	Impleme ntation	1. Technical execution: *the Ministry of Agriculture, Husbandry and Fisheries (LVV), Ministry of Regional Development (RO), and CELOS. This project is an initiative of the Government of Brazil through the Brazilian Cooperation Agency (South-South Technical Cooperation) and the Government of Suriname (coordinated by Ministry of Foreign Affairs)*
Agricult ure	Define and implement a national research, development, and innovation program, and strengthen agricultural research sector	Ministry of Agriculture, Animal Husbandry and Fisheries (MAAHF)	2 years	2020-2022	National	A national institute for land use planning is established and a multidisciplinary land use / resource planning is conducted, involving all sectors and stakeholders. Projected Funding needed: USD 2.5 million	1. Project 'Support to Agricultural Competitiveness in Suriname'[37] (2019-present) **(M/A)** 2. Precision Farming (2019-present) **(M/A)**	Impleme ntation	1A. Executing Agency: Ministry of Agriculture, Animal Husbandry and Fisheries (MAAHF) financed by IADB Acting as Administrator under the Contribution Agreement with the European Union Caribbean Investment Facility ("EU-CIF") EURO €2,350,000 2.A Executing Agency: Ministry of Agriculture, Animal Husbandry and Fisheries

[37] https://idbdocs.iadb.org/wsdocs/getdocument.aspx?docnum=EZSHARE-2056220512-6279

	Name	Lead MDA	Duration	Start / End	Location	Objective	(Related) Project(s)	Status	Remarks
									(MAAHF)□financed by IADB, USD$333,000

Source: Table was drafted by Wortel, V. 2022. From partial report: Climate Change research, climate change integrated in national policy, Information sharing, and networking. PART 1: CLIMATE CHANGE INTEGRATED IN NATIONAL POLICY, September 2022

Note: M = mitigation; A = adaptation

ANNEX III Overview of Donor Funded Projects Providing Financial, Technical and Capacity Building Support

Donor/ Funds	Project	Approved date Period	Budget	Implementing agency
IDB	**Support to Improve Sustainability of the Electricity Service** The specific objectives are to support the implementation of information technologies in business support tools for EBS, to provide financial support for upgrading critical infrastructure, and to contribute to expand electricity coverage by grid extension and renewable energy systems in the Hinterlands. The main components of the Program are: (i) Improvement of EBS Operations; (ii) Sustainable Rural Electrification; and (iii) Critical Infrastructure.	Closed (Approved 2013-12-04)	USD 30,000,000	Ministry of NH
IDB	**Agricultural Competitiveness Program** The program objective is to increase the competitiveness of the agricultural sector through the improvement of animal health, plant health and food safety and agricultural research and technology transfer services.	Implementation (Approved 2017-06-23)	USD 17,500,000	Ministry of LVV
IDB	**Support to the Institutional and Operational Strengthening of the Energy Sector** The objective of this framework is to organize the sector, and shape the conditions for its sustainability in economic, financial and environmental terms and in order to achieve this goal the GOS decided to focus on the reform of the power sector with support from the IDB. The purpose of this first operation is to support the GOS in commencing the process of policy and legislation formulation.	Closed (Approved 2012-12-01)	USD 15,000,000	Ministry of NH
IDB	**Modernization of Agricultural Public Services – I** To improve the competitiveness of the agricultural sector, through the strengthening the provision of agricultural services and implementing policy instruments oriented towards promoting private farm investment.	Closed (Approved 2013-12-16)	USD 15,000,000	Ministry of LVV

Donor/ Funds	Project	Approved date Period	Budget	Implementing agency
IDB	**Support to the Institutional Strengthening of the Energy Sector II** The overall objective of this project is to support development in Suriname by promoting sustainable energy, and therefore contributing to the country's competitiveness. The specific Objectives are: (i) support the formulation of policy and legislation that will contribute to the promotion of RE, EE, EC, rational and efficient use of energy; (ii) encourage measures to promote mitigation of greenhouse gas (GHG) emissions as well as initiatives for adaptation to climate change in the energy sector; and (iii) encourage institutional strengthening and capacity building requirements to achieve sustainable energy.	Closed (Approved 2013-12-04)	USD 10,000,000	Ministry of NH, EBS
IDB	**Support to the Institutional and Operational Strengthening of the Energy Sector III** The general objective of the program is to increase the efficiency, transparency, sustainability and accountability of the power sector. The specific objectives are: (i) to develop an institutional and regulatory framework; and (ii) to strengthen the corporate capabilities of the sector to supply electricity in an economic, efficient and sustainable manner. This operation is the third and final in a programmatic policy-based series of independently and technically connected loans.	Closed (Approved 2016-06-08)	USD 70,000,000	Ministry of NH, EBS
IDB	**Support for the Implementation of the EBS Investment Plan** The main objective is to support the Government of Suriname in strengthening efficiency and generation capacity.	Implementation (Approved 2015-02-09)	USD 33,000,000	EBS
IDB	**Sustainable Agricultural Productivity Program** The project's objective is to increase agricultural productivity in Suriname through investments in infrastructure and management of Irrigation and Drainage (I&D) systems and by improving the quality and availability of agriculture statistics.	Implementation (Approved 2018-11-13)	USD 30,000,000	Ministry of LVV
IDB	**Consolidating a Sustainable Energy Sector:** The general objective is to improve rural economic development, by ensuring adequate and modern access to sustainable electricity in order to enhance the living conditions of the rural	Implementation (Approved 2020-02-06)	USD 30,000,000	Ministry of NH

Donor/ Funds	Project	Approved date Period	Budget	Implementing agency
	population, while improving the rural business environment with better provision of electricity as a public service. The specific objectives are to: (i) advance the implementation of energy reform through support to the Energy Authority of Suriname (EAS) and operational management of the EBS; (ii) increase the reliability of the power system and promote the diversification of the energy matrix through financing pre-investment activities related to Renewable Energy (RE) and Natural Gas (NG); and (iii) expand electricity coverage through a combination of grid extension and off-grid- systems, increasing the provision of RE systems			
Global Facility for Disaster Reduction and Recovery (GFDRR) Disaster Fund	**The GFDRR project "Improving flood risk management in the capital city, Paramaribo**, resulted in a strategic flood risk assessment that includes hydrological and tidal analyses and provides initial rainfall and storms estimates for various return periods and river levels in the Saramacca and Suriname Rivers. Based on the assessment, a flood management investment plan will be developed for critical flood management infrastructure, flood monitoring, forecasting, and emergency response.	04/2016 - 05/2018	USD 349,001	NCCR
European Union (with 500,000 from UNDP)	**GCCA+ phase 2 project**: Mangrove/integrated coastal and water management project Phase 2 of GCCA+ Suriname Adaptation project builds on results from phase 1, whilst focusing on Water resource Management, one of the priority sectors identified under Suriname draft National Adaptation Plan (NAP). This project is complementary and addresses the issue of global climate change and supports Suriname in improving its adaptation measures to climate change.	2020-2023	EUR 5,500,000	UNDP

Donor/ Funds	Project	Approved date Period	Budget	Implementing agency
European Union	**Amazonia 2.0**	2017 (start)	NA	IUCN-South (coordinator) with consortium of trained organizations in Brazil, Colombia, Ecuador, Guyana, Peru and Suriname
European Union	**Trio and Wayana Indigenous Community Empowerment (TWICE)**	2020-2022	EUR 285,160	Conservation International
UNDP; Sida; European Union	**Suriname Global Climate Change Alliance (GCCA+, phase 1 project)** Phase 1 of GCCA+ project aimed to increase Suriname's resilience against the negative impacts of Climate change. The following results were achieved; a) Increase in Hydro-Met data collection capacity; b) Installation of three Micro-irrigation systems and one Solar power operated greenhouse structure; c) The Digitization of Historic Climate data within the Ministries of Public Works, and Transport and Communication; d) Development of an integrated Water Resource Management Action Plan; e) Development of a National Mangrove Strategy and Set-up of a National Mangrove Monitoring System.	2016-2019	EUR 3,400,000	UNDP
UNDP; Forest Carbon Partnership Facility (FCPF)	**Strengthening national capacities of Suriname for the elaboration of the national REDD+ strategy and the design of its implementation framework**	July 2014; probable closing December 2021	USD 7,160,000	National Institute for Environment and Development in Suriname (NIMOS)
SDG Fund Component 1	**Green agreement**, climate financing based on forest and small-scale mining	to be confirmed	to be confirmed	UNDP, UNEP, FAO and UNFPA

Donor/ Funds	Project	Approved date Period	Budget	Implementing agency
SDG Fund Component 1	For pension funds as part of the banking and finance sector for analysis into greening finance, also looks at small-scale mining and forestry sector	to be confirmed	to be confirmed	UNDP
World Bank	**Suriname Competitiveness and Sector Diversification (SCSD) Project**	2020-2025	USD 23,000,000	Ministry of Economic Affairs and the Ministry of Natural Resources
UNDP_GEF Small Grant Project	**Climate smart land-use practices in Pikin Slee village** (Upper Suriname region), including an agroforestry demonstration	2019-2021	USD 49,500	Tropenbos International Suriname (TBS)
DGIS (Netherlands)	Programme in the Upper Suriname River landscape focusing on landscape governance, climate smart land-use practices and responsible business and finances.	2019-2023	EUR 800,000	Tropenbos International Suriname (TBS)
Alcoa Foundation	**Community forests:** capacity building and sustainable forest management for village development. One community forest (Bigi Poika) in Para functions well; in Brownsweg more difficult, due to higher pressure on the forest and competition from gold mining.	2019-2021	USD 11,500	Tropenbos International Suriname (TBS)
UTSN	**Towards a more livable Paramaribo".** The first Urban Forestry project in our capital. ITC - University of Twente	2019-2021	EUR 186,569	Tropenbos International Suriname (TBS)
French Government	**Our Future Forests - Amazonia Verde**	2020-2025	USD 17,4 million	Conservation International
Dutch Government	**Sustainable protection of the livelihood of indigenous communities in South Suriname**	2019-2021	USD 220,336	Conservation International
German Government	**Sustainable income initiatives and biodiversity conservation in two indigenous communities in southern Suriname**	2021-2023	USD 198,894.56	Conservation International

Donor/ Funds	Project	Approved date Period	Budget	Implementing agency
WWF France (with ERDF funds-PCIA)	**Ecosystem Services Observatory for the Guiana Shield (ECOSEO):** The goal is to promote and preserve the benefits given by terrestrial ecosystems (forest savannahs and freshwater) of the Guiana Shield	2019-2021	EUR 415,000	WWF
WWF NL and Belgium	**Early Warning System (EWS)** piloted in Guianas to support near-real time forest monitoring and management and the prediction of deforestation	4 months (May 2021-Aug 2021)	USD 41,800	WWF
FSC	Collaborative agenda developed with key government institutions and Private sector to **promote the adoption of forest certification** within government policies	7 months (Jun 2021-Dec 2021)	USD 31,100	WWF
GCF	Strengthening of climate change finance planning processes to enable implementation, monitoring and reporting of climate actions in Suriname	Implementation, 2022	USD 999,996	FAO
GEF (regional project)	**Caribbean Renewable Energy Development Programme**	Completed 2004-2013	USD 3,726,000 (Grant) USD 17,911,050 (Co-financing)	UNDP
GEF	**Coastal Protected Area Management** To promote the conservation of biodiversity through improved management of protected areas along the western coast of Suriname	Completed 2011-2017	USD 965.556 (grant) USD 1.605.045 (co-financing)	UNDP (executed by Nature Conservation Division of Suriname)
GEF	**Development of Renewable Energy, Energy Efficiency and Electrification of Suriname** To promote the use of renewable energy (RE) and energy efficiency (EE) technologies in the urban and rural areas and increase access to energy in the Interior of the country.	Approved for implementation, 2012	USD 4.400.000 (grant) USD 21.100.000	IDB (executed by Ministry of NH)

Donor/ Funds	Project	Approved date Period	Budget	Implementing agency
			(co-financing)	
GEF	**Development of the information/ traceability systems with SBB (SFISS),** improving capacities to adapt monitoring technology.	2019-2021	NA	IDB
GEF	Implementation of the Strategic Action Programme to Ensure Integrated and Sustainable Management of the Transboundary Water Resources of the Amazon River Basin Considering Climate Variability and Change	Approved 2019;	NA	NA
GEF	**Improving Environmental Management in the mining Sector of Suriname with emphasis on Gold Mining (EMSAG project)**	Approved February 2018; in implementation	USD 29,721,041 of which USD 22,132,000 is country counter funding	UNDP Executed by Ministry of Natural Resources and the National Institute for Environment and Development Suriname (NIMOS) with the support of UNDP)
GEF	**Mainstreaming Global Environment Commitments for Effective National Environmental Management** To generate global environmental benefits through improved decision-support mechanisms and improved local planning and development processes in Suriname, by harmonizing existing information systems that deal with the Rio Conventions (climate change, biodiversity conservation, and land degradation) integrating internationally accepted measurement standards and methodologies.	Approved for implementation, 2014	USD 980.000 (grant) USD 1.400.000 (co-financing)	UNDP

Donor/ Funds	Project	Approved date Period	Budget	Implementing agency
GEF	**Minamata Initial Assessment for Suriname**	Approved	USD 200,000 (grant)	UNDP
GEF	**Artisanal and Small-Scale Goldmining (ASGM) National Action Plan (NAP) for Suriname**	Approved	USD 500,000 (grant)	UNDP
GEF (regional project)	**Technology Needs Assessments - Phase III (TNA Phase III), regional** Provide participating countries targeted financial and technical support to prepare new or updated and improved TNAs, including Technology Action Plans (TAPs), for prioritized technologies that reduce greenhouse gas emissions, support adaptation to climate change, and are consistent with Nationally Determined Contributions and national sustainable development objectives	Approved, 2018	USD 6,210,000 (grant) USD 2,745,000 (co-financing)	UNEP Executed by Technical University of Denmark - UNEP DTU Partnership (UDP), National Agencies
GEF	**Amazone sustainable Landscape project**	2020 - 2024	USD 6,473,600	UNDP
GEF (regional project)	**Umbrella Programme for Preparation of National Communications (NCs) and Biennial Update Reports (BURs) to the UN Framework Convention on Climate Change (UNFCCC)** To support eighteen (18) developing countries prepare and submit National Communications (NCs) and Biennial Update Reports (BURs) that comply with the United Nations Framework Convention on Climate Change (UNFCCC) reporting requirements while responding to national development goals.	Approved, 2020	USD 10,110,480 (grant) USD 1,000,000 (co-financing)	UNEP (executed by Ministry of ROM)

Source: Jharap, R. 2023. Retrieved from the partial report: Final report on Constraints and Gaps and related financial, technical and capacity needs – Including Workshop report on the findings and discussion with stakeholders