NATIONAL CONTEXT ANALYSIS
UPDATED WITH LCDS 2030

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Acronyms and Abbreviations

ASM - Artisanal Small-Scale Mining
BCGI - Bauxite Company of Guyana Incorporated
BSM - Biodiversity Services Markets
CH&PA - Central Housing and Planning Authority
CMRV - Community Reporting, Monitoring and Verification
CRSAP - Climate Resilience Strategy and Action Plan
EPA - Environmental Protection Agency
EUFLEGT - European Union Forest Law Enforcement, Governance and Trade
GBS - Guyana Bureau of Statistics
GDI - Gender Development Institute
GDP - Gross Domestic Product
GEF - Global Environmental Fund
GENCAPD - Guyana Environmental Capacity Development Mining Project
GFC - Guyana Forestry Commission
GGDMA - Guyana Gold and Diamond Miners Association
GGMC - Guyana Geology and Mining Commission (GGMC)
GLDA - Guyana Livestock Development Authority
GLSC - Guyana Lands and Surveying Commission
GMC - Guyana Marketing Corporation
GoG - Government of Guyana
GRDB - Guyana Rice Development Board
GSA - Guyana School of Agriculture
GTA - Guyana Tourism Authority
GUYSUCO - Guyana Sugar Corporation
GWMO - Guyana Women Miners Organization
HFLD - High Forest Low Deforestation
Hydromet - Hydrometeorological Service
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<tr>
<th>Abbreviation</th>
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<tr>
<td>IPCC</td>
<td>Intergovernmental Panel on Climate Change</td>
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<td>IUCN</td>
<td>International Union for Conservation of Nature</td>
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<td>KNP</td>
<td>Kaieteur National Park</td>
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<td>LCDS</td>
<td>Low Carbon Development Strategy</td>
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<td>LECZ</td>
<td>Low Elevation Coastal Zone</td>
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<td>LoA</td>
<td>Letter of Agreement</td>
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<td>LUP</td>
<td>Land Use Planning</td>
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<td>MEA</td>
<td>Millennium Ecosystem Assessment</td>
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<td>MMA/ADA</td>
<td>Mahaica-Mahaicony-Abary Agricultural Development Authority</td>
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<td>MNR</td>
<td>Ministry of Natural Resources</td>
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<td>MRV</td>
<td>Monitoring Reporting and Verification</td>
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<td>NAREI</td>
<td>National Agricultural Research &amp; Extension Institute</td>
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<td>NASAS</td>
<td>National Adaptation Strategy for the Agricultural Sector</td>
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<td>NBSAP</td>
<td>National Biodiversity Strategy and Action Plan</td>
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<td>NDC</td>
<td>National Determined Contribution</td>
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<td>NDIA</td>
<td>Neighbourhood Democratic Council</td>
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<td>NFP</td>
<td>National Forestry Plan</td>
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<td>NFPS</td>
<td>National Forestry Policy Statement</td>
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<td>NTFPs</td>
<td>Non-Timber Forest Products</td>
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<td>PAC</td>
<td>Protected Areas Commission</td>
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<td>PAT</td>
<td>Protected Areas Trust</td>
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<td>PES</td>
<td>Payments for Environmental Services</td>
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<td>PM</td>
<td>Particulate Matter</td>
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<td>PTCCB</td>
<td>Pesticides and Toxic Chemicals Control Board</td>
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<td>REDD+</td>
<td>Reducing Emissions from Deforestation and Forest Degradation</td>
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<td>RIL</td>
<td>Reduced Impact Logging</td>
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<td>RUSAL</td>
<td>Russian Aluminium Inc.</td>
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<td>SDGs</td>
<td>Sustainable Development Goals</td>
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<td>UG</td>
<td>University of Guyana</td>
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<td>Abbreviation</td>
<td>Full Form</td>
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<td>UNCBD</td>
<td>United Nations Convention on Biological Diversity</td>
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<td>UNCCD</td>
<td>United Nations Convention to Combat Desertification</td>
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<td>UNDP</td>
<td>United Nations Development Programme</td>
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<td>UNFCCC</td>
<td>United Nations Framework Convention on Climate Change</td>
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<td>VPA</td>
<td>Voluntary Partnership Agreement</td>
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<td>WHO</td>
<td>World Health Organization</td>
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Executive Summary
Executive Summary

This report aims to highlight the pressures and threats on biodiversity and the drivers of change across key economic sectors in the Cooperative Republic of Guyana. The report also seeks to highlight the sectors’ opportunities and constraints to engagement and involvement of stakeholders in maintaining biodiversity and ecosystem services, which are key parts of Guyana’s international and national commitments. The overall outcomes of this national context study are to:

- Document the institutional, socio-cultural, historical, and policy perspectives of key economic sectors in Guyana to support two (2) diagnostic assessments.

The specific objectives of the national context study are to:

- Identify the current national situation of the key economic sectors to be studied in the National Synthesis Assessment.
- Identify the stakeholder groups and categories across the sectors and the potential level of interest and commitment to the project of the various stakeholders to serve as a support to decision-making.

Guyana is situated in the neo-tropical biogeographical territory of northeastern South America and is also part of the Guiana Shield region that forms part of the Amazon Biome. The FAO has mapped five (5) separate Physiographic Regions as follows: i. The Coastal Plain; ii. Interior Alluvial Plains and Low-lying Lands; iii. The ‘White Sand’ Plateau and Older Pediplains; iv. Crystalline Shield Uplands; v. Highlands, Mountains, and Plateaus. Within these regions are Guyana’s major ecosystems: (i) forest, (ii) freshwater (which includes rivers, lakes, creeks, and ponds), (iii) wetland, (iv) savannah, (v) coastal, and (vi) marine. These ecosystems support a diverse array of species, several of which are globally threatened or endangered.

Guyana has an estimated 8000 species of plants identified and an estimated 3,500 species of fauna identified for the country. The International Tropical Timber Organization has partitioned Guyana’s forests as 36% rainforest, thirty-five per cent montane forest, 15% swamp and marshes, 7% dry evergreen forests, 6% seasonal forest, and 1% mangrove forest.
Biodiversity’s Overall Contribution to Guyana’s Economy

Biodiversity in Guyana has contributed and continues to contribute tremendously to Guyana’s economy both directly and indirectly. Many natural resources provide an array of goods and services necessary for the growth and development of the economy and the standard of living of its citizens. Research and the findings presented in this report have shown that ninety-five per cent of foreign exchange earnings were the result of using natural resources and biodiversity in 2013. The country’s biodiversity has also been the source of multi-sectoral activities like mining, tourism, ecotourism, health, and nutrition.

Biodiversity Threat Assessment

According to the IUCN (2021) biodiversity threat assessment showed that the major threats can be found in both the terrestrial and aquatic ecosystems, and these are from:

- Residential & commercial development
- Agriculture & aquaculture
- Energy production & mining
- Transportation & service corridors
- Biological resource use
- Hunting, poaching, and illegal pet trade
- Natural system modifications
- Invasive and other problematic species, genes & diseases
- Pollution
- Geological events
- Climate change & severe weather

The Mining Sector in Guyana

There are six mining districts in Guyana demarcated as the (1) Berbice Mining District, (2) Potaro Mining District, (3) Mazaruni Mining district, (4) Cuyuni Mining District, (5) North-West Mining District, and (6) Rupununi Mining District. The mining and quarrying sector of Guyana
contributed an average of 40.6% to the total GDP (2021) with the Gold Industry contributing an average of 5.9%, the Bauxite Industry contributing an average of 0.3%, and all other mineral mining activities contributing an average of 1.5% to total GDP. The majority of mining activities in Guyana occur in the interior areas along river courses or within the dense forest areas of the country. The findings presented in this report indicate that Artisanal Small-scale Gold Mining (ASGM) is the largest mining operation in Guyana with the biggest ecological impacts. There are two broad areas of concern identified: 1) land and soil clearing and 2) chemical pollution, particularly heavy metals.

Overall, the mining sector in its present operation is the most prominent source of ecological destruction in terms of habitat removal and pollution in Guyana.

The Forestry Sector in Guyana

Guyana has a land cover of 19.7 million hectares, with 18.5 million hectares (87% of land cover) (Convention on Biodiversity CBD, 2022) of the primary or otherwise regenerated forest. Most of Guyana's forest cover has been designated as production forest, with 84.6% being publicly owned by the State and the remaining 15.4% either declared as indigenous lands or privately owned. In its 2019 report, the Guyana Forestry Commission (GFC) indicated that the entire export value for forest products in 2018 was US$37.9 million, down 3.09% from the previous year's total export value of US$39.1 million.

Long-term data has shown that the operations within the forestry sectors cause ecological damage whether done sustainably or unsustainably. Over the years, ecological damage has been documented in Guyana’s forestry sector and are as follows:

- Impacts of Conventional and Reduced Impact Logging Systems
- Cumulated Canopy Cover Loss
- Ground Clearance and Disturbance
- Effects of Logging Activities on Residual Trees
- Impacts on the commercial stand
- Introduction of Invasive Species
The Agricultural Sector in Guyana

The agriculture sector accounts for an estimated 12.9% of the gross domestic product (GDP) in 2021 (Guyana Bureau of Statistics, 2022). The sectors also directly employ 30-33% of the country’s labour force in both urban and rural settings. The sector is dominated by small farmers (>60%) that have land holdings that are 5 ha or less but there are a number of large private and public sector enterprises. The sector is divided into five subsectors, namely the rice industry, the sugar industry, fisheries, livestock (including apiculture), and the non-traditional crop industry. Agro-processing is also an emerging and ever-growing activity in the agricultural sector.

The agriculture sector has had a significant negative effect on Guyana’s ecosystem and ecological processes. These negative effects have grown along with the sector over the years. Various studies have documented the negative ecological impacts, examples of the factors discussed in this report include:

- Deforestation and Forest Degradation
- Surface and Groundwater Pollution
- Soil Degradation, Destruction, and Contamination
- Contribution to Climate Change
- Erosion of Genetic Diversity
- Introduction of invasive species
- Declining Fisheries

The Urban and Built Environment in Guyana

A significant amount of Guyana’s annual budget is allocated to develop the infrastructure in urban areas, particularly on the low coastal plain which more than 90% of the country’s population inhabits. There are plans to establish more housing schemes within the next five years to satisfy the ever-increasing demand each year and this will require additional land which brings a
conundrum, which may mean either wetlands or other natural habitats are modified to accommodate the new development or farmlands reclaimed which will cause a food security issue. Guyana's coast is home to 90% of the country's population, necessitating the need for ongoing development, whether it be infrastructural, economic, or social. Some of the difficulties connected with this urban and built environment that might have an impact on biodiversity are as follows:

- Improper disposal of Waste (Land and Water)
- Water contamination from various sources (Factory and household discharges and agricultural runoff)
- Air emissions from factories and vehicles
- Clearance of habitats for infrastructural development

The Tourism Sector in Guyana

Over the past 10 years, Guyana has seen a gradual upsurge in its global reputation as a tourist destination (World Bank, 2022). The tourism sector in Guyana has been tagged alongside the country’s drive towards a sustainable economy as the administrations of the country have identified tourism as a sustainable industry in line with the goals of both the Low Carbon Development Strategy (LCDS). Guyana has a comparative advantage in the abundance of green spaces and intact forest ecosystems and unlike the other Caribbean islands that have built their tourism product on surf and sand, Guyana's eco-tourism potential is vigorously reliant upon its rich biodiversity. Guyana's ecotourism also possesses great potential for community-based tourism which is the utilization of persons within the community to oversee and run tourism activities. In Guyana, the Iwokrama Centre and the Kaieteur National Park are two exemplary sustainable tourism models whereby the tourism revenue supports conservation efforts within a protected area. These models incorporate the elements of biodiversity management, community engagement, and financial sustainability through their tourism products.

Concluding Remarks
Based on our analysis of the current safeguards and sustainable financing mechanisms in national developmental plans, it is clear that biodiversity conservation and sustainable management need to be given much more consideration in national long-term planning. With the commencement of the preparatory process towards and the drafting of the post-2020 Global Biodiversity Framework which is underway as agreed by Member States of the UNCBD in 2018, the coming years could mark a turning point for global biodiversity conservation – and Guyana has a significant role to play. The new targets and goals for the next decades will frame the actions of governments, non-governmental organisations, other stakeholders, and decision-makers over the next decades. The themes and sectorial priorities reported here for Guyana, though local in their contexts are global in their application.
Guyana
Geophysical Settings
1. Introduction

Guyana is geographically situated in the northern part of South America (10° to 8½° North Latitude and 56½° to 61½° West Longitude). It shares a border on the north by the Atlantic Ocean; on the south with Brazil; on the east with Suriname and the west with Venezuela and Brazil. The area of the country is 215,000 square kilometres (km²) (83,000 square miles (mi²)) and the country is divided into ten administrative regions. With forests covering a total of 87% of the country, Guyana comprises four separate geographic landforms namely the coastal plain, sand plateau, forested highlands, and interior savannahs (Guyana Lands and Surveys Commission, 2017; Guyana Forestry Commission, 2018). Mostly located below sea level, the coastal plain comprises about 4.3% of the landmass and varies in width from 8 to 65km. The sand plateau belongs to the endangered ecosystems. It is primarily a sandy and clayey region with poor nutrient content. The sand plateau constitutes 13.7% of the total land mass of Guyana. About two-thirds (74%) of Guyana's land mass is made up of densely forested highlands, which have varied elevations of between 300m and 1,200m. The remaining parts (8%) of Guyana's land are made up of interior savannahs characterised by flat wetlands. Interior savannahs have elevations which varied from 100 to 120m, with abruptly elevating altitudes of 610m to 990m.

1.1 Guyana’s Biophysical Setting

1.1.1 Geographical Realms

Phytogeographically, Guyana is in the Neotropical Realm which spans the entirety of South, and Central America, and the Caribbean (Figure 1-1), except for the southern tip of Chile which is considered part of the Antarctic Realm (Olson et al., 2001; Udvardy, 1975).
Guyana is in the Neotropical Realm which spans the entirety of South America, the Caribbean and most of Central America (Figure 1-2) (Pedrotti, 2013a, 2013b).
Various ecological zones with their own unique characteristics such as climate, soil type, etc. that influence both the floral and faunal assemblages (Holt et al., 2013; Meng et al., 2019) can be found within the Neotropical realm.

1.1.2 Climate

Currently, Guyana has four climates according to the Koppen-Geiger climate classification system (Figure 1-3) (Beck et al., 2018; Peel et al., 2007):

**Tropical rainforest (Af) climate** which is characterized by observable rainfall is always above 150cm but averages between 2500mm to 3000mm with a temperature variation of 18°C to 31°C, rarely exceeding 35°C. The entire coastal plain of Guyana is heavily influenced by the ocean (Tropical Marine Climate) which is responsible for the rain outside of the May/June rainy season and also keeps the temperature relatively stable.

**Tropical monsoon (Am) climate** is also called the tropical wet climate and is characterized by mean temperatures above 21°C to 30°C. The annual mean rainfall is greater than 1000mm.

**Tropical Savannah (Aw) climate** is the most moisture deficient climate that can be found in Guyana. The temperature ranges from 18°C to as high as 33°C and the driest month only receives a mean of 60mm of rainfall while receiving annual mean precipitation of 1270mm.

**Temperate with no dry season, warm summer (Cfb) climate** can be found at the high-altitude border regions where temperatures can drop below 20°C at night.
1.1.3 Geophysical regions of Guyana

*Low Coastal Plain:* Stretches approximately 440 Km and is relatively flat. The terrain is flat and most of the coastal belt is 1 m to 3 m below the mean sea level. The dominant soil type is silty clay and pegasse (Gleysols and Histosols) and to a lesser extent, some areas have sandy clays. Over 90% of Guyana’s agricultural activity is conducted on the low coastal plain (Figure 1-4).

*The Hilly Sand and Clay Region:* This region is dominated by low to medium-height vegetation and dominated by white sandy soil (*Albic arenosols*). The hilly sand and clay region is located south of the low coastal plain and is known for various minerals such as bauxite and white clays (Kaolin). The terrain is undulating to hilly (30m to 122m high).
The Hinterland Forest: This region comprises 73% of the total area of the country and has a number of mountain ranges, Kanuku, Pakaraima, Imataka and Acarai mountain ranges.

The Rupununi Savannah: Located in the southwestern region of Guyana and is dominated by grassland with scrub and low trees with hills in some areas. The Kanuku mountains divide the region into the north and south Rupununi Savannahs.

Elevation Profile: The elevation profile of Guyana ranges from 1m to 3m below the mean sea level on the low coastal plain (Figure 1-5), which is prone to flooding, to as high as 2,835m at the summit of Mount Roraima located in the Northwest of Guyana. Mount Roraima is part of the Pakaraima Mountain Range (CIA, 2020; GoG, 2019b).

Hydrologic Profile: Three main rivers drain from the south of Guyana into the Atlantic Ocean which is to the north of the country (Figure 1-6). The Essequibo River, which is the largest of the three, runs for 1,014Km draining a total estimated area of 140,637 Km². The Berbice River which is the second-largest river runs for 595Km and drains an area of 5,102 Km². Finally, the Demerara River is the smallest of the three main rivers. It runs for approximately 346Km and drains an area of 4,040 Km² (FAO, 2015a; US Engineer Corp, 1998).
Figure 1-4 Geophysical regions of Guyana (Source: GLSC, 2021)
Figure 1.5 Elevation map of Guyana (Source: GLSC, 2021)
Figure 1-6 Main rivers of Guyana (Source: GLSC, 2021)
1.2 Ecosystems

1.2.1 Aquatic

*Freshwater:* Three freshwater ecoregions have been identified in Guyana. These are the Orinoco Delta and Coastal Drainages, the Essequibo, and the Guianas (Figure 1-7). To date, over four hundred and seventy-six species of freshwater fish, of which approximately eighty-three are endemic, have been found within these ecoregions. Of particular importance is the Essequibo ecoregion, which serves as an important biological corridor that is connected to the Amazon Basin. This link allows for a continuous expanse of water during the wet seasons between the tributaries of Rio Branco, Brazil, and the Rupununi River (GoG, 2015b).

*Marine Ecoregions:* Located between the estuaries of the Amazon and Orinoco Rivers, Guyana’s profile coastline and the siltation of outfalls are directly affected by the movement of coastal currents and shoals (Figure 1-8). The country’s coastal zone is identified by the vast inter-tidal mudflats divided by narrow strips of sand and shell beaches, and its mangrove swamps with

*Figure 1-7 Freshwater ecoregions in Guyana (Source: WWF Guianas & Google Earth)*
shallow saline swamps and lagoons on its inner fringes. Known for its diverse inhabitants, in particular the manatee, as well as being a nesting ground for the endangered Leatherback, Hawksbill, Olive Ridley, and green turtles, Shell beach is a popular beach with its unique structure of mangrove forests, inland swamp forests, and savannahs (GoG, 2015b).

1.2.2 Terrestrial

*Terrestrial Ecosystem:* Approximately sixty per cent of Guyana’s forests are considered primary forests, yet most of its ancient soils are infertile (Figure 1-9) (FAO, 2015a). To date, these forests are inhabited by 1,260 species of amphibians, birds, mammals, and reptiles, and over 8000 plant species. The International Tropical Timber Association has partitioned Guyana’s forests as 36% rainforest, thirty-five per cent montane forest, 15% swamp and marshes, 7% dry evergreen forests, 6% seasonal forest, and 1% mangrove forest (GoG, 2015b; Guyana Lands and Surveys Commission, 2013; ter Steege, 2000).
Figure 1-9 Vegetation map of Guyana (Source: GFC, 2019)
The forested areas are rich with plant endemism. With an estimated, eight thousand species of vascular plants, (Boggan et al., 1997) have noted the likelihood that half of these species might be endemic to Guyana’s forests. Owing to its vegetation, a significant forested area has been given the name Guyana Lowland Floristic Province. Its southern area is known as the transverse dry belt and is characterized by semi-open forests, patches of savannah, and dense mesophytic forests on higher elevations as well as beside rivers and streams (Northern South America: Guyana, Suriname, French Guiana, northern Brazil, and eastern Venezuela/Ecoregions/WWF).

1.3 Species

In this assessment, the species were estimated based on the number of species that were documented in the protected areas.

1.3.1 Plants

An estimated 8,000 species of plants have been identified in Guyana. Many of these species have been used as sources of food, raw materials for the manufacture of goods and shelter. There are several ecologically important areas (GoG, 2019c).

Iwokrama has documented a total of 1,556 plant species, an estimated 2,700 plant species have been recorded in Konashen, 1,577 species in the Kanuku Mountains, 1,100 species in the Kaieteur National Park and an estimated 1,153 species in the Mabura Hill Forest Reserve. An equally important area is Shell Beach but there was a limited number of floral studies conducted. The floral studies were conducted between 2004 and 2009 which identified more than 100 plant species in the Shell Beach Protected Area (Figure 1-10) (GoG, 2015b, 2019c; Prince et al., 2004; Kalamandeen and DaSilva, 2005; Hollowell, 2009).
1.3.2 Bacteria

Approximately 33 species of bacteria, 13 species of nematodes and an estimated 30 viruses have been documented as of 2015. In terms of archaea and protist species, there were no records found that documented any archaea and protist species (GoG, 2015b, 2019c).

1.3.3 Fungi

To date, more than 1,200 species of fungal species have been documented in Guyana. Most of the documented species fall into the phylum Basidiomycota (mushrooms) (Hance, 2008; HENKEL et al., 2002; Henkel et al., 2004; Smith et al., 2015).

1.3.4 Animals

There are over 3,500 species of animals that have been documented in Guyana (Figure 1-11). The breakdown is 467 fishes; 130 amphibians; 179 reptiles; 814 birds; 225 mammals and 1,690 invertebrates (FAO, 2015a; GoG, 2015b, 2019c).

Figure 1-10 Number of species found in various biologically important areas in Guyana (Source: GoG, 2015b, 2019c)
1.4 Agrobiodiversity

In Guyana, when it comes to agrobiodiversity, numerous crops are cultivated. On record, there are more than 140 species of plants from more than 100 plant families that are cultivated in the agricultural sector. On a very small scale, there are 2 species of fungi (Oyster mushroom (*Pleurotus ostreatus*) and Common mushroom (*Agaricus bisporus*)) that are cultivated. With regard to animal species, the agriculture sector is not very diverse (Figure 1-12). Only an estimated 27 species of animals are reared which have numerous breeds that are periodically improved by incorporating the genetic material of exotic breeds (MoA, 2016; World Crop Database, 2021).

*Figure 1-11 Number of species recorded per animal group found in Guyana (Source: GoG)*
In the crop industry (both traditional and non-traditional), there are various categories of fruits, vegetables and cereals that are cultivated in Guyana’s agricultural sector (Figure 1-13). The category of cereals is the least diverse with only an estimated 5 species while the fruit category is the most diverse with an estimated 78 species and the vegetable category has an estimated 65 species.
Apart from what is mainly cultivated in the agricultural sector, several plant and animal species are reared in some instances on a subsistence level by local and indigenous communities that are not sold regularly on the open agricultural produce market since the demand is not high. A lot of the species that are used might be classified as wild plants and animals. There are also more than 10 different species of fungi that are used in the various indigenous communities (Henkel et al., 2004).

1.5 Biodiversity’s Overall Contribution to Guyana’s Economy

Biodiversity in Guyana has and continues to contribute tremendously to Guyana’s economy both directly and indirectly. Many natural resources provide an array of goods and services necessary for the growth and development of the economy and the maintained standard of living of its citizens. Research has shown that ninety-five per cent of foreign exchange earnings were the result of using natural resources and biodiversity in 2013 (EPA, 2014). Some examples of direct contribution are timber and non-timber forest products which are sold locally and exported. Next, there is the fisheries industry which consists of marine and inland components. The country’s
biodiversity has also been the source of multi-sectoral activities like mining, tourism, ecotourism, health and nutrition.

With a surface cover of approximately 83.9% intact forest, Guyana has maintained a deforestation rate of less than 1% for decades (GFC, 2020). By opting to maintain its low rates of deforestation, Guyana is helping to reduce CO$_2$ emissions into the atmosphere, making it instrumental in mitigating climate change throughout the world. As a more indirect approach, Guyana’s biodiversity has also provided millions of dollars in revenue by preserving it through the forestry industry (sustainable timber and non-timber forest products), sustainable wildlife trade, pharmaceuticals, etc. Realizing the importance of keeping Guyana’s forested areas intact, the Kingdom of Norway entered an MOU with the Government of Guyana in 2009 to provide up to two hundred and USD 50 million to Guyana’s economy as an incentive to maintain or lower the annual deforestation rate of less than 0.056% (Laing, 2018). Various sectors directly depend on biodiversity

1.6 Country Status

*Terrestrial Species Conservation Status Assessment:* The conservation status of most of the terrestrial biodiversity is of the least concern (91.2%) while 2.17% is vulnerable, and 1.11% of the species are endangered (Figure 1-14). Approximately 0.38% of the species are classified as critically endangered and 3.53% of the species could not be assessed since there is no data to do so. No species is recorded to have gone extinct (IUCN, 2021).

*Aquatic Species Conservation Status Assessment:* The conservation status of most of the known and recorded aquatic biodiversity is of least concern (83.5%) while 3.1% is vulnerable, and 3.1% of the species are endangered (Figure 1-15). Approximately 0.9% of the species are classified as critically endangered and 6.8% of the species could not be assessed since there is no data to do so. No species is recorded to have gone extinct in Guyana within the last 20 years (IUCN, 2021).
Figure 1.14 Terrestrial species conservation status (Source: IUCN, 2021)

Figure 1.15 Aquatic species conservation status (Source: IUCN, 2021)
1.7 Biodiversity Threat Assessment

An IUCN biodiversity threat assessment showed that the major threats are as follows (IUCN, 2021) and these threats can be found in both the terrestrial and aquatic ecosystems:

- Residential & commercial development
- Agriculture & aquaculture
- Energy production & mining
- Transportation & service corridors
- Biological resource use
- Human intrusions & disturbance
- Natural system modifications
- Invasive and other problematic species, genes & diseases
- Pollution
- Geological events
- Climate change & severe weather

*Terrestrial Ecosystem Threats:* The results of the threat assessment showed that different forms of biological resource use ranked the highest with scores of 191, 186 and 156 respectively (top 3 threats to the terrestrial ecosystem) (Figure 1-16). Climate change and severe weather had the 10th highest threat score (96) (IUCN, 2021). Please refer to Figure 1.16 to assess the need for action based on the ratings for each of the threats listed above.

*Aquatic Ecosystem Threats:* The results of the threat assessment showed that biological resource use ranked the highest with scores of 191, 186 and 156 respectively (top 3 threats to the terrestrial ecosystem) (Figure 1-16). Climate change and severe weather had the 10th highest threat score (96) (IUCN, 2021).
Figure 1-16 Top 10 threats to biodiversity in Guyana’s terrestrial ecosystem (Source: IUCN, 2021)

Figure 1-17 Top 10 threats to biodiversity in Guyana’s terrestrial ecosystem (Source: IUCN, 2021)
The GoG has recognized the importance of its rich biodiversity and has developed key policy directives that incorporate the management and conservation of its biodiversity across multiple ecosystems. The LCDS has assessed and incorporated biodiversity positive strategies and actions into its long-term developmental goals. The need for biodiversity conservation in Guyana was articulated in the LCDS document outlining some of the mechanisms that fit within the larger trajectory framework for securing the country’s biodiversity by 2030. The importance of biodiversity to its forestry, fisheries and wildlife sectors additionally, the LCDS recognizes the potential of several off-shoot enterprises that can stem from biodiversity preservation including ecotourism, bioprospecting and indigenous biodiversity-based livelihoods.

The biodiversity-positive strategies and actions outlined in the LCDS have a foundation based on The Economics of Ecosystems and Biodiversity (TEEB). The TEEB approach is based on the principles of understanding the value of ecosystem services and biodiversity to communities and society. This approach is one of the core pillars of the LCDS which identifies the importance of ecosystem services, the valuation of ecosystem services and the importance of biodiversity conservation to the economy. The themes covered under the ecosystem services framework of the LCDS include i) Forest – Based Ecosystem Services; ii) Biodiversity conservation and protection; iii) Water resources, and iv) Ocean/Marine economy. In terms of biodiversity-related policy actions, the LCDS has included elements that will focus on:

1. **Valuing Ecosystem Services**

Within the LCDS document, Guyana has outlined a goal for a new ecosystem services economy by 2030. The vision was built upon the payment for forest climate services that the country has undertaken with the REDD+ programme. The LCDS outlines a plan to continue advancing the country’s forest climate services and invest new revenues into low-carbon economic activity.

2. **Integrated Water Resources Management**
The LCDS recognizes the importance of holistically managing freshwater resources in the country. Integrating water resource management necessitates a comprehensive assessment of the hydrological, topographical, socio-cultural, economic, political, environmental and institutional factors that influence the use of water across all sectors in Guyana, according to the LCDS report. The country’s water resource is a critical ecosystem supporting the majority of the country’s biodiversity as well as its importance in the country’s economic sectors. The strategic vision of the LCDS intends to address; i) issues on water rights and allocation; ii) water supply and sanitation; iii) issues with water and the environment; iv) water allocation and challenges for the agriculture sector; v) water for energy; vi) waste water management; vii) water governance, and viii) the role of public-private partnerships.

3. Protected Areas and Conservation

Guyana has recognized the importance of protected areas by establishing the Protected Areas Commission (PAC) and designating, so far, five national protected areas in the country. The LCDS captures the importance of protected areas in biodiversity conservation and the maintenance of ecosystem services. The report emphasizes the need for biodiversity research and integrating sustainable business models to support conservation efforts, particularly eco-tourism. Protected Areas in Guyana comprise ecosystems that are both hinterland and coastal. As part of the country’s conservation efforts, the expansion of protected areas for Guyana includes more terrestrial and coastal protected areas especially to preserve the forest stock, indigenous lands and culturally significant sites. Additionally, the expansion of protected areas will also include the marine ecosystems of the country.

4. Carbon Market Mechanisms

The LCDS clearly outlines a strategy for the country to benefit from the growing global climate market. The document predominantly outlines the expansion of the REDD+ agreement with Norway and the development of a carbon credit system backed against the carbon sequestration potential of the country’s forest biomass. The LCDS’ aim for the development of a carbon credit system requires several policy mechanisms including the identification of its carbon credit
objective, setting a market standard, engaging with ART-TREES, selling the credits and re-investing and sharing benefits with communities. The carbon credit system will be an important concept to capture within the national biodiversity context as this system is indirectly related to biodiversity. The carbon market will only be possible so long as the health of the forest is intact. Biodiversity markers are often used to assess the health of forest ecologies therefore, research into the conservation of forest biodiversity can be used to assess the continued state of the carbon credit system.

5. Village Sustainability Plans

Village Sustainability Plans (VSPs) identify community needs through village workshops to create a unifying vision for the community and identify areas that require support and investment to achieve the vision. The implementation of projects within these priority areas helps to enable Regional and National development goals outlined in the LCDS 2030. The two main areas of focus of the VSPs are; 1) community involvement in ecosystem services management; and 2) sustainable business opportunities for communities such as eco-tourism, indigenous tourism and sustainable agriculture.

6. Habitat Restoration

ART-TREES was identified as the primary standard suitable for Guyana in the forest climate services mechanism and in expanding the REDD+ programme beyond the bi-lateral agreement with Norway. The benefits and economic opportunities stemming from the ART-TREES plans will then be used in habitat restoration. The LCDS outlines that these plans include the reclamation of mine-sites with the document outlining several land reclamation projects undertaken already since 2014. In addition to the mine-site reclamation aspects, continued work is expected in mangrove restoration with the country having conducted a major restoration project since 2015. The restoration of habitats has direct impacts on biodiversity health and therefore is an important component of the LCDS that links to the country’s commitment to the UNCBD.
7. **Biodiversity Research and Development and Capacity Building**

According to the LCDS, biodiversity data and documentation is vital for the country to better understand and manage its natural assets and green spaces. Despite this, Guyana has numerous gaps in biodiversity data stemming from poor data collection processes, poor data standardization and poor data management as outlined in Guyana’s National Biodiversity Strategy and Action Plan (2012 – 2020) prepared by the Environmental Protection Agency (EPA) and the Ministry of Natural Resources. Biodiversity databases exist in Guyana but consolidating existing databases in a manner where knowledge sharing is palatable and user-friendly amongst stakeholders is relatively non-existent (Guyana’s National Biodiversity Strategy and Action Plan (2012-2020). As such, the policy action outlined in the LCDS to strengthen the research and development and capacity building for biodiversity knowledge and data will look at a collaborative effort between the public sector environmental stakeholders and the University of Guyana. Through this collaboration, the GoG intends to:

1. Build the data competency and capacity of professionals with management and regulatory responsibilities.
2. Build the capacity of advisory services and technical support related to the CBD.
3. Promote and invest in modern cutting-edge technology that is suitable to Guyana’s context and environmentally friendly. This will increase the data collection capacity of agencies.
4. Provide the needed resources and technology to conduct monitoring and enforcement. Through this, incorporating information communication technologies (ICTs) in biodiversity conservation and management.
The Mining Sector of Guyana
2. The Mining Sector in Guyana

Guyana has a longstanding history with mining which started in the country pre-independence with the bauxite mining industry celebrating 100 years in operation in 2016. Mining is fabricated into the economy and culture (Clifford, 2011) of Guyana being the main source of foreign exchange, foreign direct investments, employment, and national wealth for the past century, though this has changed with the emergence of the oil and gas industry in the country. Guyana’s mining industry has expanded and evolved over the years. The industry predominantly exports bauxite, gold and diamonds but the country has a variety of mineral deposits including silica sand, kyanite, feldspar, copper, tungsten, iron and nickel just to name a few (International Trade Administration, 2020). According to the Mining Amendment Regulations (2005) for Guyana, mining operations generally occur on three scales: 1) large-scale mining classified as an operation whereby a minimum volume of 1000m$^3$ of material is excavated or processed as aggregate for 24 hours, 2) medium-scale operation where the volume range for materials excavated or processed in a day is 200m$^3$ to 1000m$^3$ and 3) small scale operations where the volume range for materials excavated or processed in a day is 20m$^3$ to 200m$^3$ (Thom, 2020). There are six mining districts in Guyana demarcated as the (1) Berbice Mining District, (2) Potaro Mining District, (3) Mazaruni Mining district, (4) Cuyuni Mining District, (5) Northwest Mining District, and (6) Rupununi Mining District (See Figure 2.1).
The mining industry is segmented into a number of broad-based activities. The industry presently consists of bauxite mining by large multinational companies, mining of gold by medium-sized and large-scale foreign companies, small and medium-size local gold miners and aggregate and other mineral mining by small local companies. The mining districts outlined in Figure 2.1 shows the distribution of mining activities throughout the Hinterland regions of the country with operations utilizing the many river tributaries and waterways. A significant percentage of mining activities in Guyana occur within the vicinity of forested lands and indigenous lands which has led to several land use issues and conflicts (Colchester et al. 2002). Despite this, the mining sector is still valued as an important economic contributor to Guyana’s development and will be part of the country’s
outlook for a while. The key for policymakers and stakeholders is to comprehensively assess the positive and negative impacts of mining on the social and environmental facets of Guyana to have a deeper understanding of the necessary measures, strategies and policies needed to shift the industry to one that is responsible. The information prepared for this report will look at several of the pertinent impacts on the economy, society and the environment of Guyana that hinders responsible mining.

2.1 Socioeconomic Overview of the Mining Sector in Guyana

Before Guyana’s Oil Industry, the mining sector in Guyana was viewed as the key driver of economic growth and the primary source of foreign exchange (Thomas, 2009). For the period 2012 - 2019, the mining sector of Guyana contributed an average of 12% to the total GDP with the Gold Industry contributing an average of 8.9%, the Bauxite Industry contributing an average of 1.2% and all other mineral mining activities contributing an average of 1.5% to total GDP. For the year 2019, mining contributions peaked for this period with a total of 15% of GDP due to mining production (See Table 2.1). In the 2020 and 2021 calculations of GDP, the oil and gas sector was calculated under the sub-theme of mining and quarrying. Looking at the disaggregated values for the mining sector, 11.6% and 7.9% of GDP in 2020 and 2021 respectively came from the mineral mining sectors.

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<tbody>
<tr>
<td>Mining and Quarrying Aggregated</td>
<td>12.2%</td>
<td>10.3%</td>
<td>9.2%</td>
<td>9.3%</td>
<td>14.9%</td>
<td>12.4%</td>
<td>12.8%</td>
<td>15.0%</td>
<td>27.1%</td>
<td>40.6%</td>
</tr>
<tr>
<td>Bauxite</td>
<td>1.6%</td>
<td>1.3%</td>
<td>1.3%</td>
<td>1.2%</td>
<td>1.1%</td>
<td>0.8%</td>
<td>1.0%</td>
<td>1.0%</td>
<td>0.4%</td>
<td>0.3%</td>
</tr>
<tr>
<td>Gold</td>
<td>9.9%</td>
<td>8.2%</td>
<td>6.7%</td>
<td>6.6%</td>
<td>11.7%</td>
<td>9.6%</td>
<td>8.5%</td>
<td>9.9%</td>
<td>9.6%</td>
<td>5.9%</td>
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</table>
The data demonstrates that the Gold Industry in Guyana is the driver in the mining sector with gold production accounting for 66% of the mining output in 2019. The Gold Industry in Guyana is dominated by Artisanal Small-Scale Mining (ASM) operations which account for 70% of gold production in the country (McRae, 2014, Pasha et al., 2017). In 2019, gold exports accounted for 55% of all export value and foreign exchange in the country which amounted to US$411,214,600.00 (Liang & Moonsammy, 2021). As of 2021, the dominant export for Guyana is now the country’s Oil Industry with 68% of the export value and foreign earnings and the Gold Industry is now second with 20.7% of the country’s export value and foreign earnings which amounted to US$205,609,300.00 (Guyana Bureau of Statistics, 2021). In terms of public revenue from mining, taxes and royalties from mining have increased by 86% from US$1,500,000.00 in 1998 to US$14,000,000.00 in 2008 (Thomas, 2009). The mining sector accounts for 4 - 6% of the country’s labour supply and its downstream industries benefit approximately 33% of the population (The Guyana Office of Investment, 2021).
Figure 2-2 National Bauxite Production Value from 1990 – 2020.

Source: Adapted from the Guyana Bureau of Statistics
The data shows that the mining sector continues to be a significant economic contributor to Guyana’s development and that the industry itself has grown over the past 20 years but despite this, the investments and management into the sector have varied. The Bauxite industry in the past three years has been marred with uncertainty as to the leading Bauxite Company RUSAL, which oversees the Bauxite Company of Guyana Incorporated (BCGI) temporarily suspended their operations in 2020 and retrenched 326 Guyanese workers with their suspended operation along with the Berbice River (Mason, 2020). The future of RUSAL’s involvement in the BCGI (who are a 90% shareholder in the BCGI) is uncertain as the company has started to sell equipment and has discontinued their contractual arrangement with the Bauxite Shipping Company Oldendorff Carriers Guyana Inc. forcing the company to close its operations and retrenching 132 Guyanese workers. The dominance of RUSAL’s operations and decisions significantly impacted Bauxite Mining for 2020 as Figure 2.2 shows a sharp dip in production by 71.4% for the year the company suspended activities.
The Gold Industry in the past 10 years has seen a sharp increase in the number of ASM operations and an increase in the volume of gold declared (Figure 2.3). Though this has brought significant economic prosperity, the increase in ASM operations coincided with an increase in illegal mining operations, an increase in foreign operators, particularly from Brazil and Venezuela and an increase in undeclared gold and smuggling across the land borders of Guyana. In 2015, the Guyana Geology and Mining Commission (GGMC) estimated that approximately 15,000 ounces of gold are smuggled out of Guyana on a weekly basis which amounts to approximately US$1 billion a year passing through smuggling routes (Pasha et al., 2017). According to Lowe (2006), the GGMC estimates about 17% of ASM operations are owned by Brazilians with this proportion steadily increasing to date. The growth in Brazilian and now Venezuelan miners fuels the smuggling issue with the value lost through smuggling almost doubling the value earned nationally as foreign exchange and resource rents. The prominent loss from smuggling is a clear indication of the monitoring and enforcement challenges public agencies such as the GGMC has in overseeing mining activities.

With the volume of revenues and production output from the Gold Industry, ASM operators employ the highest percentage of the workforce in all the mining sectors. In terms of income and salaries, the ASM sector employs many unskilled workers and pays a salary that is more competitive than many public sector professions such as teaching and police services. Unskilled labourer earnings can range between US$9,600.00 - US$12,000.00 per year in wages and skilled workers such as dredge operators can earn up to US$60,000.00 per year in wages (Liang & Moonsammy, 2021). The attractive wages from ASM mining draw a consistent workforce for the sector, particularly from the Indigenous Communities within the various mining districts. The ASM sector is the highest employer of men from Indigenous Communities. The sector is generally male dominated by approximately 10 – 20% of the sector is females (Wazia & Westerman, 2021).

The presence of the mining industries within the various districts is a stimulant for economic activities in the communities close to the mining operations. Several communities and towns such as Bartica and Linden which are within mining districts 3 and 4 (See Figure 2.1) have developed local enterprises to provide services to the mining sector such as lodging, catering, recreation and entertainment and transportation services. These service businesses stimulate the local economy,
increase employment opportunities, especially for Indigenous peoples and foster overall community development through horizontal and vertical value chains. The economic significance of the mining sector especially at the community level and as a national foreign exchange earner for Guyana has given it status as an industry that ‘is too big to fail’ in Guyana according to Thomas (2009). Despite this, the political and policy structure of Guyana has not fully capitalized from mining rents as overall development across other sectors is not being observed meaning that there are no revenue spillovers to develop other sectors in the economy which is an indication of the ‘resource curse’, a typical phenomenon with extractive economies (Hilson & Liang, 2017).

2.2 Community and Institutional Arrangements in the Mining Sector

Gold and Diamond mining is an important part of Guyana’s culture with former slaves starting the ‘pork knocking’ culture after emancipation that they learnt from the activities of the indigenous peoples (Forte, 1999). The expansion of mining in the country has caused varying effects in the communities across Guyana. While many communities prosper from economic activities, an increase in the number of miners especially foreign miners has also caused conflicts between miners and indigenous communities (Hilson & Liang 2017). The culture of mining in Guyana, particularly the ASM sector at the community level has a myriad of social issues (Laing & Moonsammy, 2021). Mining activities are often associated with drug abuse, the prostitution of indigenous and immigrant women, narcotic and human trafficking and the prevalence of infectious diseases including Malaria and STDs.

2.2.1 Community dynamics and social issues in mining

The large mining operations in Guyana are predominantly managed by foreign companies which often operate with structured protocols in compliance with the laws and constitution of the country. The management structure of the large mining companies ensures their operations maintain legal integrity with the communities the companies are involved in. The companies often engage in community outreach and contribute to community development through the provision of employment, capacity development and corporate social responsibility. The main negative social
issues in the communities often come from resource conflicts and labour rights matters (Colchester et al., 2002).

The main social issues stem from small-scale mining operations. The social challenges from small-scale mining cannot be directly attributed to the nature of the operation itself but to the culture and localities surrounding the operations. Small mining especially ASM operations function in very isolated terrains in the Hinterland often within the proximity of Indigenous villages seeking economic opportunities. Where the mining sector offers economic opportunities through employment to the Indigenous communities, the ASM management structures and policies are very weak therefore in the absence of established employment policies, ASM operations often employ underage workers and have workers in poor working conditions (Liang & Moonsammy, 2021).

The volume of revenue generated and the geographical isolation of ASM operations are the two main contributing factors to the proliferation of illegal activities around mining communities. Colchester et al. (2002) document reports of the prostitution and sexual abuse of indigenous women in mining camps with some of the reports highlighting girls as young as 12 years old. In addition to issues of prostitution and sexual abuse, reports have shown the trafficking of indigenous women and children into Brazil and Venezuela to work either in the sex industry, as drug mules or as house servants (Colchester et al., 2002; Mantini, 2008; United States Department of State, 2018). The same routes used for human trafficking are also used for smuggling gold, weapons and narcotics between Guyana, Brazil and Venezuela (Clegg, 2014; Mantini, 2008).

2.2.2 Community rights issues and the mining sector

Across the hinterlands of Guyana, indigenous groups are disputing the inhabitants of the coast (‘coast landers’) for control of the gold resources found on indigenous lands. The ‘coast lander’ – indigenous people dichotomy has been a long-standing national issue going back to the 1950s with the perpetual division occurring both geographically and in social ideology (Hilson & Liang, 2015). According to Bulkan (2013), the ‘coast landers’ approach the interior lands in an extractivist manner, exploitative and rent-seeking without regard for the environment and cultural resources
of the hinterlands which are often damaged in the process. With the growth of the mining sector, especially gold mining, the ‘coast landers’ argument presently fueling the dichotomy with the indigenous peoples is that the indigenous villages have benefited tremendously from employment in gold mining despite reports from Colchester et al. (2002) showing that the indigenous people’s perspective shows mining has created an unhealthy dependence on the industry and a demoralizing impact on indigenous livelihoods through the neglect of traditional indigenous customs, especially by the younger generations. Indigenous communities argue that the indigenous way of life is being eroded and is endangered by going extinct due in part to activities in the hinterlands such as mining. The conflicts between ‘coast-landers’ and indigenous peoples primarily are centred on the rights to the use of indigenous lands for mining and forest concessions which have fueled a racial and ethnic divide that has led to the discrimination and negative stereotyping of the indigenous peoples (Gavin & Hilson, 2015). In 1976, the Burnham Administration pioneered the Amerindian Act (1976) which provided a measure on entitlements for people in the indigenous lands with the trust of the minerals remaining with the state. The Amerindian Act (1976) has resulted in the homogenization of this dichotomy where the indigenous peoples are treated as a racially and spatially distinct demographic in the country but their entitlements and rights to public goods and state benefits are undifferentiated from the rest of the country.

The Amerindian Act (2006) now provides the entitlements and demarcation of boundaries done by the state, to the indigenous communities in the hinterland. According to the Ministry of Amerindian Affairs, there are currently 169 Amerindian Communities with 96 of these communities having legal recognition of the lands they occupy and use. To address the indigenous land claims under the Amerindian Act (2006), the Government of Guyana adopted a procedure based on occupancy, unlike many other countries that require indigenous peoples to show their ancestral connection.

Despite the progress in legislation and claims to demarcate indigenous lands, the issues of resource use on indigenous lands have not been adequately addressed. The ‘coast lander’ and indigenous dichotomy for mining resources still prevail. Even under the Amerindian Act (2006), the International Working Group for Indigenous Affairs (2021) identified that the forest resources/timber on government-titled indigenous lands are fully managed by the indigenous title
holders whereas the mineral for mining is still controlled by the state. According to the Guyana Mining Act (1989), the indigenous peoples are deemed as lawful occupiers of the lands demarcated as indigenous, but they are prohibited from extracting minerals and resources unless they possess a license from the Guyana Geology and Mining Commission (GGMC). In cases where they do have licenses, extracted resources can be sold on behalf of the indigenous communities by the GGMC. This means that mining concessions and licenses can be granted by the government for companies to operate on indigenous lands with minimal accountability to the indigenous communities and the resources on indigenous lands are the affairs of the GGMC as the lead state agency overseeing the mining industry. The stakeholders in the mining sector are presented in Figure 2-4.

*Figure 2-4 Stakeholders in the mining sector in Guyana.*

### 2.2.3 Institutional arrangement for Mining in Guyana

Executive authority and oversight for the mining sector in Guyana are overseen by the Guyana Geology and Mining Commission headed by the Mining Commissioner who reports to the Ministry of Natural Resources (MNR). The GGMC was established in 1979 under the Guyana
Geology and Mines Commission Act (1979) and supersedes the Department of Geological Surveys and Mines and the Geological Survey of British Guiana. Presently the GGMC technical divisions include the Geological Services Division, Mines Division, Environment Division, Petroleum Division and Land Management Division (Thom 2020). The roles and functions of the GGMC are as follows (See Table 2.2):

Table 2-2 Roles and Functions of the Guyana Geology and Mining Commission

<table>
<thead>
<tr>
<th>The roles of GGMC</th>
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<tbody>
<tr>
<td>1. To act as a development change agent in the diversification of the economic base of Guyana through its activities in the mineral sector.</td>
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<tr>
<td>2. To create the opportunities for rapid economic development that an expanding mineral sector is ideally suited to provide.</td>
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<tr>
<td>3. To act as a national repository for all information relating to geology and mineral resources which will facilitate an understanding of the resource base of the country.</td>
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<tr>
<td>4. To provide the general public with basic prospection information and advisory services, on the available economic mineral prospects.</td>
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<tr>
<td>5. To provide advice to the government on appropriate mineral policy matters so that Guyana’s mineral resources can be rationally developed and utilized.</td>
</tr>
<tr>
<td>6. To regulate on behalf of the government all activities in the mineral sector.</td>
</tr>
<tr>
<td>7. To act as a development change agent in the diversification of the economic base of Guyana through its activities in the mineral sector.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>The functions of GGMC</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Promotion of mineral development</td>
</tr>
<tr>
<td>2. Provision of technical assistance and advice in mining, mineral processing, mineral utilisation and marketing of mineral resources</td>
</tr>
<tr>
<td>3. Mineral exploration</td>
</tr>
<tr>
<td>4. Research in exploration, mining, and utilisation of minerals and mineral products</td>
</tr>
<tr>
<td>5. Enforcement of the conditions of Mining Licenses, Mining Permits, Mining Concessions, Prospecting Licenses (for Large Scale Operations), Prospecting Permits (for Medium and Small-Scale operations) and Quarry Licenses</td>
</tr>
<tr>
<td></td>
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<td>---</td>
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<td>7.</td>
</tr>
</tbody>
</table>

**Overall objectives of GGMC**

1. Increase opportunities for mineral resources development from year-end 2014 levels by preventing waste, encouraging improved levels of tailings management and greater recoveries but at the same time protecting the rights of the property owners.

2. Improve safety in the mines and the processing facilities from year-end 2014 levels by adhering to the requirements for the granting/renewal of permits, field inspections, accident investigations, special investigations and enforcement.

3. Reduce the occurrences of identified pollution violation levels associated with mines and production processing facilities from year-end 2014 levels by identifying and correcting existing environmental threats and by working with and using the financial and other resources of the property owners, the government and GGMC.

4. Increase the efficiency of information provision by promoting the implementation of efficient information technology programs and encourage easy access to in-house (commission) information and more efficient integration of new information into the existing database; design systems that would encourage customer-friendly retrieval of online information.

5. To develop and implement the policy for the recruitment of quality employees who can be developed, placed in positions of responsibility that are consistent with proven performance and receive competitive compensation.

**Major goals of GGMC**

1. Support the exploration, documentation and extraction of our mineral resources but at the same time protect the rights, provide equal and fair access for all entities and ensure that the charges (fees, royalties, etc.) are fair.

2. Promote safety programs through training, monitoring and enforcement to advance safety in the operation of the various mining systems.

3. Promote environmental protection by assuring that all mineral production, storage/disposal of tailings and storage/delivery of products are conducted in such a way as to minimize harmful effects on the environment and to preserve our mineral resources.
4. Provide public access to information and services and we should strive to maximize the use of electronic programs/software by developing technological improvements and promoting efficient programs that would allow us to provide more services to all stakeholders and the general public.

5. To create an environment where we continue to recruit, develop, reward and retain our human resources for institutional continuity and growth.

Source: GGMC - [https://www.ggmc.gov.gy/page/who-we-are](https://www.ggmc.gov.gy/page/who-we-are)

To deliver on its mandates, the GGMC regularly partners with national and non-governmental agencies on several joint projects. The GGMC collaborates with the Protected Areas Commission (PAC) of Guyana to monitor and penalize illegal mining activities operating in protected areas in Guyana. The GGMC is currently partnering with the Environmental Protection Agency (EPA) of Guyana on addressing the issues of mercury importation and the transition to mercury-free gold mining. The GGMC and EPA are also conducting joint monitoring exercises for Hydro-Sedimentology with assessments conducted in the tributaries and main branches of the Cuyuni and Mazaruni rivers in 2021. In 2019, the GGMC and Guyana Forestry Commission agreed to establish a joint committee to address the issue of deforestation caused by mining and land reclamation. The focal point of the committee included the forest rehabilitation programme, rehabilitation and maintenance of hinterland roads, the use of technology for enhanced resource management, data sharing, and monitoring and enforcement operations. In 2013, the GGMC and the World Wildlife Fund (WWF) signed a grant agreement where the WWF provided the GGMC with financial and technical support for national capacity building, baseline studies and training of stakeholders. Conservation International- Guyana (CI-Guyana) received funding from the Norwegian Agency for Development Cooperation’s Climate (NORAD) and Forest Initiative Support Scheme (NICFI), for a project called Addressing the Drivers of Deforestation (ADoD) in 2016 aimed at artisanal miners as part of its Responsible Mining Initiative (RMI). As part of this project, grants were given to the GGDMA and the NTC to strengthen their capacity to do their jobs efficiently while also ensuring green growth principles, including enhancing resource management and reducing forest loss, were integrated into management policies. Other partners for the RMI are the Guyana Gold and Diamond Miners Association (GGDMA), the Guyana Geology and Mines Commission (GGMC), the Guyana Women Miners’ Organisation (GWMO), the National Toshaos Council.
(NTC), the Environmental Protection Agency (EPA), the Ministry of Natural Resources and local communities. The RMI supports Guyana to steer clear of these dangers by working across strong, diverse partnerships to secure gold mining livelihoods and profitability while reducing the impact on forests.

Institutionally, the mining sector in Guyana has multiple agencies working alongside the GGMC to improve the modus operandi of mining in Guyana. This is because mining is an important economic sector, but its culture, history and geography create numerous challenges in efficiently managing it (Laing & Moonsammy, 2021). If one only looks at it from the lens of monitoring all the mining areas (see Figure 2-1), the sheer size of the hinterland regions and accessibility of the mining terrains is a challenge for the GGMC to monitor especially with a limited resource capacity (McQuilken et al., 2019). To develop the mining sector for the future sustainability of Guyana, continued institutional and stakeholder collaborations are essential.

The myriad of social, cultural, and environmental issues and conflicts stemming from the mining sector has sparked many negative connotations from the communities across Guyana about how the sector is managed by the GGMC. In 2014, the GGMC conducted a management and systems review which showed a community perception that the GGMC is corrupted, lacks transparency and has a low public image (Walrond et al., 2015). The Management review conducted by the GGMC revealed the prevalence of bribes and a steady decrease in funding for monitoring activities by mining officials. Even from the mining communities, the miners’ perspectives are that there is a lack of controls and adherence to regulations primarily due to a culture of corruption among mining officials (Bulkan & Palmer, 2016). In 2019, the President of Guyana at the time, the Honourable David Granger, received a complaint about the mismanagement and corruption at the GGMC which sparked a probe into its operation by the Ministry of Natural Resources. The accusations have prompted a restructuring of the GGMC under the stewardship of the Ministry of Natural Resources to be more transparent and accountable in the management of the mining sector.

2.3 Ecological Impacts of the Mining Sector
Globally, mining of any type has garnered a reputation for activities that have deleterious environmental impacts. The environmental impacts of mining vary from land clearing, sedimentation, noise pollution and chemical discharge to biodiversity loss and habitat fragmentation. The majority of the mining activities in Guyana occur in the interior areas along river courses or within the dense forest areas of the country. According to Pasha et al. (2017), the ASM is the largest mining operation in Guyana with the biggest ecological impacts. There are two broad areas of concern identified: 1) land and soil clearing and 2) chemical pollution, particularly heavy metals. Several varying ecological effects occur as a result of these two broad areas of impact.

2.3.1 Land and Soil Clearing

The mining sector in Guyana is the leading cause of deforestation in the country. According to Bholanath and Cort (2015), approximately 90% of the country’s deforestation is caused by mining mainly from the ASM sector (see Figure 2.4). The large bauxite and gold mining operations clear large sections of a concentrated area whereas the vast number of small-scale gold miners clear small pockets of forested areas over a wider spatial range. Miners clear forested areas for mining pits, tailing ponds, build mining camp facilities and use wood for fuel. Pasha et al. (2017) reported that approximately 45,000 hectares of forest were cleared for small-scale mining in Guyana between 1990 and 2009. There are several ecological disturbances associated with forest clearing in the mining sector. The loss in forest cover also affects the ecosystem services associated with the habitat. The forest cover provides habitat, shelter, hydrology regulation, erosion protection, sequestration services and potential bioprospecting.
The data presented in Figure 2-5 were sourced from the GFC and show the rapid increase in deforestation rates caused by mining. The empirical evidence shows a rapid expansion of the mining industry, particularly the small-scale gold mining industry with deforestation rates from mining increasing from 1,500 hectares in 1990-2000 up to 12,500 hectares in 2012. From 2015-2018, deforestation rates from mining have stabilized partially due to stricter forest policies and stabilization of new mining operations but the range still represents a significant increase when compared to the years before 2000. The surge in deforestation rates due to mining has sparked a national debate as to whether the present operation of the industry can be part of the country’s low carbon, low deforestation development strategy for Guyana (Lowe, 2014). There is also a contradiction for the National Determined Contribution (NDCs) agreed upon by Guyana to the United Nations Framework Convention on Climate Change (UNFCCC) Conference of Parties (COP) at the Paris Agreement. Guyana committed to the maintenance of its low deforestation rates which is challenging to maintain if the mining sector maintains or increases its current rate of operation (Laing, 2015). Of recent, Guyana’s forest policies all target mining as its biggest hindrance sparking the formation of the joint committee between the GGMC and GFC which the
literature shows is a key component missing in managing the mining-deforestation conundrum as outlined by Dezécache et al. (2017).

Figure 2-5 Map showing Mining Activities in the Forested Areas of Guyana *(Source: The Diggings, 2021)*
Despite the contribution to deforestation caused by the mining sector, Guyana still has a significantly large and rich forested area. The main effect of deforestation caused by mining operations is the fragmentation of forest habitats which impacts animal corridors and biodiversity (see Figure 2.5). Forest fragmentation generally reduces the forest's health and habitat, which leads to biodiversity losses, an increase in invasive species, pests and pathogens and reduced water quality. In addition to fragmentation caused by forest loss, mining activities also disrupt the soil habitats causing varying degrees of soil fragmentation. Singh et al. (2013) estimate that a single dredge can remove up to 130 tonnes of soil a day. Using the GGMC estimates on the number of operational dredges, an estimated 520,000 tonnes of topsoil is removed daily from mining activities. This value is a conservative estimate as more data is needed looking at soil removal activity. The estimates reflect an intense disruption of the substrate ecosystems which results in heavy sedimentation in the river courses of the country. As it relates to soil movement, the spatial spread of the small-scale gold mining sector creates smaller fragmented impacts whereas the larger bauxite mining operations generate large fragmentation in the areas of the country that concentrate on bauxite mining. According to the Ministry of Natural Resources (2019), large mined-out bauxite mining pits are readily visible in mining communities such as Linden or Kwakwani with minimal reclamation and closure monitoring. The Ministry of Natural Resources also highlighted that the lack of reclamation and mined-out management programmes has created thousands of hectares of mined-out lands in Guyana which are characterized by large deep ponds or lakes, steep and unstable landforms, extensive erosion, large, concentrated deforestation areas, and uncontrolled access leading to unlawful dumping and extraction of materials mainly for construction. The mined-out areas are not barren wastelands as natural processes such as ecological succession does occur eventually restoring some vegetation and wildlife present in the area. The country through the GGMC and the Guyana Lands and Surveys Commission (GLSC) has partnered with many international organizations such as the Food and Agriculture Organization (FAO) and Conservation International and research institutions such as the University of Guyana to conduct projects on managing and alleviating the effects of mined-out pits. The GGMC does have in its mandates to look at strategies for the sedimentation issues stemming from top-soil removal, but no policy initiative has been identified to tackle the problem.
2.3.2 Chemical Pollution

The most documented environmental issue related to the mining sector is the chemical discharge into the ambient environment particularly the discharge of heavy metals. The most well-documented issue in Guyana looks at mercury pollution from gold mining ((Hilson and Laing, 2017a; Lowe, 2006; Pasha, Wenner and Clark, 2017; Roopnarine, 2002; Singh et al., 2013). Mercury is used in the amalgamation process of gold mining and as of 2015, Guyana imports between 7.5-22.5 tonnes of mercury annually (Legg et al., 2015) for the gold mining sector. The country also has an undocumented volume of mercury that is smuggled into the country mainly from illegal mining operators in the country (IUCN, 2020). The volume of mercury used in gold mining as a heavy metal pollutant in Guyana exceeds the global ecological standards for safe use. Guyana’s Initial Minimata Assessment Report estimated that total mercury emissions for air, water and land are 28,790 kg annually. Howard et al. (2011) estimated mercury loadings in the sediment at gold mining sites in Guyana at 226 ± 171 ng/g with some sites showing values up to 527 ± 92 ng/g and mercury levels in the water levels across Guyana ranging between 0.053 to 0.301 μg/g. The GGMC in 2001 surveyed carnivorous freshwater fish and found that 57% of the sample exceeded the World Health Organization (WHO) guidelines. Singh et al. (2000) reported the concentration of methyl mercury found in fish specimens across Guyana ranging between 0.24 – 1.81 μg/g with 39% of the specimens exceeding WHO guidelines. The estimated values since the report of Singh et al. (2000) are expected to increase as mercury use in the country has steadily increased since then. The mercury contamination in the air, water and soils as heavy metal is persistent in the environment and accumulates over time. The accumulation eventually enters the biological system either through direct contamination or through bioaccumulation in the food system. The mercury pollution in Guyana has entered the food system as shown in the report by Singh et al. (2000) and this contaminates the wildlife and people that use the rivers to catch fish or as a source of potable water. Where no study has been sourced looking at mercury levels in megafauna in Guyana such as the Jaguar, Caimans or River Otters to assess the contamination of mercury on biodiversity, studies were done with indigenous people. Colchester et al. (2002) reported findings of 2 – 22 μg/g of mercury in hair samples of communities along the Barima River in Guyana. Singh et al. (2013) showed estimates from various indigenous communities across Guyana ranging up to 70.8 μg/g in hair specimens, some of which included nursing and
pregnant women. The values reported by Singh et al. (2013) were up to 5 times more than the WHO safety level.

The direct use of mercury in mining activities also exposes another vulnerable group to mercury contamination. The miners who are directly in contact with mercury in the amalgamation process are the demographic in the country most vulnerable to mercury poisoning. While no research was sourced explicitly looking at mercury levels in miners, several reports have indicated the susceptibility of miners working with mercury as the majority of mining operations in Guyana, particularly the small operations do not have appropriate safety equipment or safety measures. Miners are exposed to methylmercury directly or from the mercury vapour. According to Hays and Viera (n.d.), policymakers recognize the issue of mercury exposure by miners, but the country has a culture of dangerous, vague and complex concepts about the dangers of being exposed to mercury. The Guyana Environmental Capacity Development Mining Project (GENCAPD) attempted to address the issue of education and awareness amongst miners by distributing a variety of mercury awareness materials to miners across various mining communities. The WWF-Guianas developed programs to increase awareness of health issues pertaining to gold mining in the hinterland areas with varying results. Despite many institutional efforts, the issue still is prevailing in the small mining sector. Reports from the GGMC for their assessment of the Minamata Convention often cite the customary culture of practice developed in the gold mining sector when it comes to the use of mercury. As the country ratifies the Minamata Convention, the biggest challenge comes room untangling a deep-rooted operational practice to truly see the adoption and implementation of a mercury-free gold mining sector.

Bauxite mining in Guyana though not as widespread as gold mining but the chemical processes are more complex often resulting in a larger variety of chemical pollutants discharged into the ambient environment. Bauxite mining in Guyana discharges aluminium, arsenic, cadmium, copper, chromium, lead, silicon and titanium at varying levels of concentration. Not only do these pollutants enter the ambient environment during the bauxite operations, but residual pollutants persist even after the mined-out phase. Williams et al. (2019) evaluated mined-out pits that were now lakes in Linden, Guyana and found arsenic, cadmium, copper, chromium and lead in the soils of all the pits sampled though the ranges were within the WHO safety guidelines. The study also
found aluminium, silicon, iron and titanium with mean concentrations ranging between 2-70% (see Table 2.3).

Table 2.3 Chemical Properties of Mined-Out Pits in Linden, Guyana

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Pit Lake 1</th>
<th>Pit Lake 2</th>
<th>Pit Lake 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arsenic (µg/l)</td>
<td>30</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>Cadmium (µg/l)</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Chromium (µg/l)</td>
<td>20</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Clarity (m)</td>
<td>5.9</td>
<td>4</td>
<td>2.6</td>
</tr>
<tr>
<td>Lead (µg/l)</td>
<td>10</td>
<td>15</td>
<td>10</td>
</tr>
<tr>
<td>Aluminium (mg/l)</td>
<td>9.02</td>
<td>23.06</td>
<td>0.1</td>
</tr>
<tr>
<td>Clarity (m)</td>
<td>0.7</td>
<td>1.1</td>
<td>0.7</td>
</tr>
<tr>
<td>Copper (µg/l)</td>
<td>2</td>
<td>9.4</td>
<td>2</td>
</tr>
<tr>
<td>Iron (mg/l)</td>
<td>3.96</td>
<td>10.56</td>
<td>0.032</td>
</tr>
<tr>
<td>Manganese (mg/l)</td>
<td>2.4</td>
<td>2.14</td>
<td>0.2</td>
</tr>
<tr>
<td>Zinc (µg/l)</td>
<td>103.4</td>
<td>498.4</td>
<td>9.75</td>
</tr>
<tr>
<td>Silicon (mg/l)</td>
<td>5.1</td>
<td>7.1</td>
<td>0.4</td>
</tr>
<tr>
<td>Titanium (µg/l)</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
</tbody>
</table>

Source: Adapted from Williams et al. (2019)

In addition to the chemical discharge that enters the ecology and food system, bauxite mining operations are notorious for discharging particulate matter into the ambient air environment which has caused respiratory effects in communities such as Linden. The EPA identified that the Boosai Bauxite Mining Company operating in Linden has started to install mitigation measures for its particulate matter (PM) discharge to the relief of the residents of Linden (Al Circle, 2020). The PM discharge if left unchecked, also affects the surface areas of plants, threatens the insect populations and can afflict respiratory issues for the fauna around the areas as well.

Non-compliance with the mining regulations that govern the sector has also been a major source of chemical pollution emanating from the mining sector. There is an instance where mercury has
been emitted because of improper storage methods. The impact per miner might be small but the cumulative impact is significant. Accidents in the sector have also brought large-scale contamination events in the past, the most notable in Guyana’s history is the Omai cyanide spill which occurred on August 19, 1995, when the retaining wall of a tailing pond at the Omai Mine broke and released an estimated 3.03 billion litres of cyanide-laced material into the Omai River (at a rate of 59.43 million litres/hour) which travelled in the Essequibo River. They even caused widespread aquatic contamination that resulted in massive fish kills which were sighted 13 Km downstream of the spill. Herds of Peccaries (wild hogs) also fell victim to the spill since they depend on the river for water as well (Associated Press, 1995; Buffalo News, 1995; Chatterjee, 1997; Spokesman, 1995).

Overall, the mining sector in its present operation is the most prominent source of ecological destruction in terms of habitat removal and pollution in Guyana (Roopnarine, 2002). The effects on Guyana’s ecology include impacts on forest ecosystems, soil ecosystems, water ecosystems and the ambient air environment. There has been quite a number of studies done looking at the impacts of mining on ecosystems, particularly those looking at the land clearing issue (Laing, 2015), soil contamination (Williams et al. 2019) and water contamination (Roopnarine, 2002; Singh et al., 2013). The country still needs to do further research on the systemic impacts on ecosystem functions such as the level of heavy metal infiltration into the food chain, contamination of trees from the substrate levels and the vulnerability of endangered megafauna in Guyana particularly the Arapaima, Jaguar and River Otter which can be seen as ecosystem indicator species.

2.4 Policy Outlook for a Sustainable Mining Sector

Since the early 2000s, Guyana has continuously committed to transitioning its economy to a green economy. In 2009, the Government of Guyana initiated a Low Carbon Development Strategy (LCDS) which incorporates a transition to low carbon industries through renewable energy sources. The LCDS provided a policy framework for Guyana’s economic growth based on green industrial development. The LCDS also focused on a low carbon thrust but also incorporated a
sustainable approach to all economic sectors. The updated LCDS 2030 also includes commitments from industries to improve the sustainability of their operations and incorporates elements of the country’s commitment to international conventions such as the Minamata Convention and the Paris Agreement.

The country’s thrust toward a sustainable economy must incorporate the mining sector because of its economic importance. The question though is whether the mining sector can be sustainable. The prevailing global perception is that sustainable mining is a fallacy and a glorified concept that has more to do with a corporate branding image rather than a mechanism to alleviate the negative impacts of mining (Kirsh, 2009). Wherever the divide on sustainable mining lies, presently, the mining sector in Guyana can be classified as unsustainable. Liang and Moonsammy (2021) used the Sustainable Development Goals (SDGs) as a framework to assess the sustainability of the mining sector. Essentially, the study looked at how the mining sector will affect the country’s achieving the SDG targets. The conclusion of the study highlighted that mining is a significant contributor to the SDG goals that are economic-related but the current modus operandi for the industry will negatively impact the country’s achieving the SDG targets related to the social and ecological components.

Many of the social issues identified are not directly related to mining operations per se but stemming from a culture that surrounds the mining communities. The social-related issues regarding mining operations have to do with employment rights and gender equality in mining. All others which include criminal activity, drug use, prostitution and smuggling are associated with mining because of the secluded and unmonitored environments in which miners operate. As it relates to employment rights, mining has varying levels of employment policies. Miners working with large established operators like Boosai Ltd. or Omai Ltd. have legally binding contractual arrangements for which the companies have committed standard operating procedures and human resource procedures to ensure employee rights are maintained. Employment and labour issues in mining in Guyana occur with small-scale gold mining whereby workers have poor working conditions, unregulated work arrangements and underage employment (Colchester et al., 2002). Guyana has several laws that are geared to protect workers’ rights including the Labour Act, the Occupation Health and Safety Act and the Employment of Young Persons and Children Act.
Despite this legislative framework, the policy environment to enforce labour and employment rights in small-scale mining is absent. The gender issue in mining is another major hindrance in achieving the SDG targets related to gender as the sector has a proportion of 10 – 20% of its workforce being female. Guyana is actively engaging in gender policies across all economic sectors with the development of several gender-related institutes and NGOs that are championing gender equality in the country. The University of Guyana has developed a Gender Development Institute which is currently conducting research on gender and mining within the mining sector itself, the Guyana Women Miners Organization (GWMO) continuously lobby for more women's involvement and equal rights for women employed in mining. There is a definite need for more research looking at specific gender policy requirements for the mining sector to bridge this gender gap.

The impacts on the ecological components of the SDGs are directly related to mining operations in Guyana. Mining impacts both lives on land and life in water through the clearing of habitats and chemical pollution. In addition to the SDG targets, the destruction of forested areas and heavy metal pollution are direct implications for Guyana’s commitment to the Paris Agreement and Minamata Convention. To reduce the ecological impacts of mining, the country has developed several policy initiatives focusing on dealing with the deforestation issue caused by mining and tackling the discharge of mercury which is the most prominent pollutant from the mining sector.

2.4.1. Deforestation and Mining Policy

Mining in Guyana is identified as one of the leading causes of deforestation in Guyana which essentially makes the mining sector a contrary activity to Guyana’s forest conservation activities such as REDD+ (Laing, 2015). Guyana’s REDD+ agenda was advanced through the MOU with Norway and Guyana whereby Norway will pay Guyana up to US$250 million to keep their deforestation rates low. For the country to commit to this agreement, the issue of mining-related deforestation needed to be addressed. As previously discussed, the GGMC-GFC joint committee was formed to look at the issue. In the Joint Concept Note under the Guyana-Norway MoU, provisions included the need for land reclamation of mined-out areas, reducing mercury use, strengthening the mineral maps, increasing the use of more effective recovery practices in the mining sector, and guaranteeing greater compliance with environmental and safety guidelines and
rules (Benn, et al., 2020). The country through the GGMC increased its environmental regulation, particularly the enforcement of existing regulations in response to the needs of the REDD+ policy (Laing, 2015).

Under the policy directives of the updated LCDS, the GoG has initiated an integrated plan for managing the mining and forestry sectors in recognition of the economic importance of these sectors in lieu of the impacts that mining causes on the forests. As such the integration between forestry and mining according to the LCDS is to ensure that economic returns are maximized while maintaining social and environmental standards. The action items outlined by the LCDS (draft document as of 2022) include


2. Advancement of transparency through the Guyana Extractive Industries Transparency Initiative (GYEITI). The GYEITI is based on the global standards entitled the Extractive Industries Transparency Initiative (EITI) which is geared towards promoting open and accountable management of natural resources.

3. Low impact mining through mineral mapping intends to use state-of-the-art prospecting technology to identify economically exploitable deposits that can improve mining productivity while minimizing the deforestation impacts from traditional prospecting.

4. Exploring the options for land reclamation and reforestation of mined areas. The GoG has identified approximately 200,000 hectares of mined-out areas available for rehabilitation and reforestation which can contribute to the carbon sequestration volume from the forested area of the country.

To effectively capture the regulation and legal issues associated with the modus operandi of the mining sector in Guyana, the GoG has developed the National Mineral Sector Policy Framework. The purpose of this framework is to create a policy structure for responsible extraction,
development and utilization of mineral resources while preserving the natural environment and advancing the country’s green economy agenda.

2.4.2 Mercury and Mining Policy

As part of the Minamata Convention which Guyana is a ratified signatory, the country commits to a mercury-free mining environment. The initial assessment of the Minamata Convention indicated that Guyana has a robust legal framework for mercury use but within the Mining Act, the legislation refers to mercury in large-scale operations and not small operations which dominate Guyana’s mining landscape. According to the Department of Public Information, Guyana is committed to the terms of the Minamata Convention at all scales of mining and the GGMC started looking at stricter mercury importation regulations. In 2019, the GGMC, EPA and the Pesticide and Toxic Chemical Board of Guyana signed a memorandum of understanding on the importation and use of mercury to phase out the practice completely. The GGMC alongside a few private merchants have started to introduce mercury-free technology into the mining sector but more research is needed to look at the factors that can affect its adoption and diffusion.

2.5 Biodiversity incentivisation mainstreaming options

In 2014, the Government of Guyana partnered with United Nations Development Programme (UNDP) on a project that focused on enhancing biodiversity protection by strengthening the monitoring, enforcement and uptake of environmental regulations in the mining sector. The project finished in 2017 had two primary outcomes; 1) enabling the monitoring and enforcement of regulations and codes of practice to be strengthened, and 2) enhancing capacities that promote biodiversity conservation. In 2021, the project scope was expanded as more financial support was received through the Global Environmental Fund (GEF), the UNDP and several state agencies including the Environmental Protection Agency (EPA), the Ministry of Natural resources, the GGMC, the Ministry of Amerindian Affairs, Guyana Forestry Commission (GFC) and the Guyana Lands and Surveying Commission (GLSC). The extended project has four proposed outcomes that the project coordinating committee intends to achieve; 1) Strengthening policy and regulatory frameworks on the environmental impacts of mining; 2) increased institutional capacity and inter-
institutional coordination; 3) adoption of environmentally friendly mining practices; and 4) knowledge management, monitoring and evaluating to support learning.

The project is at the forefront of addressing the biodiversity issues related to mining as the country recognizes the need to strike an appropriate balance between the prosperity of the mining sector and maintaining the country’s green space and biodiversity which are critical components of achieving a sustainable society. The project is the main movement in incentivizing biodiversity as a mainstreaming activity within the mining sector of Guyana. As stated, prior, the mining sector is a key economic sector for the country, and this is unlikely to change even in the wake of global environmental pressures. The Government of Guyana (GoG) and the various international agencies working within Guyana have recognized this challenge for the country, which is essentially the backdrop for the GoG, UNDP and GEF projects. Overall, the project intends to achieve the following targets in its biodiversity incentivisation mechanism (see Table 2-4).

**Table 2-4 Biodiversity Incentivisation Mainstreaming in the Mining Sector in Guyana**

<table>
<thead>
<tr>
<th>Milestone</th>
<th>Target</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>National Mineral Sector Policy Framework and Actions</td>
<td>6,500,000 hectares of forests within the six (6) mining districts</td>
<td>Policy framework to improve biodiversity protection through participatory mechanisms that foster a balance between mineral development and biodiversity, habitats, and watershed management.</td>
</tr>
<tr>
<td>Mercury Free Mining</td>
<td>Phase out 10.2 metric tonnes of mercury used in mining areas targeted by the project</td>
<td>As part of the country’s commitment to the Minamata Convention and recognizing the significant impacts of mercury on biodiversity, the movement to mercury-free technology in mining is essential in preserving the health of biodiversity within the forests and rivers of the country.</td>
</tr>
<tr>
<td>Adoption of Responsible Mining Practices</td>
<td>1,235 miners implementing environmentally responsible mining practices.</td>
<td>The adoption and diffusion of responsible mining practices need to be infused within the community of practice to shift what has become a cultural norm of mining to one that is more environmentally responsible.</td>
</tr>
<tr>
<td>Reduction of Prospecting Related Deforestation</td>
<td>1,209 hectares of highly valued forest conserved through shifting prospecting practices.</td>
<td>One of the main contributors to deforestation within the mining sector is prospecting. By improving prospecting efficiency, deforestation-related activities stemming from prospecting can significantly reduce.</td>
</tr>
<tr>
<td>Education and Awareness on the Impacts of Mercury</td>
<td>1,499 Miners, 2,178 community members and 4,355 indigenous peoples targeted for educational outreach programs</td>
<td>Lack of education and awareness about the dangers of mercury has contributed to the continuance of its use as a practice in the country.</td>
</tr>
</tbody>
</table>

Source: The Environmental Protection Agency (EPA) of Guyana

2.6 Future commitments in relation to UNCBD

By 2030, Guyana aims to sustainably utilize, manage, and mainstream biodiversity into all sectors to contribute to the country’s advancement in biosecurity, socio-economic and low carbon development. In the country’s National Biodiversity Strategy and Action Plan (NBSA) (EPA, 2014) report for the UNCBD, the biggest threat to biodiversity identified for Guyana was land change due to mining. Since then, the country has made strides in addressing this issue through the various projects and policy items discussed prior. The NBSA outlined several priority areas including the need for the rehabilitation and restoration of mangrove belts and mined-out areas, reviewing existing legislation across all sectors with a notable ecological footprint, expansion and maintenance of protected areas and good soil health through reduced chemical emissions. For the key areas identified, from 2014 to 2021, Guyana has implemented projects on rehabilitation of
mined-out pits, reviewed and enforced stricter regulations and laws for mining activities, have committed to the integrity of protected areas by monitoring for illegal mining activities in these areas and through the interventions done for mercury and sustainable mining practices, committed to reducing soil-related environmental impacts caused by mining.

The country and overseeing authorities are still plagued with many challenges that impede the effective management of the mining sector to align with UNCBD commitments. These challenges include funding, manpower, capacity, bureaucratic hurdles and corruption. Despite this, efforts such as the joint task force between the GFC and GGMC to tackle deforestation and mining, the efforts by GGMC and within the joint GoG, UNDP and GEF project to transition to mercury-free mining and to train, educate and inculcate a culture of practice in sustainable mining are all demonstrating the country’s commitment to the UNCBD. The policy actions outlined in the LCDS particularly enhancing the code of practices of the GGMC and the GFC and advancing transparency are initiatives that are taking the sector in the right policy direction but the efforts of the stakeholders in implementing are still needed. The LCDS facilitation of stakeholders’ engagement provides the necessary support in principle to achieve this.

To re-emphasize the sentiments that mining in Guyana might be ‘too big to fail’ is not too farfetched to think especially in the context of the magnitude that mining means to Guyana’s culture. Mining will continue to grow for many years in Guyana, but the sector needs to evolve instead of its notorious reputation on the environment. The economic ecological balance of sustainable mining within the boundaries of Guyana has been recognized at all levels nationally as a key pillar in the country’s quest for a sustainable society.
The Forestry Sector of Guyana
3. The Forestry Sector in Guyana

Several studies have found that forest restoration and mitigating deforestation are relatively cost-effective to reduce carbon emissions compared with those in energy-intensive sectors (e.g., McCarl and Schneider, 2001; Kindermann et al., 2008; Jichuan and Jie, 2012; Kim et al., 2014; Kuik, 2014; Pan, et al. 2020). Tropical deforestation and degradation produce about 10% of global anthropogenic carbon emissions (that is, 4.8 of 49 GtCO$_2$yr$^{-1}$; see Pan et al., 2011: 988; Intergovernmental Panel on Climate Change (IPCC), 2014: 6; Overmann, et al. 2019) or the equivalent of 9 billion barrels of crude oil per year (Carnegie Endowment for International Peace, 2015). Since 2008, developing countries, especially those in tropical rainforest regions, have been gradually adopting REDD+ projects. Reducing emissions from Deforestation and Forest Degradation (REDD+) is another option to mitigate carbon emissions given that deforestation in tropical countries constitutes 7%–14% of humane-induced carbon emissions (Harris et al., 2012; Henders and Ostwald, 2014; Pan, et al. 2020). Guyana is considered a High Forest Low Deforestation (HFLD) country (Da Fonseca et al. 2007) and ranks 151st worldwide in per capita GDP (CIA, 2015). Guyana has 83.9% forest cover, with much of its non-forest area covered by natural savannah and has been at the forefront of REDD+ development since 2006. Guyana is also a partner country of both the UN-REDD Programme and the World Bank’s Forest Carbon Partnership Facility (UNFCCC 2017, FCPF 2017, The REDD desk, 2016, GFC, 2020). In late 2009, Guyana signed a five-year bilateral performance-based REDD+ agreement with Norway worth up to US$250M to facilitate REDD+ readiness and low-carbon projects and showed interest in extending the collaboration (Government of Norway 2016, Joint Concept Note 2015, The REDD desk, 2016; Overmann, et al. 2019). Guyana reported that its forests contain an average of 284 metric tons of carbon (tC, or mega gram, Mg) per hectare (aboveground and belowground living biomass pools, range 239–331, GoG, 2015), and it uses the interim carbon price set by Brazil’s Amazon Fund in 2009 to determine its carbon price revenue (US$5 per tCO$_2$, Joint Concept Note, 2015). Indeed, Guyana’s forest sector has been, and is still, very key to the matter of global need for action on humane-driven climate change and very vital in international collaboration. This section of the report looks into the sector by providing a synthesized socioeconomic overview of the sector in Guyana, the community and institutional arrangements for it, the ecological impacts of the sector, its policy outlook for sustainability, the biodiversity
incentivisation mainstreaming options for the sector and its future commitments to UNCBD.

3.1 Socioeconomic Overview of the Forestry Sector in Guyana

Guyana has a land cover of 18,057,340 hectares (83.9% of land cover) of primary or otherwise regenerated forest (Guyana Forestry Commission, 2020; FAO, 2015). Most of Guyana's forest cover has been designated as production forests, with 84.6% being publicly owned and the remaining 15.4% being privately owned by indigenous people (Timber Trade Portal, 2020). In 1979, the Guyana Forestry Commission was established as the entity responsible for managing state lands (Mangar, 2004). Krieger (2001), examined the economic values of this resource and classified them as

- Direct use values - consumptive and non-consumptive uses of forests, i.e., timber, fuel, and tourism.
- Indirect use values – multiple forest services, such as the protection of watersheds and carbon sequestration.
- Option values – reflecting a willingness to pay for conserving the option of making use of the forest even though no current use is made of it.
- Non-use values- a willingness to pay for the forest in a conserved or sustainable use state.

The country's forest resources have long been exploited to produce timber and non-timber forest products (NTFPs), agriculture, research, ecotourism, and conservation (GOINVEST, 2020). The products derived from Guyana's forests include dressed and undressed sawn wood, logs, round wood (piles, poles, posts, spars), plywood, veneer, fuelwood (charcoal, firewood), wooden ornaments, utensils, craft, split wood (shingles, staves), palm heart, wildlife, nibi, kufa, mangrove bark, tibsiri, manicole palm, balata and mokru. Value-added products, such as furniture (indoor and outdoor/garden) and building componentry such as doors, windows, door components, rails, spindles, mouldings and other builder's joinery, are also derived from Guyana's forest resources (Guyana Forestry Commission, 2018). The resources provided by the forest are essential to Amerindian communities who depend on the forests for food (wildlife, fruit, seeds, and nuts), medicines (from over 130 plant species), building materials, textile and weaving fibres, and tannins and dyes.
In its most recent (2020) report, the Guyana Forestry Commission (GFC) indicated that the entire export value for forest products in 2018 was US$37.9 million, down 3.09% from the previous year's total export value of US$39.1 million (Guyana Forestry Commission, 2019). However, examining this sector's contribution to Guyana's GDP before 2017 reveals a fluctuating but decreasing trend, as shown in Figure 3-1. This decrease is due to the Bureau of Statistics releasing a new series of Gross Domestic Product in 2010 that was rebased and re-benchmarked to the year 2006, replacing the 1988 series. This change meant the contributions made towards the country's GDP from value-added products were no longer calculated under the forestry sector but the manufacturing sector instead.

From the onset, the forestry sector has contributed significantly to Guyana's gross domestic product and, to an extent, the country's gross national income, primarily through the exportation of logs and sawn wood. Although logs are a significant part of the industry's exports, the national log export policy aims to encourage more value-added activities in Guyana, for example, by charging a gradually increasing rate of export commission (currently max. 20%) on targeted species that have been reflecting high volumes of export (Guyana Forestry Commission, 2020). Guyana's timber is exported to various parts of the world; logs are primarily shipped to China and India, while sawn wood and other processed products are shipped to a considerably broader range of countries (Timber Trade Portal, 2020).

The forestry industry is also a source of employment, livelihood, and ecological integrity. However, like its contribution to the country's GDP, the number of persons employed by the forestry sector has fluctuated over the years. This is evident with 20,887, 19,597 and 19,640 persons being employed in 2016, 2017 and 2018, respectively. In the forty-two years since its establishment, the forestry industry's expansion has sparked the establishment of other manufacturing and service businesses. Its goods are used in various industries, including residential construction, furniture manufacturing, printing, and publishing. This sector has experienced a series of gains and losses that usually coincides with a state of political instability, as experienced in 1998, following the 1997 elections. An examination of the contributions by this sector for the years 1996, 1997, and 1999 reflect GYD 229, 264, 204 and 226 million, respectively. Given Guyana's sustainable economic trajectory, efforts continue to be made towards more
sustainable forestry practices while maintaining the contribution of this traditional sector to Guyana's GDP.

Table 3-1 Contribution of the forestry sector to Guyana’s GDP

<table>
<thead>
<tr>
<th>Year</th>
<th>GDP (USD$ BLN)</th>
<th>Forestry Sector (USD$ MLN)</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009</td>
<td>2.60</td>
<td>45.50</td>
<td>1.75</td>
</tr>
<tr>
<td>2010</td>
<td>2.89</td>
<td>49.00</td>
<td>1.70</td>
</tr>
<tr>
<td>2011</td>
<td>3.33</td>
<td>40.60</td>
<td>1.22</td>
</tr>
<tr>
<td>2012</td>
<td>4.06</td>
<td>40.07</td>
<td>0.99</td>
</tr>
<tr>
<td>2013</td>
<td>4.17</td>
<td>39.60</td>
<td>0.95</td>
</tr>
<tr>
<td>2014</td>
<td>4.13</td>
<td>54.10</td>
<td>1.32</td>
</tr>
<tr>
<td>2015</td>
<td>4.28</td>
<td>45.60</td>
<td>1.07</td>
</tr>
<tr>
<td>2016</td>
<td>4.48</td>
<td>41.90</td>
<td>0.94</td>
</tr>
<tr>
<td>2017</td>
<td>4.75</td>
<td>39.10</td>
<td>0.83</td>
</tr>
<tr>
<td>2018</td>
<td>4.79</td>
<td>37.90</td>
<td>0.79</td>
</tr>
</tbody>
</table>
3.2 Community and Institutional Arrangements in the Forestry Sector

1. National Forestry Sector Hierarchy: The directives of the forestry industry in Guyana are set by the Ministry of Natural Resources (MNR) which are then implemented via the Guyana Forestry Commission (GFC) which is one of four agencies that fall under the ministry. The GFC is responsible for providing advice on issues relating to forest policy, forestry laws and regulations, administration and management of all State Forest land including distribution of forest land for all forest-related activities from logging to export. The Commission also develops and monitors standards for protecting and conserving Guyana’s forest as well as monitoring activities that take place within it. Its work is guided by the National Forest Plan which supports the goals of the forest policy. Its three (3) technical divisions (Planning and Development, Forest Monitoring and Forest Resource Management) and 40 forest stations across the length and breadth of Guyana implement its activities. Although the EPA technically does not have responsibility for forests in Guyana, the agency does however have to grant environmental authorizations so that the development of the
forest operation can commence as long as measures are in place for the concessionaire to comply with the Environmental Protection Act which the EPA has the mandate to enforce.

2. **Community Forestry Sector Hierarchy:** Indigenous communities are considered as private land and not state lands, so the Forests Act technically does not apply to such operations and the Guyana Forestry Commission has no direct jurisdiction within any indigenous reservation. The village council dictates and approves all the forestry activities that occur on indigenous reservations. Any indigenous villages’ council can voluntarily work along with the Guyana Forestry Commission (GFC) to make sure that all the forestry activities on the reservation are being conducted sustainably and this can be a selling point for their forest produce on the open market. Any of the forests that products once utilized on the reservation, will not be subject to any of the rules and regulations that govern the state forests. However, any forest product that is produced by any indigenous village that is sold in the open market outside of the boundaries of the reservation is still subjected to the Guyana Forestry Commission’s guidelines on removal, marketing, sales, export, etc.
Figure 3-2 National Forestry Sector Hierarchy
3. *Legal Framework*: There are many legislations, guidelines and plans that govern and regulate Guyana’s forestry sector and the following are all the laws and guidelines that govern the sector (Table 3-2):

Table 3-2 Laws and guidelines that govern Forest Sector in Guyana

<table>
<thead>
<tr>
<th>LEGISLATION</th>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td><strong>Forests Act 2009 (implemented October 2010) repealed the 1998 Forests Act</strong></td>
<td>Promotes community participation in sustainable forestry and includes a declaration of Protected Areas and a Code of Practice. The Act improves coordination with mining and as a result, a public consultation before a license for mining or petroleum prospecting can be granted.</td>
<td></td>
</tr>
</tbody>
</table>
The Act also allows for the Forestry Commission to enter into forestry concession agreements and community forest management agreements (Forests Act, 2009).

<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>Timber Marketing Act (1998)</td>
<td>An Act that provides for the control of the sale and use of timber and purposes connected therewith (Timber Marketing Act, 1974)</td>
</tr>
<tr>
<td>Forests (Exploratory Permits Amendment) Act 1997</td>
<td>An Act to amend the Forests Act to provide for the grant of exploratory permits and matters connected therewith (Forests Exploratory Permits Amendment) Act, 1997).</td>
</tr>
<tr>
<td>Guyana Forestry Commission Act</td>
<td>This Act provides for the establishment of the Guyana Forestry Commission as a body corporate. The Commission shall encourage the development and growth of forestry in Guyana on a sustainable basis. The Commission shall, among other things: develop a forestry policy; provide an inspection, certification and accreditation service for quality control of forest produce; and administer the Forests Act 2007. The Commission is responsible to the Minister for the discharge of its functions. The Commission shall from time to time appoint a person as Commissioner of Forests, who shall be the chief executive officer of the Commission. The Act also makes provisions with respect to a certain financial arrangement</td>
</tr>
</tbody>
</table>
The Forest Regulations 2018

Under Section 42 Article 8 states that the Minister may grant permission to a lessee or permit holder of a wood cutting tract to construct and use ways of transportation (such as roadways) in any state forest as may be necessary to facilitate the transportation of timber or other forest produce. Article 29 outlines that every person who has a business purchasing timber for resale must keep a record of the time of each purchase; each purchase of timber grown in Guyana; the species, measurements, and quantity of timber; the name and address of who sold the business the timber and the numbers of any permits under which timber was transported. This record (book) can be inspected at any time (The Forest Regulations, 2018).

National Forest Plan 2018

This National Forest Plan (hereafter ‘the Plan’) accompanies the Guyana National Forest Policy Statement (hereafter ‘the Policy’), which was developed with technical as well as stakeholder inputs over the period February to September 2017. The inputs of stakeholders, including agency, private sector, community and Indigenous Peoples, were key to identifying the actions needed for the operationalizing of the new Policy (GoG, 2018c).

National Forest Policy Statement 2018

The overall objective of the National Forest Policy is the conservation, protection,
management and utilisation of the nation’s forest resources while ensuring that the productive capacity of the forests for both goods and services is maintained or enhanced. Whereas the specific objectives are to a) promote sustainable and efficient forest activities which utilize the broad range of forest resources and contribute to national development while allowing fair returns to local and foreign entrepreneurs and investors; b) achieve improved sustainable forest resource yields while ensuring the conservation of ecosystems, biodiversity, and the environment; c) ensure watershed protection and rehabilitation: prevent and arrest the erosion of soils and the degradation of forests, grazing lands, soil and water; promote natural regeneration, afforestation and reforestation; and protect the forest against fire, pests and other hazards; and d) identify and quantify environmental services to generate forest incentives for national development. Part II on Land Use Policies deals with integrated land use planning as a basis for Forest (GFC, 2011b; GoG, 2018d)

| State Lands Regulations | The Regulations provide in detail for Grants, licences and permissions (application, renewal, transfer, reversion) (Part I), Surveys (II), Sale of preferential claims in case of a plurality of applications (III), Grants to small cultivators (IV), Leases (for agricultural and grazing |
purposes) (V), Permissions for grazing areas on the pasture lands of the interior (VI), Licences of Occupancy (VII), Licences to cut wood (VIII), Licences to collect balata, gums etc. (IX), Licences for quarrying stone, gravel, kaolin and other clays (X), Miscellaneous provisions (XI). The two Schedules deal with fees and forms (GoG, 1973).

**Iwokrama International Centre for Rain Forest Conservation Act**

<table>
<thead>
<tr>
<th><strong>ASSOCIATED PROCESSING/MANUFACTURING LAWS</strong></th>
</tr>
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<tbody>
<tr>
<td><strong>Code of Practice for Forest Operations</strong> (Article 35)</td>
</tr>
<tr>
<td>Article 61</td>
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<tr>
<td>-----------------</td>
</tr>
<tr>
<td>Article 38</td>
</tr>
<tr>
<td>Article 11</td>
</tr>
<tr>
<td>Article 30</td>
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</tbody>
</table>

**ASSOCIATED TRADE LAWS**

<table>
<thead>
<tr>
<th>Article 13</th>
<th>Security bond (Forests Act, 2009)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Article 80</td>
<td>Regulations to prescribe fees, charges, and levies (Forests Act, 2009)</td>
</tr>
<tr>
<td>Article 42</td>
<td>Quality control of timber (Forests Act, 2009).</td>
</tr>
<tr>
<td>Article 45</td>
<td>Pricing below true market value (Forests Act, 2009).</td>
</tr>
<tr>
<td>Article 74</td>
<td>Interest and recovery of sums due (Forests Act, 2009).</td>
</tr>
<tr>
<td>Article 81</td>
<td>Other regulations (Forests Act, 2009)</td>
</tr>
</tbody>
</table>

**The Guyana-EU Voluntary Partnership Agreement**

A Voluntary Partnership Agreement (VPA) is a legally binding trade agreement between the EU and a timber-exporting country outside the EU. A VPA aims to ensure that all timber products destined for the EU market from a partner country comply with the laws of that country. In
addition to promoting trade in legal timber, VPAs address the causes of illegality by improving forest governance and law enforcement (GoG, 2016; GoG & EU, 2010).

| Community Forest Management Agreement (CFMA) | The purpose of a Community Forest Management Agreement (CFMA) "is to provide communities with a means of acquiring clear and secure rights to manage and benefit from their local forests on a sustainable basis to help meet local needs, stimulate income generation and economic development, and enhance environmental stability. The Commission may (...) grant a community group a forest management agreement by entering into a legally binding agreement with the group concerned authorising that group to occupy a specified area of State Forest and manage that area in accordance with the agreement" (Section 1(2)(3), Forest Act, 2009). This agreement is enforced under Section 11, Forests Act 2009 (entered in force in October 2010); State Land Act, 1910 (1997) (Almeida, 2015; GFC, 2011a; GoG, 2018b; Forest Act, 2009; The Forest Regulations, 2018). |

| ASSOCIATED TRANSPORT LAWS |  |
| Public Lands (Private Roads) Act | An Act to enable persons to construct and maintain private roads for mining, woodcutting, and other purposes on public lands, and to impose and recover, subject to certain conditions, tolls for the use of other persons of |
| Section 42 Article 8 | Notwithstanding any other provision of this Act, no person shall carry out any forest operations or forest conservation operations within a concession area larger than 8097 hectares except (Forests Act, 2009):

a) after the Commission has approved a forest management plan of at least 5 years duration and annual operations plan for the concession area; and

b) in accordance with those plans. |
| Article 29 | Assistance in fire or natural disaster (Forests Act, 2009). |
| Article 37 | 1. The Minister may by order provide for prohibiting the importation of forest produce or any class or description of forest produce from any country. Except under the authority of an import licence granted by the Minister.

2. No person shall import into or convey within Guyana any forest products that have been unlawfully obtained in or unlawfully exported from any country.

3. In any prosecution for an offence of contravening or failing to comply with subsection (1), the defendant shall have the burden of proving that any imported forest produce has been legally obtained in and legally exported from its country of origin. |
<table>
<thead>
<tr>
<th>Section 2 of the Forests Act</th>
<th>Interpretation (Forests Act, 2009)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Article 43</td>
<td>Compliance with international standards (Forests Act, 2009)</td>
</tr>
<tr>
<td>Article 44</td>
<td>Export of forest produce (Forests Act, 2009)</td>
</tr>
<tr>
<td><strong>Guyana National Bureau of Standards Act</strong></td>
<td>AN ACT to provide for the preparation and promotion of standards in relation to commodities, services, processes and practices by the establishment and operation of a Bureau of Standards, to establish the Guyana National Bureau of Standards and the National Standards Council, to vest the management of the Bureau in the Council, to define the objects of the Bureau and the powers and functions of the Council and for matters incidental thereto (Guyana National Bureau of Standards Act, 1984).</td>
</tr>
</tbody>
</table>

**OTHER ASSOCIATED LEGISLATION**

<table>
<thead>
<tr>
<th>Amerindian Act 2006</th>
<th>An Act to provide for the recognition and protection of the collective rights of Amerindian Villages and Communities, the granting of land to Amerindian Villages and Communities and the promotion of good governance within Amerindian Villages and Communities (Amerindian Act, 2006).</th>
</tr>
</thead>
<tbody>
<tr>
<td>State Land Act</td>
<td>An Act to provide for the proper regulation of the State Lands, Rivers and Creeks of the State (Amerindian Act, 2006).</td>
</tr>
<tr>
<td>Protected Areas Act 2011</td>
<td>An Act to provide for the protection and conservation of Guyana's natural heritage and natural capital e creation, management and financing of a national system of protected</td>
</tr>
</tbody>
</table>

72
areas; the maintenance of ecosystem services of national and global importance including climate regulation; the establishment of a protected areas commission; the establishment and management of a protected areas trust fund; the fulfilment of Guyana's international environmental responsibilities; public participation in protected areas and conservation; and related purposes (Protected Areas Act, 2011).

### Amerindian Protected Areas

‘Amerindian Protected Area’ means a protected area created by the Amerindian Village Council over its (titled) Village Lands or any part thereof and which has been recognized as an Amerindian Protected Area under chapter V (Protected Areas Bill N° 11/11)” (Section 6, Protected Areas Bill, 2011). To establish an Amerindian Protected Area, an Amerindian Village Council must apply with the Protected Areas Commission. To apply, the Amerindian Village must comply with several prerequisites and present complex documentation. The Protected Areas Commission has the authority to approve or reject an Amerindian Village application. If an application is denied by the Protected Areas Commission an Amerindian Village Council may appeal to the Minister (Part V, Protected Areas Bill N° 11/11) (Amerindian Act, 2006; Protected Areas Act, 2011).
| Guidelines for Forest Operations for State Forest Authorizations- Timber Sales Agreements, Wood Cutting License Holders, State Forest Exploratory Permits (SFA-TSAs, WCLs, SFEPs). | The Guidelines for Forest Operations (large concession) provides a range of standards and rules that will help concessionaires to adopt appropriate practices. Its aim is thus to function as (GFC, 2018b):

- an effective instrument for the implementation of sustainable management of Guyana’s forests;
- a compendium of guidelines that will facilitate forest activities compatible with international directives and principles, regional criteria and indicators, and the GTLAS and WTS;
- a series of guidelines that will help conserve biological diversity, forest regeneration and wildlife protection;
- a tool for promoting enhanced productivity, sustainability and economic viability of forest harvesting;
- a tool for promoting improved living conditions and safety of the workforce; and
- a tool for promoting improved relations between logging companies and local communities. |
<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>Guidelines for Forest Operations For State Forest Authorizations- State Forest Permission (SFAs-SFPs)</td>
<td>The Guidelines for Forest Operations (small concession) provides a range of standards and rules that will guide concessionaires to adopt appropriate practices. Its aim is thus to function as (GFC, 2018c):</td>
</tr>
</tbody>
</table>
| State Forest Authorizations: Timber Sales Agreements, Wood Cutting License Holders, State Forest Exploratory Permits, State Forest Permissions, Community Forestry Management Agreements (SFA-TSAs, WCLs, SFEPs, SFP, CFMAs). | The Code of Practice for Forest Operations provides a range of standards, guidelines and rules that will help concessionaires to adopt appropriate practices. Its aim is thus to function as (GFC, 2018a):

- an effective instrument for the implementation of sustainable management of Guyana’s forests;
- a compendium of guidelines that will facilitate forest activities compatible with national and relevant international directives and principles, regional criteria and indicators, and the GTLAS and WTS;
- a series of guidelines that will help conserve biological diversity, forest regeneration and wildlife protection;
- a tool for promoting enhanced productivity, sustainability and economic viability of forest harvesting;
- a tool for promoting improved living conditions and safety of the workforce; and
- a tool for promoting improved relations between logging companies and local communities. |
international directives and principles, regional criteria and indicators, and the GTLAS and WTS;

- a series of guidelines that will help conserve biological diversity, forest regeneration and wildlife protection;
- a tool for promoting enhanced productivity, sustainability and economic viability of forest harvesting;
- a tool for promoting improved living conditions and safety of the workforce; and
- a tool for promoting improved relations between logging companies and local communities.

<table>
<thead>
<tr>
<th>STRATEGIES AND PLANS</th>
<th>National Development Strategy (NDS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sets out priorities for Guyana’s economic and social development. The NDS stressed that the basic principle of Guyana’s development must not threaten the integrity of the environment and among its objectives include “to increase the economic benefits of which Guyana derives from its forests and associated natural resources” (MoF, 1997). Some of the actions include:</td>
<td></td>
</tr>
<tr>
<td>a) Through the development of fiscal measures, financially viable local markets will be developed from Guyana’s timber and timber products,</td>
<td></td>
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with emphasis on the utilization of lesser-used/lesser-known species

b) The marketing of lesser-used/lesser-known species will be optimized through research and development to identify appropriate processing technologies at various stages of the supply chain

2 Village Sustainability Planning

The LCDS 2030, goes further to specifically outline a participatory mechanism for implementing village sustainability plans which would include ecotourism and other activities that are based on the forest resource at the community level. The process of Village Sustainability Plans (VSPs) is to determine community needs through village workshops to identify the vision for the community and areas where community needs can be effectively met. The two main areas of focus of the VSPs that align with the National Context Analysis report are:

1) community involvement in ecosystem services management; and
2) sustainable business opportunities for communities such as eco-tourism, indigenous tourism, and sustainable agriculture.
3.3 Ecological Impacts of Forestry Activities

Forests are one of nature's versatile and abundant renewable resources covering thirty-one per cent (31%) of the global land area (FAO, 2020), offering a wide array of social, economic, environmental and cultural services simultaneously. The significance of forest ecosystems for human well-being cannot be overstated. While vegetation constitutes the distinguishing component of this ecosystem, there are additional elements: soil and microorganisms, which act to purify air and water whilst regulating climate and recycling nutrients (Popradit et al., 2015). Without these services, forest ecosystems would be futile, and life would not be possible.

Since 1925, Guyana has been exploiting its forest resources, initially under the stewardship of the Guyana Forestry Department and from 1979, under the Guyana Forestry Commission (Mangar, 2004). Our forest resources have primarily been used for the production of logs for exportation. Most often, this logging would focus on the extraction of a limited number of commercially marketable tree species. For Guyana, this was the *Chlorocardium rodiei*, aka Greenheart. Long-term data has shown that the operations within the forestry sectors cause ecological damage whether done sustainably or unsustainably. Over the years, ecological damage has been documented in Guyana’s forestry sector and they are as follows:

3.3.1 Impacts of Conventional and Reduced Impact Logging Systems

Before reduced impact logging (RIL) was adopted by the forestry sector of Guyana, conventional logging via clearcutting was practised. Previous research shows that the conventional logging practice was especially detrimental to the most sought-after high-value species such as *Chlorocardium rodiei* (Greenheart), *Peltogyne venosa* (Purpleheart), *Hymenea courbaril* (Locust) and *Diplotropis purpurea* (Tatabu). Trees were being harvested at an astonishing rate of 8.7 trees/ha which is an average of 27.8m³/ha and was considered to be highly unsustainable considering that 97% of the tree that was cut was *Chlorocardium rodiei*. Since *Chlorocardium rodiei* is endemic to Guyana, this put significant pressure on the species. There was also the added threat of illegal logging which added to the conventional logging system and caused somewhat of multiple stressor effects. The conventional logging system also caused significantly large felling
gaps which were undesirable because of trees being harvested in clusters which would cause significant degradation effects (van der Hout, 2000).

With the implementation of a reduced-impact logging system, the size of the filling gaps was reduced which meant that the trees that were selected for felling would be more uniform in their distribution hence the felling gaps would be more uniformly distributed as well. Also, more species were being targeted, twenty-six species, and this significantly reduced the pressure on *Chlorocardium rodiei* although the species still accounted for over 50% of the number of trees felled (van der Hout, 2000).

RIL also significantly reduced the area of forests that had to be cleared to create skid trails to get the logs out of the stumpage area compared to the conventional logging system. The main element in the RIL system that reduced the damage to the surrounding forest associated with retrieving the logs from the stumpage area is planning which was not practised in the conventional logging system. Guyana’s current system for timber harvesting includes the implementation of RIL and the GFC monitors forest operators against RIL criteria.

### 3.3.2. Cumulated Canopy Cover Loss

Although selective logging is practised in Guyana’s forestry sector, there is still the issue of cumulative canopy cover loss. Although this is not physically apparent, the issue still exists whether the RIL system or the conventional logging system is used. Previous studies in Guyana and other nations using similar logging systems shows the average cumulative canopy loss in both RIL and CL was 4.6% to 4.8% of the total logged area respectively while the natural undisturbed cumulative canopy loss averaged just over 3% (Pereira et al., 2002).

There are various effects of canopy loss due to logging on the forest stand. Although the RIL system used would not significantly affect the albedo of the forest stand, in areas where there is significant deforestation, the albedo would significantly increase. This would be especially evident in areas that are illegally logged or on concessions that have low to no compliance with the GFC code of practice which the concessionaires are supposed to religiously follow. The canopy loss
could also cause warmer and drier conditions to occur in the understory when compared with undisturbed forests. The warmer and drier conditions cause increased risks of fires although they are not significant. Similar effects were observed in other areas with similar forest structures and compositions which utilize the RIL system. Canopy gaps have also been shown in many instances to encourage the invasion of non-native species which can damage and change the native ecology and also have a negative effect on regeneration (Baret et al., 2008; Devagiri et al., 2016; Hubbell et al., 1999; Jackson & Adam, 2020; Karsten et al., 2013; Pedersen & Howard, 2004; Qiang et al., 2019; Saiful & Latiff, 2019; Salvador-Van Eysenrode et al., 1998; Senécal et al., 2018). However, to curb canopy loss and its effects the Forestry Operators’ Code of Practice dictates that if trees of harvestable size are within 8m of each other, none shall be felled to minimize gaps and safeguard the successful regeneration of commercial species and control the shooting or sprouting of undesirable vines, weeds, or non-commercial pioneer tree species. The proximity distance is measured from the centre of one tree to the centre of the other tree.

3.3.3 Ground Clearance and Disturbance

The skidding process creates significant understory clearance which significantly damages or results in the destruction of the understory vegetation. Apart from vegetation being damaged or disturbed, the soil is significantly disturbed which in some cases will lead to problems such as erosion which will be due to the compaction caused by the heavy machinery and the excess runoff due to the lack of infiltration into the soil because of compaction (Akbarimehr & Naghdi, 2012b; Arevalo et al., 2016; DeArmond et al., 2021; Donagh et al., 2010).

Some studies have estimated that erosion due to logging roads and skid trails can be as high as 320 t/yr at 20% gradients and gentler gradients, as high as 264 t/yr. Massive amounts of sediment are dislodged. As much as 60% of the eroded material comes from the running surface and an estimated 40% of the eroded material originates from the cut and fill material along the road. The majority of the eroded material from logging roads and skid trails temporarily ends up in flood plains which can cause alteration to the habitat. In cases where the eroded material reaches waterways, the aquatic environment is altered (Akbarimehr & Naghdi, 2012a; Ampoorter et al., 2007; Arevalo et al., 2016; DeArmond et al., 2021; Donagh et al., 2010; Sidle et al., 2004).
3.3.4. Effects of Logging Activities on Residual Trees

In the forestry operation, three levels of damage may be done to the residual trees that are not being targeted by the operation. This damage can happen during felling, skidding of the log from the stumpage area, building skid trails or logging roads, etc. The levels of damage can either be minor, moderate or severe which influences the survival probability and growth form of the tree. When minor damage is inflicted on the residual tree, there is a higher probability that the negative effects on the tree will be temporary and therefore short-term (van der Hout, 2000).

For moderate damage, there might be significant negative effects on the growth form of the tree and may also significantly affect the survival of the damaged tree. In many cases, the internal mechanisms of the tree below the bark are exposed and the tree may then fall victim to infection by various types of diseases (fungal, bacterial or viral) or decay. In cases where there is severe damage, the tree will be subjected to significant negative effects on the growth form that range from split trunks, gouges, tops breaking off completely, etc. which would most likely kill the tree. In cases where the tree survives, it might be crooked, slanted, split, etc. which would disqualify it as a candidate for commercial use in the future (Figueira, 2008; Jalonen et al., 2014; Lee et al., 2002; Ng et al., 2009; Ratnam et al., 2014).

3.3.5. Impacts on the commercial stand

Research has shown that selective logging causes significant damage to the forest stands over a long-term period. The damage is caused by intentionally removing the adult tree from the forest stand for the commercial species hence why the commercial species are heavily affected. Non-commercial or lesser-known species are not affected since the demand for those species is very low to non-existent. The main question in the selective logging system, is how many of the commercial trees will survive the selective logging process? (Hout, 2016; van der Hout, 2000).

Damage is also done on a genetic level. Since the desired phenotypes (straight boles, large diameter, little to no rot/decay, etc.) are removed for commercial use, that leaves the undesirable
phenotypes (crooked boles, prone to decay/rot, etc.) which would make the stand undesirable for the main commercial purposes. On a genotypic level, genetic erosion will occur, and a significant amount of diverse genotypes are removed from the stand which decreases the genetic diversity of the stand. A decrease in genetic diversity can make the stand more susceptible to attacks from pests and diseases, natural hazards, the effects of climate change, etc. (Leal et al., 2014; Sebbenn et al., 2008).

3.3.6. Introduction of Invasive Species

To reverse deforestation in Guyana, especially mined-out areas, a plan was formulated to restore the mined-out areas and since there was no viable native candidate at the time, a decision was taken to introduce a non-native species, Acacia (*Acacia mangium*). The species has since spread into other areas where it was not planted and is encroaching on the native forest species because of its fast growth rate, the characteristic that initially made it a good reforestation species (EPA, 2011b).

3.4 Policy Outlook for Sustainability in the Forestry Sector

Guyana has always made steady progress in the sustainable use and management of its forestry resources. The development of the LCDS reflects that it was intended to guide the development of policies over the next two decades such that it fulfilled the commitments made under the United Nation's Sustainable Development Goals. In addition to this, the formulation of policies is particularly critical as it pertains to the Forestry Sector in Guyana, seeing as it is the 'cornerstone of the country's national patrimony' (Government of Guyana, 2018.). To that end, there is an implicit need for continuous monitoring of direct and indirect drivers of deforestation. However, such activities can only be facilitated long-term through stringent forest governance that seeks to promote careful management and monitoring of forestry resources and encourage the changing of patterns and behaviour of users (GoG, 2019a).

The current revision of the National Forestry Policy Statement (NFPS), and by extension the National Forestry Plan (NFP), extensively covers much of the immediate concerns in the forestry sector.
sector but is only intended to cover a period of ten years (2018 to 2028), with a review in 2023 and the Low Carbon Development Strategy (LCDS) 2030 which builds on what was done for the 2009 version of the LCDS. The LCDS was initially heavily based on maintaining and increasing Guyana’s forest cover through reforestation, afforestation and other similar activities (OP, 2013).

The first of these policy recommendations is ensuring and strengthening sustainable forest management for low emissions. The main objective is to reduce and/or maintain low forest degradation rates, forest loss, and retain healthy forests well into the future (GoG, 2019a). Following that, there is a recommendation that uses GFC’s experience to help other landowners improve their forest monitoring and management. The goal is to improve the national forest monitoring system in Guyana among all the stakeholder groups and, thus, ensure that deforestation stays below a certain level.

Another such future policy seeks to enhance the array of forest management tools, measures, and plans as well as involve key stakeholders in cooperative forest resource management, monitoring, and research. Herein, emphasis is placed on utilising technological advancements to improve data collection in the forestry sector. But, more importantly, it allows for capacity building among the citizens of Guyana.

Policy recommendations that emphasised stakeholder participation focus on strengthening Community Reporting, Monitoring and Verification (CMRV) Programmes of indigenous communities and implementing provisions under the Amerindian Act 2006, which mandate Amerindian village councils to manage forest resources. Policies like these consider indigenous rights and allow villages to benefit from the forestry sector directly and develop sustainably. The Revised National Forest Policy (2018) also emphasizes the implementation and development of agroforestry systems in hinterland regions, especially areas where the risk of mass wasting is high and where forest cover will have to be maintained. On abandoned agricultural land and in urban areas, afforestation projects will be implemented to increase Guyana’s overall forest cover and carbon sequestration capabilities.
Lastly, there are policy recommendations for advanced certified technical and vocational training for effective forest management and monitoring, forest rehabilitation and monitoring, control and reporting on wildlife trading (legal and illegal). The first two outcomes entail promoting education and training on necessary techniques for forest rehabilitation and the best operational management practices. Additionally, the need for policies that address wildlife trading is highlighted to be of utmost priority. This ensures that the wildlife trade is kept within legal, sustainable levels (GoG, 2019a).

3.4.1 Incentivizing Sustainable Forestry Management within the Low Carbon Development Strategy

In terms of sustainable forest management, Guyana has demonstrated a highly efficient management system built on exemplary codes of practice for timber harvesting, the implementation of reduced impact logging techniques, strong practices of forest governance and legalities and methodical planning of pre and post-harvesting. Within this sustainable forestry approach, Guyana has seen one of the lowest rates of deforestation from its lumber supply chain. The success of the forestry sector is a critical component to the success of the LCDS as the country’s forest endowment is one of the critical resources needed for the carbon reduction commitments of Guyana. As such the LCDS outlines an investment programme that supports:

1. Finalizing and implementing the Voluntary Partnership Agreement (VPA) under EU-FLEGT - The European Union’s Forest Law Enforcement Governance and Trade (EU-FLEGT) programme seeks to support forest governance through strengthening sustainable and legal forest management and promoting trade in legally produced timber. The VPA, when concluded, will be a bilateral trade agreement between the EU and Guyana, and will enable Guyana to export legally sourced and verifiable wood products to EU markets.
2. Implementation of Programme for Endorsement of Forest Certification (PEFC) – As an extension of the current FLEGT and REDD+ programme with the Programme for Endorsement of Forest Certification The purpose of the PEFC is to provide strong linkages with existing government policies and processes. The GoG will seek to build stakeholders’ capacity to manage and audit PEFC areas and will support marketing efforts to boost local and international trade of certified lumber products.
3. Improving added-value activities for forest products locally – The LCDS identifies value-added enterprises beyond primary production as integral to further reducing pressures on forest resources. The LCDS investment programme will therefore develop technical skills, support technology transfer and enable more marketing and promotion of local forest products.

3.4.2 Forest Ecosystem Development and the Carbon Market within the LCDS

From a policy perspective, the success of the LCDS goals is heavily hinged on the plans to ensure the health of the country’s forest ecosystem. The forest ecosystem is the basis of its carbon commitment declared in Guyana’s NDCs. As previously outlined, the forest resource is a significant carbon sink while in tandem representing the largest biodiversity space in the country. As a result of this, the LCDS framework has outlined forest ecosystem conservation as a key action item to ensure biodiversity health is maintained, forest markets can be sustained indefinitely and give the country the option to enter the global carbon market as a net sink. To expand the forest ecosystem services of Guyana the government has earmarked the following actions within the LCDS document: i) Expansion and restoration of Guyana’s mangrove forests and ecosystems; ii) Utilization of green-grey solutions by incorporating mangrove forests into coastal protection; iii) Maintenance of intact forest landscapes, and iv) Watershed protection.

Expanding the forest ecosystem stock then translates into an increase in the flow of ecosystem services from the forested areas. Guyana has recognized the significant economic benefits that can be derived from the forest ecosystem services and has therefore explored mechanisms in the LCDS to tap into these benefits. For instance, Guyana has advocated in the past for forest climate services to be included in carbon markets which was a mechanism eventually built into the REDD+ programme internationally. Guyana has undertaken a three-phase process to develop its forest climate service which was first outlined in its LCDS 2009 document. Phase 1 consisted of the Guyana-Norway REDD+ agreement which saw the development of a state-of-the-art Monitoring, Reporting and Verification System (MRVS) for forest carbon. The country has completed the objectives this phase 1. Phase 2 consists of moving towards a carbon market mechanism. Guyana alongside several other countries with a rich forest ecosystem pursued the enshrinement of a workable market mechanism with the UNFCCC with notable progress being made at COP 26.
Within the LCDS, as of 2022, Guyana intends to sell its forest climate services as credits on voluntary carbon markets with the verification of these credits ensuring to adhere to the UNFCCC rules for REDD+. To benefit from this voluntary climate market, the GoG intends to implement a five (5) step process; i) Confirm Guyana’s objectives; ii) Choose a standard (i.e. determine if there is a global carbon market standard that matches Guyana’s objective); iii) Engage with the chosen market standard; iv) Sell Guyana’s credit, and v) Ensure a fair sharing of revenues. Presently, some work has been done in the delivery of the processes outlined. For step 1, Guyana’s objectives for its proposed carbon market mechanism would consist of four components; i) Reduced deforestation; ii) forest restoration; iii) carbon removal, and iv) conserving sequestered carbon. For step 2, the GoG assessed potential voluntary market standards against Guyana’s objectives. The assessment results revealed that only the ART-TREES (the REDD+ Environmental Excellence Standards) which is supported by several governments globally, comes closest to Guyana’s criteria. As stated within the LCDS (draft as of 2022) document –

“The ART-TREES standard also recognises Guyana’s forest climate services for the period 2016-2021, which would allow no gap in payments. With ART-TREES, Guyana can deliver on the second phase of its vision for forest climate services where Norway paid in Phase I for credits from 2009-2015, with ART-TREES credits being available from 2016 to enable the start of Phase 2.”

Guyana is presently in the process of finalizing step 2 under phase 2 but the LCDS document outlines its plans for steps 3-5 which include mechanisms for determining the volume of credits, allocating credits and selling the credits on voluntary markets. With respect to step 5, the LCDS proposes that all revenues be re-invested into 1) National programmes (such as renewable energy, land titling, coastal infrastructure and climate mitigation measures) and 2) community/village-led programmes (for indigenous and local people as set out in the Village Sustainability Plan).

3.5 Biodiversity incentivisation mainstreaming options

Part III of Guyana’s Forest Act (2009) is committed but not limited to the protection and conservation of Guyana’s forests and includes special measures to ensure the conservation of biodiversity and the protection of specific trees and plants (Forests Act, 2009). However, to support
Guyana's economic development, unsustainable harvesting practices within the forestry sector have caused a reduction in ecosystem resources and services over time. From an economic standpoint, this is primarily attributed to the fact that these forest resources’ environmental or ecosystem services are often externalised during developments (Bynoe, de Souza, & Agard, 2011). This is so because some of the benefits provided by these ecosystems may be cultural or aesthetic, and therefore undermined since the loss of such is not viewed as a "cost" to society (OECD, 1996). Mainstreaming economic biodiversity incentives into the forestry sector can help to promote the sustainable management of forests and forest resources by putting a monetary value on the intangible benefits attained from these ecosystems and resources so that they are given the recognition that is deserved (Bynoe, de Souza, & Agard, 2011, p. 16)

Payments for Environmental Services (PES) are incentives that can be incorporated into Guyana's forestry sector to help preserve its biodiversity and ecosystem services. PES is an intangible benefit produced from a land area or ecosystem purchased from a provider, given that the provider assures the provision of the services (Bynoe, de Souza, & Agard, 2011). This will ensure that persons who attain certain benefits from the environment they reside in are compensated if another party seeks to utilise these services and benefit from them, thereby internalising these benefits (Mayrand & Paquin, 2004). However, for PES programmes to be successful, the institutional framework necessary to support them must be implemented and enforceable. At the same time, other factors such as a clear identification of the services provided, their value, the sellers, buyers, willingness to pay and other factors must be considered (Bynoe, de Souza, & Agard, 2011).

Several mechanisms are utilised for PES, such as Ecological Markets, which refer explicitly to the markets that trade permits or credits directly linked to ecosystem services (Ecosystem Marketplace, n.d.). For example, forests that store more carbon than they emitted are referred to as carbon sinks, which can be seen as an intangible service gained from the ecosystem. As such, Carbon Markets have been incentivised as a means of trading carbon to gain income and reduce forest cover depletion. Carbon Markets convert forest biomass to carbon credits that can either be brokered or sold and utilises this as a commodity. Carbon credit emissions trading markets are utilised as a regulatory mechanism by the UNFCCC to ensure countries that have signed on to international agreements or treaties meet the legally binding carbon emissions allowances. Carbon
Markets are also used voluntarily mechanisms whereby individual efforts are taken to reduce carbon footprints so that companies can sell excess carbon credits or for other satisfactory and personal reasons (Bynoe, de Souza, & Agard, 2011; Forests Act, 2009). Presently, Guyana receives payment from the international agreement made with Norway under the Low Carbon Development Strategy (LCDS) to preserve forest cover and reduce carbon emissions (GRIF, 2020). However, now discussions are surfacing on the potential to market Guyana's carbon credits (Guyana Chronicle, 2021). Forest-based carbon trading has become so popular that the international market for climate finance is estimated to reach about $640 billion this year (Wensing, 2021), making it a seemingly viable option for mainstreaming.

Biodiversity Services Markets can also be a favourable option for maintaining biodiversity if mainstreamed into Guyana's forestry sector. In Biodiversity Services Markets, services are not directly sold, but instead, land uses that enable species protection and preserve ecosystems or genetic diversity are sold. Economic incentives that exist in this market include but are not limited to inducing payment for access to certain species and habitats like protected areas, increasing the price of high-value habitats or lands that have high species diversity, implementing cap-and-trade regulations allowing for tradable biodiversity credits, and the incorporation of ecological value-adding tax to compensate conservation efforts (Bynoe, de Souza, & Agard, 2011, pp. 27-28). Though other economic biodiversity incentives or options - such as the incorporation of Watershed Services Markets - are present, each incentive presents various advantages and drawbacks, making them somewhat challenging to implement. For example, Guyana might lack the institutional and legislative framework needed to support these markets and the technical capacity to monitor forest cover and forest resources frequently. Nevertheless, it can be noted that the incentives above are just some of many that have the potential to promote forest conservation; by adding a fiscal cost on ecosystem resources and services, consumers will be faced with the choice of either paying or preserving.

The updated Low Carbon Development Strategy (LCDS) 2030 also covers those aforementioned aspects of ecosystem services; however, it has expanded into the ocean/marine economy (blue economy). The ocean/marine economy emphasizes on

- Ocean/marine-based industries that are emerging or already established
The ocean environment and its environmental management along with its resources

There is the potential for innovative solutions for key environmental challenges and to be a source of new types of sustainable jobs and innovative economic activity.

In addition to payment for ecosystem services, the LCDS 2030 also indicated that considerable effort will be made for ecosystem services valuation which is one of the key aspects of payment for ecosystem services. The vision was originally built upon the payment for forest climate services that Guyana has undertaken with the REDD+ programme. The LCDS 2030 outlines a plan to continue advancing the country’s forest climate service and invest new revenues into low-carbon economic activity. Pertinent to the Biodiversity Engagement Facilitation National Context Report, the LCDS advancements in its ecosystem services economy will focus on low-impact mining and forest ecosystem services. Mining and the forestry sector were two key economic sectors identified in the Biodiversity Engagement Facilitation and therefore need to be considered under the ecosystem services context of the LCDS 2030.

For the development of a carbon credit system, several policy mechanisms include the identification of its carbon credit objective, setting a market standard, engaging with ART-TREES, selling the credits and re-investing, and sharing benefits with communities. The carbon credit system will be an important concept to capture within the National Context Analysis report as this system is indirectly related to biodiversity. The carbon market will only be possible so long as the health of the forest is intact. Biodiversity markers are often used to assess the health of forest ecologies therefore, research into the conservation of forest biodiversity can be used to assess the continued state of the carbon credit system.

3.6 Future commitments in relation to UNCBD

The United Nations Convention on Biodiversity is an international instrument responsible for conserving and maintaining biodiversity around the world while promoting sustainable development. "The convention, therefore, has three main goals, namely, the conservation of biodiversity, sustainable use of the components of biodiversity and the sharing of the benefits arising from the commercial and other utilisation of genetic resources "fairly and equitably"
Guyana was amongst 168 countries that signed this treaty in June of 1992.

Guyana's biodiversity includes over eight thousand plant species and approximately thousand eight hundred recorded species of amphibians, birds, reptiles and mammals. One of the country's most valuable assets is its forests, with a forest cover of approximately 87% with estimated forest land between 18.416 million hectares and 18.695 million hectares and approximately 12% designated as protected areas (Bynoe, de Souza, & Agard, 2011). The main drivers of forest cover loss in Guyana (from the most to least responsible) are mining, fire, agriculture, forestry, infrastructure and settlements (Guyana Forestry Commission, 2018).

With forestry being one of the top three sources of foreign exchange and employment contributing to approximately 5% of Guyana's GDP, respectively, more so, there is potential for development in this sector. Guyana has progressively taken important steps towards meeting the obligations of the United Nations Convention on Biodiversity and is ensuring the conservation, protection, and sustainable use of its natural resources. Thus, Guyana's future commitments to the UNCBD are:

1. All areas under forestry should be managed sustainably, ensuring the conservation of biodiversity by continuing with the process of establishing the REDD+ framework and also developing and establishing a National Conflict Resolution/ Grievance mechanism for REDD+.
2. To Consolidate/harmonise policy, legal, regulatory, and administrative frameworks that will support sustainable use, protection, and management of biodiversity resources by developing the EU Forest Law Enforcement, Governance and Trade (FLEGT) timber legality assurance system in Guyana.
3. Substantially improve biodiversity monitoring at the national level and within crucial productive sectors and the private sector by developing the EUFLEGT Voluntary Partnership Agreement (VPA) and continuing the development and implementation of a Monitoring Reporting and Verification (MRV) system.
4. Strengthen the information knowledge base and capacity for conservation, management, and sustainable use of biodiversity by monitoring and assessing forest carbon.
The Agriculture Sector of Guyana
4. The Agricultural Sector in Guyana

The development of agriculture has led to the rise of sedentary human civilization. Even today, it is considered one of the most vital sectors around the globe (Maroli, et al. 2021). While the potential of agriculture for development has long been neglected (Byerlee et al. 2009), there has been a renewed interest in the role of agriculture in poverty reduction (Diao, Hazell, Resnick, & Thurlow, 2007; Haggblade, Hazell, & Reardon, 2007; Byerlee et al., 2009; Ligon & Sadoulet, 2018; Dorinet, et al. 2021). Christiaensen, Demery, and Kuhl (2011) highlight four elements that determine to what extent the development of a sector can affect poverty reduction: (i) the extent to which poor people participate in the sector, (ii) the relative importance of that sector in the economy, considering the value-added share, (iii) growth of the sector itself and (iv) its indirect impact on growth in other sectors. Their study highlights not only the importance of agriculture in growth strategies at the early stages of development but also suggests the need for policy intervention in the agricultural sector in resource-rich economies (as emphasized by Dorinet, et al. 2021).

In Guyana, there is currently a paradigm shift in agricultural production away from the traditionally grown crops (rice and sugarcane) to a more diversified agricultural sector that encompasses the traditionally grown crops with non-traditionally grown crops (cereal grains, legumes, root provisions, spices, fruits, and vegetables) (Guyana Ministry of Agriculture, 2013; Moonilall, et al. 2020).

Several studies show that climate sensitivity indicates that it is having and will harm agricultural output (Rosenzweig and Parry, 1994; Mendelsohn and Dinar, 1999; Tang and Hailu, 2020; Suresh, et al. 2021). That is a product of warmer future temperatures, changing rainfall patterns and increased frequency and/or severity of extreme weather events all of which are forecast to reduce average crop yield (Weerasekara et al., 2021a, 2021b; Khanal et al., 2021). This in turn produces greater volatility in yields and poses a challenge globally in terms of food security for smallholder farmers in developing countries (Wheeler and Von Braun, 2013), Guyana inclusive. The information prepared for this section of the report will look at several of the pertinent impacts of agriculture on the economy, society, and environment of Guyana. Specifically, the socioeconomic
overview of agriculture in Guyana, community and institutional arrangements in agriculture, ecological impacts of agriculture, policy outlook for sustainable agriculture, biodiversity incentivisation mainstreaming options and future commitments in relation to UNCBD, are considered in this section.

4.1 Socioeconomic Overview of Agriculture in Guyana

The agriculture sector (Figure 4-1) accounts for an estimated 20% of the gross domestic product (GDP). The sectors also directly employ 30-33% of the country’s labour force in both urban and rural settings. The sector is dominated by small farmers (>60%) that have land holdings that are 5 ha or less but there are a number of large private and public sector enterprises (BoG, 2020; Bubbico et al., 2020; GO-Invest, 2018; ITA, 2020).
The sector is divided into five subsectors, namely the rice industry, the sugar industry, fisheries, livestock (including apiculture) and the non-traditional crop industry. Agro-processing is also an emerging and ever-growing activity in the agricultural sector.

4.2 Community and Institutional Arrangements in Agriculture

4.2.1 Stakeholders:

There are various stakeholders that input resources into the agricultural sector. The various government agencies that fall under the Ministry of Agriculture provide technical expertise to the
sector (Figure 4-2) and conduct capacity building to keep agricultural production as high as possible. There are eleven (11) such agencies:

- Hydromet Department
- Pesticides and Toxic Chemicals Control Board (PTCCB)
- National Drainage and Irrigation Authority (NDIA)
- National Agricultural Research & Extension Institute (NAREI)
- Mahaica-Mahicony-Abary Agricultural Development Authority (MMA/ADA)
- Guyana Sugar Corporation (GUYSUCO)
- Guyana School of Agriculture (GSA)
- Guyana Rice Development Board (GRDB)
- Guyana Marketing Corporation (GMC)
- Guyana Livestock Development Authority (GLDA)
- Fisheries Department

Apart from the agencies under the Ministry of Agriculture, the Environmental Protection Agency (EPA) also has the mandate to provide technical guidance and manage projects in the agriculture sector. This is manifested in the issuing of permits for agriculture and governs effluent discharges and air contamination. There are also various educational institutions such as the University of Guyana (UG), Guyana School of Agriculture (GSA), etc. which all input knowledge into the sector. Various other stakeholders provide both monetary and technical inputs to the industry i.e., non-governmental organizations and financial institutions. The input suppliers provide necessary resources such as fertilizers and other agrochemicals that are necessary for the upkeep and improvement of the sector. There are various groups that also directly participate in the sector in which farmers are also members in most cases and these are in the form of friendly societies, cooperatives, etc. The consumers are also stakeholders that benefit directly from the sector in the form of goods and services generated by the sector and create the demand that drives agricultural production. The sector is overseen, regulated, monitored, and managed by the Ministry of Agriculture.
4.2.2. National Arrangement:

On a national level, various sub-sector agencies manage and/or regulate the agricultural sector, See Figure 4-3 and Table 4-1:
Figure 4-3 National Arrangement for Agriculture sector

Table 4-1 Agencies that manage and regulate the agriculture sector at the national level, their mandates and assigned sub-sectors

<table>
<thead>
<tr>
<th>Agency</th>
<th>Mandate</th>
<th>Subsector</th>
<th>All</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydromet Department</td>
<td>The Hydrometeorological Service’s general responsibility is to monitor and evaluate the weather and water resources in Guyana and to actively support the government in disaster risk management and aeronautical, water, agriculture, engineering and other agencies for the socio-economic development of the country. It is the official</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Pesticides and Toxic Chemicals Control Board (PTCCB)</strong></td>
<td>The Pesticides and Toxic Chemicals Control Board were established for the management of pesticides and toxic chemicals in Guyana. The Board is tasked with responsibility for licensing, registration, training, inspection and enforcement and executes these activities to ensure sound chemicals management in Guyana; reduce human health and environmental risk, and food safety in agriculture production.</td>
<td>All</td>
<td></td>
</tr>
<tr>
<td><strong>National Drainage and Irrigation Authority (NDIA)</strong></td>
<td>The National Drainage and Irrigation Authority (NDIA) functions as Guyana’s apex organization dealing with all public matters pertaining to the management, improvement, extension and provision of drainage, irrigation and flood control infrastructure and services in declared areas of the country.</td>
<td>All</td>
<td></td>
</tr>
<tr>
<td>National Agricultural Research &amp; Extension Institute (NAREI)</td>
<td>Responsible for spearheading agricultural research and extension activities for productivity enhancement and diversification of the non-traditional crops sector (fruits and vegetables), biofuel development as well as plant quarantine services.</td>
<td>Non-traditional Agricultural industry</td>
<td></td>
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</tr>
<tr>
<td>Mahaica-Mahaicony-Abary Agricultural Development Authority (MMA/ADA)</td>
<td>The Authority was formed as the executing agency for the construction of all drainage and irrigation works in Region No. 5, Mahaica/Berbice on the northeastern Atlantic seacoast of Guyana. The agency is also responsible for the allocation of State Lands between the Berbice and Mahaica Rivers.</td>
<td>Sugar Industry</td>
<td></td>
</tr>
<tr>
<td>Guyana Sugar Corporation (GUYSUCO)</td>
<td>Aims to be a world-class sugar manufacturer by producing high-quality sugar and added-value by-products, while ensuring customer satisfaction, employee development, environment protection, and safe working practices. In so doing we will achieve growth and sustained profitability in any foreseeable marketing situation to contribute to the Sugar Industry</td>
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</tr>
<tr>
<td><strong>Guyana School of Agriculture (GSA)</strong></td>
<td>Addressing technical capacity building in both agriculture and forestry through the development of skills and capacities, as well as enhanced knowledge and information exchange between, the actors involved in innovation, including farmers and their organizations, agricultural research, education and training institutions, extension and advisory services institutions, and the researchers and professionals working in the agricultural sector of Guyana and the Caribbean.</td>
<td>All</td>
<td></td>
</tr>
<tr>
<td>Guyana Rice Development Board (GRDB)</td>
<td>The general functions of the GRDB are to (1) develop the rice industry and promote the exportation of rice, (2) establish facilities and undertake research on rice production for the benefit of farmers, and (3) engage in other promotional and development activities to develop the rice industry.</td>
<td>Rice Industry</td>
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<tr>
<td>Organization</td>
<td>Description</td>
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<tr>
<td><strong>GRDB</strong></td>
<td>is also a facilitator of selected activities within the rice industry that is now owned and operated by the private sector.</td>
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<tr>
<td><strong>Guyana Marketing Corporation (GMC)</strong></td>
<td>The corporation is charged with the responsibility of providing marketing services to stakeholders (farmers, agro-processors, exporters) of the non-traditional agricultural sector.</td>
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</tr>
<tr>
<td><strong>Guyana Livestock Development Authority (GLDA)</strong></td>
<td>The thrust of the agency is to “promote greater efficiency in the livestock product industry and to provide enhanced services in livestock husbandry, livestock health and research to make provision for effective administration and regulation of trade, commerce and export of livestock or livestock products and matters related and incidental.”</td>
<td></td>
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</tr>
<tr>
<td><strong>Fisheries Department</strong></td>
<td>Responsible for managing, regulating and promoting the sustainable development of the nation’s fishery resources for the benefit of the participants in the sector and the national</td>
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</table>
economy. The Fisheries sector is made up of three primary components: Marine Fishery, Aquaculture, and Inland Fishery.

**Environmental Protection Agency**

The Environmental Protection Agency (EPA) was legally established by the Environmental Protection Act in 1996. It has the responsibility to take the necessary measures to manage, conserve, protect and improve the environment. This entails that the Agency takes actions to prevent and control pollution; assess the impact of economic development on the environment; ensure the sustainable use of Guyana’s natural resources and provide technical guidance and/or manage projects in the agriculture sector.

| 4.2.3. Community Arrangement |

The Neighbourhood Democratic Council (NDC) oversees a small geographic area within the administrative region that is usually comprised of a group of villages (Figure 4-4). The NDC is
responsible for the maintenance of public property which includes drainage and other associated infrastructure which directly or indirectly influences agricultural activity within the area.

The village councils are specific to a particular community and are headed by a village chairperson. The village council usually works along with the NDC and other agencies to implement specific projects within the community whether it be agricultural or projects of a different nature. There are also various community groups within the various communities with the help of the village council that get involved in various aspects of community development depending on their mandate.
4.2.4 Legal Framework

There are legal frameworks that govern the agriculture sector of the Cooperative Republic of Guyana, and these are synthesized in Table 4-2.
## LEGISLATION

<table>
<thead>
<tr>
<th>Act</th>
<th>Description</th>
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<tbody>
<tr>
<td><strong>Guyana Rice Development Board’s Act</strong></td>
<td>An Act to provide for the regulation of the manufacture and marketing of rice, for securing effectively the development of the rice industry through the establishment of the Guyana Rice Development Board, and matters connected therewith <em>(Guyana Rice Development Board Act, 1994).</em></td>
</tr>
<tr>
<td><strong>Guyana Rice Producers Act</strong></td>
<td>An Act to provide for the establishment of the Guyana Rice Producers Association and purposes connected therewith <em>(Guyana Rice Producers Association Act, 1946).</em></td>
</tr>
<tr>
<td><strong>National Agricultural Research and Extension Institute Act</strong></td>
<td>AN ACT to promote greater efficiency in the crops and agricultural product industry, to provide enhanced services in Agricultural Research and Extension and Crop Protection and to establish the National Agricultural Research and Extension Institute, to make provision for effective administration and regulation of trade, commerce and export of crops and agricultural products and for the matter. related</td>
</tr>
</tbody>
</table>
or incidental (National Agricultural Research and Extension Institute Act, 2010).

<p>| <strong>Pesticide and Toxic Chemicals Control Board Act</strong> | An Act to regulate the manufacture, importation, transportation, storage, sale, use and disposal of pesticides and toxic chemicals, and to provide for the establishment of the Pesticides and Toxic Chemicals Control Board, and for matters connected therewith or incidental thereto (PESTICIDES AND TOXIC CHEMICALS CONTROL ACT, 2002). |
| <strong>Pesticides and Toxic Chemicals Control (Amendment) Regulations</strong> | These Regulations amend the Pesticides and Toxic Chemicals Control Regulations 2004 in regulation 95 and the Sixth Schedule by adding a new Part (VIA) on the importation and exportation of pesticides or toxic chemicals. A person who wishes to import or export a controlled product must approach the Registrar for a licence. Forms of (an application for) an export licence are set out in the Sixth Schedule (Pesticides and Toxic Chemicals Control (Amendment) Regulations, 2007). |
| <strong>Fisheries Act</strong> | An Act to regulate fishing in the waters of Guyana (FISHERIES ACT, 1957). |
| <strong>Slaughter Of Cattle (Control) Act</strong> | This Act regulates the slaughter of bulls, oxen, steers, cows, heifers or calves (Slaughter of Cattle (Control) Act, 1974). |
| <strong>Regulations Made Under Animal Health Act 2011 (Act No. 7 of 2011)</strong> | An Act to control the movement of animals into and within Guyana and to prevent the introduction and spread of animal diseases within Guyana and from other countries, and |</p>
<table>
<thead>
<tr>
<th>Statute Name</th>
<th>Summary</th>
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<tbody>
<tr>
<td>Animal Health Act, 2011</td>
<td>to ensure the safe and humane movement of animals to and from Guyana and to regulate the importation and production of animal products and livestock feeds and other matters related thereto and connected therewith (Animal Health Act, 2011).</td>
</tr>
<tr>
<td>Rice Farmers (Security of Tenure) Act</td>
<td>This Act provides for further regulation of land tenure contracts between rice farmers and landlords to strengthen the position of the former. The Minister may establish committees that shall perform several duties in relation to the assessment of rents and the observance of conditions of contracts of tenancy in a specified area (sects. 8 to 26). The Minister may make regulations to implement provisions of this Act (sect. 55). (59 sections and 5 Schedules) (Rice Farmer (Security of Tenure) Act, 1956).</td>
</tr>
<tr>
<td>Rice Farmers (Security of Tenure) Regulations</td>
<td>These Regulations implement provisions of the Rice Farmers (Security of Tenure) Act. They regulate the procedures of application for the ascertainment of maximum rent with an Assessment Committee under section 12 of the Act. (5 regulations and 4 Forms)(Rice Farmers (Security of Tenure) Regulations, 1956).</td>
</tr>
<tr>
<td>Sugar Industry Special Funds Act</td>
<td>An Act to make provision for the establishment in respect of the sugar industry of a Price Stabilisation Fund, a Rehabilitation Fund and a Labour Welfare Fund and for purposes connected therewith (Sugar Industry Special Funds Act, 1947).</td>
</tr>
<tr>
<td>Act/Regulation</td>
<td>Description</td>
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<tr>
<td>Seeds Act</td>
<td>An ACT to regulate the production, sale, import, export and quality of certain seeds for sowing; to provide for certification of seeds and related matters (Seeds Act, 2011).</td>
</tr>
<tr>
<td>Plant Protection Act</td>
<td>An Act to regulate the importation and exportation of plants, planting material and objects derived from them, to protect from the introduction of exotic pests and diseases to Guyana and to control and eradicate diseases and pests within the country (Plant Protection Act, 2011).</td>
</tr>
<tr>
<td>Guyana Livestock Development Authority Act</td>
<td>The Act to promote greater efficiency in the livestock and livestock product industry to provide enhanced services in livestock husbandry, livestock health and research and to establish the Guyana Livestock Development Authority to make provision for effective administration and regulation of trade, commerce and export of livestock or livestock products and for matters related or incidental (Guyana Livestock Development Authority Act, 2010).</td>
</tr>
<tr>
<td>Water Quality Regulations</td>
<td>The water quality regulations regulate discharges from various industries that include agriculture (Environmental Protection (Water Quality) Regulations 2000).</td>
</tr>
<tr>
<td>Hazardous Waste Regulations</td>
<td>Regulates hazardous waste disposal from various industries that include agriculture (Environmental Protection (Hazardous Wastes Management) Regulations 2000).</td>
</tr>
<tr>
<td>Regulations</td>
<td>Description</td>
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<td>-------------------------------------------------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td><strong>Air Pollution Regulations</strong></td>
<td>Limits and monitors atmospheric emissions from various industries (Environmental Protection (Air Quality) Regulations 2000).</td>
</tr>
<tr>
<td><strong>Draft Compliance and Enforcement Regulations</strong></td>
<td>(Housty, 2014).</td>
</tr>
<tr>
<td><strong>Litter Enforcement Regulations</strong></td>
<td>Environmental Protection (Litter Enforcement) Regulations (EPA, 2012).</td>
</tr>
</tbody>
</table>

**GUIDELINES**

<table>
<thead>
<tr>
<th>Guidelines</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Poultry Rearing Guidelines</strong></td>
<td>Environmental Guidelines for poultry rearing operations (EPA, 2013).</td>
</tr>
<tr>
<td><strong>Swine Rearing Guidelines</strong></td>
<td>Environmental Guidelines for swine rearing operations (EPA, 2011a).</td>
</tr>
</tbody>
</table>

**PLANS AND STRATEGIES**

<table>
<thead>
<tr>
<th>Strategy</th>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td><strong>Vision for Agriculture 2020: A National Strategy for Agriculture in Guyana 2013 – 2020”</strong></td>
<td>This policy has five areas of focus:</td>
</tr>
<tr>
<td></td>
<td>● Food Security – consolidating the end of hunger in Guyana, ensuring everyone has enough food in every community.</td>
</tr>
<tr>
<td></td>
<td>● Fibre and nutritious food accessible by citizens – nutrition security for all.</td>
</tr>
<tr>
<td></td>
<td>● Fuel production – helping to develop alternative fuel sources, reducing dependency on fossil fuel, and creating a bio-energy industry in Guyana.</td>
</tr>
<tr>
<td></td>
<td>● Fashion and health Products – An agro-process industry that creates a new industry in Guyana.</td>
</tr>
</tbody>
</table>
110

<table>
<thead>
<tr>
<th>Goals of the Strategy</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Furniture and crafts – an industry which we expect to grow in importance in Guyana.</td>
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</table>

The goals of the strategy are:

- Reducing imports of foods such as corn, soya, and potatoes.
- Increasing exports of rice and sugar, as both bulk and value-added commodities.
- Increasing exports of non-traditional crop products.
- Meeting local demand for milk and dairy products with local production.

### 4.3 Ecological Impacts of Agriculture

The agriculture sector has had a significant negative effect on Guyana’s ecosystem and ecological processes. These negative effects have grown along with the sector over the years. Various studies have documented the negative ecological impacts which this section will outline.

#### 4.3.1 Deforestation and Forest Degradation

In Guyana, agriculture is rated as the third largest driver of deforestation. Deforestation as a result of agricultural activity peaked in 2014 at 817 ha (GoG, 2015a; Guyana Forestry Commission, 2018) (Figure 4-5). Deforestation has many negative effects with the most dangerous and unsettling effect being habitat loss (FAO, 2015b). This has resulted in a number of negative human-wildlife interactions. For example, on the West Coast of Demerara in the Canal Polders, a number of farmers have reported negative interactions with a number of wildlife species with the most common species being the Brown chapuchin Monkey. On the East Bank of Demerara in Canal #3 Polder (Mocha Arcadia), farmers have reported that the most common negative human-wildlife interaction is with the Red Rumped Agouti. In both of the aforementioned cases, the
farmers thought it best to kill the wildlife in both instances which can result in the species becoming absent in those areas and may negatively affect other species in a ripple effect causing net biodiversity loss.

![Figure 4-5 Annual deforestation rates from 1990 to 2017](image)

The effects of deforestation are especially felt in areas such as the Linden-Soedyke highway which has a lot of agricultural activity. The lands that are allocated to farmers in such areas are mostly forested, so the farmers initially clear the land by burning it. The removal of the forest cover results in extreme temperature variations between day and night. This temperature variation can cause heat stress on both the human and animal inhabitance as seen in only many poultry farms. The removal of the forest cover for agriculture also causes an increased release of carbon dioxide (a potent greenhouse gas) into the atmosphere. This results in heavy losses for both above and below-ground carbon which decreases the soil fertility considerably and increases the risk of desertification.

A recent assessment has shown that there is a correlation between agriculture and mangrove deforestation and degradation ($R^2 = 0.9821$) (Conservation International, 2018). In many cases, mangroves are cleared for the sake of agricultural activities. Mangrove deforestation and
degradation due to agriculture are especially prevalent on the West Coast of Berbice (Region 5) and the agricultural activities that were responsible are large-scale rice cultivation (see Figure 4-6) and animal rearing. In the case of animal rearing, livestock farmers would allow their animals to graze in the mangrove stands which degrades them and then eventually leads to deforestation. For the rice industry, in addition to clearing away the mangrove stand for rice to be planted, a lot of the effluent that is produced by the industry is discharged into the mangrove stand and this may be upsetting various ecological processes (Conservation International, 2018; NAREI et al., 2010).

Figure 4-6 Rice cultivation encroaching on mangrove stand

Mangrove forests provided three very important ecological functions, i.e.:

1. Mangrove forests provide coastal protection against flooding (due to storm surges, elevated tides, etc) and erosion
2. Mangroves act as a buffer zone between the land and the sea where pollutants in runoff from agriculture are absorbed by the mangroves due to their ability to break down certain compounds and their high affinity for certain heavy metals
3. Mangroves also serve as habitats for wildlife and are also very important to the fishing industry. When the mangrove stand is removed for agricultural activities, there are increased risks of erosion and sedimentation which can be currently observed in various areas along Guyana’s coast in various communities that are suffering from heavy flooding during the rainy season and saline intrusion.

4.3.2 Surface and Groundwater Pollution

Unregulated, unmonitored, and unsustainable agricultural activities in the crystalline plateau of Guyana can also put groundwater resources on the coastal plain at risk of being contaminated. Since the gleysolic soil on the coastal plain is mostly impermeable, the water that infiltrates into the soil on the crystalline plateau then moves through the soil towards the coast via throughflow and gravity. When the water reaches the coast, it then accumulates and forms aquifers which are then tapped for various purposes. A lot of the agricultural activity that is carried out in the crystalline plateau is chemically intensive because of the most nutrient-deficient nature of the albic arenosols which dominate the crystalline plateau (see Figure 4-7).
Many farmers end up using agrochemicals in excess with the most common one being overused urea and this can have negative effects on the soil. Chemical residues can also get into the soil water and can be transported into the groundwater which can cause a decline in groundwater quality and make it unfit for potable or commercial uses. Chemical residues from agricultural activities in Guyana also cause surface water contamination when transported to waterbodies via excess runoff. An example of this effect can be found in both the sugar and rice industries. In the rice industry, farmers are especially guilty of exceeding the recommended dosages for agrochemicals to reduce the pest population, in particular the paddy bug, to reduce crop destruction. They are also guilty of exceeding the recommended fertilizer dosages with the thought that the more fertilizer they use, the higher the crop production. With these practices, there is both soil and surface water pollution (MoA, 2016).

4.4.3. Soil Degradation, Destruction and Contamination

Apart from surface water pollution, soil biota is also negatively affected by the overuse of agrochemicals. Although there have not been extensive studies into the effects of excessive use of
agrochemicals on soil microbiota, studies from a similar area show that agrochemicals significantly reduce the soil microbiota population in as little as 7 to 30 days after application. There is microbiota such as N-Fixing Microbes and Mycorrhizal Fungi which are both important components for nutrient conversion in the soil that are negatively affected and cause crop production to be significantly reduced. The reduction of the aforementioned soil microbes not only affects crop production but can also negatively affect the normal growth and development of the natural vegetation which can increase the risk of desertification with implications for animals that depend on the vegetation for survival (Igbedioh, 1991; Kalia & Gosal, 2011; Mandal et al., 2020; Pimentel, 1989; Sidhu et al., 2019).

Tillage erosion is another phenomenon that is common in Guyana but is not monitored and measured. However, other types of erosion, water and wind, are monitored under various projects. Studies from other parts of the tropics show that tillage erosion is far more common than water and wind erosion. There is a high probability that tillage erosion is one of the ecological effects of agriculture in Guyana. Other common types of erosion that can be observed throughout Guyana in various agricultural areas are water erosion (Olson, 2010; Wilken et al., 2020; Wysocka-Czubaszek & Czubaszek, 2014).

4.4.4. Contribution to Climate Change

For Guyana, agriculture contributes as much as 33% of the total greenhouse gas emissions. Agriculture has also been found to be a major source of methane and nitrous oxide which are both greenhouse gases with higher global warming potentials than carbon dioxide. Rice cultivation alone accounts for 82% of Guyana’s total methane emissions and 94% of Guyana’s total nitrous oxide emissions. Another major source of methane emissions is livestock production predominantly due to enteric fermentation and the prescribed burning of savannahs which are done as part of land preparation for cultivation in some instances. The use of synthetic fertilizers is also a source of emissions and energy use is also a major source of emissions (GoG, 2012).

4.4.5. Erosion of Genetic Diversity
Within the agricultural sector of Guyana, most of the farmers have all but abandoned the local cultivars and are currently pursuing external high-yielding cultivars. On average, this practice has caused at least 75% of the plant genetic diversity in the agricultural sector of developing countries to be eroded/lost (Friis-Hansen, 1999; Hammer & Teklu, 2008). One such example is the 2019 introduction of the GRDB16 rice variety which generates higher yielding in high salinity conditions. This is mostly possible because of international laws such as the International Union for the Protection of New Varieties of Plants which aims to protect new plant varieties that do not exist in nature and formalise certain seed cultivation systems. This goes against other laws such as the International Treaty on Plant Genetic Resources for Food and Agriculture for which the main objective is to preserve the low-yielding landrace varieties. The livestock industry is in a better state since the local breeds of various livestock could not be completely abandoned, and farmers mostly used mixed breeds crossbred between native and non-native breeds with cattle, goats, sheep, and poultry.

4.4.6. Introduction of invasive species

In seeking to improve the productivity in the agriculture sector of Guyana in the past, decisions were taken to import and incorporate various exotic species from different parts of the world. Over time after the introduction of these exotic species, they became invasive and had various negative ecological effects:

*Echinochloa pyramidalis* (Antelope grass): Antelope grass was introduced to Guyana in the early 1900s to improve livestock pastures specifically aimed at increasing production in the dairy industry. After its introduction, the species proved to be very prolific and quickly established itself. However, today antelope grass is one of the most invasive species that can be found on Guyana’s coast growing in very thick mats and obstructing waterways which adds to the flood problem. As early as 1982, antelope grass was also recognized as one of the main threats to the sugar industry and caused significant alterations in the aquatic environment while overwhelming and out-competing other species (Bushundial, 1991; Cumberbatch et al., 1996; Overholt & Franck, 2017; R de Araújo et al., 2021).
Gold tilapia (*Oreochromis aureus*), Mozambique Tilapia (*Oreochromis mossambicus*) and Nile Tilapia (*Oreochromis niloticus*): Tilapia was introduced to Guyana in 1951 for aquaculture and today makes up the majority of the fish species that are cultivated in Guyana’s aquaculture industry. Today, tilapia is one of the most common species that can be found in Guyana’s waterways since they outcompete most of the native species because of their hardiness and ability to survive in both fresh and brackish water if needed. They can also survive and successfully reproduce in highly disturbed habitats that native species cannot. There is a possibility that the prolific habits of the tilapia might be driving down the population of the native species as observed in other parts of the tropics (Chong et al., 2010; EPA, 2011b; Firmat et al., 2013; MoA, 2016).

Small Indian Mongoose (*Herpestes javanicus*): This species was originally introduced to Guyana in the 1900s to reduce the snake population in the sugar industry. The species is a formidable predator that affects both livestock, specifically poultry, and wildlife. The small Indian mongoose is also an opportunist feeder that can feed on many other species, dead or alive. Because of its habits, the species can significantly disturb the food web (Barun et al., 2010, 2011; Fineran, 2016; Scanes, 2018; Simberloff, 2001).

Other invasive species to note that may significantly affect ecological processes in Guyana:

Africanized Honey Bees (*Apis mellifera scutellate*): This species is having more of a positive effect rather than a negative one. This species was not intentionally introduced to Guyana like the aforementioned species. Africanized honeybees migrated to Guyana from Brazil in the 1970s after escaping from a farm. After crossing into Guyana, they started to aggressively breed with the Italian Honeybees which were prevalent in Guyana at the time but have since bred out the Italian Honeybee strain from Guyana and remain the only commercial strains used in Guyana’s honey industry. The Africanized Honeybee has cemented itself into Guyana’s natural food web and is responsible for over 70% of the sector’s crop production since they have become the main agricultural pollinator. Studies have shown that they can outcompete and cause the disappearance of native species, especially specialized competitors. Removal or the disappearance of the Africanized Honey Bee can cause a complete ecological collapse in both the natural and built...
environments (Goulson, 2003; Jemmott, 2017; Roubik, 2002; Roubik & Villanueva-Gutiérrez, 2009; Roubik & Wolda, 2001).

Leucaena/ River Tamarind (*Leucaena leucocephala*): It is not clear when this species was introduced to Guyana, but it is often observed growing in small dense monodominant thickets that often displace other species. When conditions are right this species can be very invasive. The same pattern has been observed in other parts of the tropics (Marod et al., 2012; Mello & Oliveira, 2016; Ramanand & Olckers, 2013).

### 4.4.7. Declining Fisheries

Over the years in Guyana, expanding agricultural activity has resulted in a significant amount of mangrove deforestation. One of the main services provided by mangrove forests is as a reproductive, nursery, feeding and protective cover for various aquatic species. In many instances around the world, there was a significant correlation between the fish population and the absence/or presence of mangroves or the health and extent of the mangrove stand. Although this was not formally assessed in Guyana, there is an observed trend in many parts of the world to suggest that this is a problem in Guyana (AI Robertson, 1987; Campbell, 2021; K Ikejima, 2003; Natalia Siahaan & Wasiq, 2020; Shinnaka et al., 2007).

![Graph](image)

*Figure 4-8 Guyana marine capture production from 2007 to 2016 (Source: GoG, 2019; FAO, 2018)*
The marine fish catch data for Guyana does not indicate a definite trend of declining fish catches (Fig. 4-8). However, there is anecdotal evidence from fishermen who stated that to catch the same amount of fish as they had in the past, their trips last longer, are more frequent, and the size of the fish are smaller which can be an indication of declining marine fisheries in Guyana (Inamdar et al., 2019).

4.5 Policy Outlook for Sustainable Agriculture

Under the Low Carbon Development Strategy (LCDS) focus is being given to avoiding deforesting new lands for agriculture. Instead, there are major tracts of unforested lands which are going to be the main focus of agricultural expansion, the intermediate savannahs and the rupununni savannahs, which are both wide expanses of natural grasslands (the second and third agricultural frontiers for Guyana). To make this happen, the strategy that is to be used is to attract large-scale enterprises that will make significant investments to develop the aforementioned areas into major sustainable agricultural schemes that are similar to the ones found on the coastal plain; Canal Polders 1 and 2 located on the West Bank of Demerara, Canal Polder 3 (Mocha Arcadia) located on the East Bank of Demerara, Black Bush Polder land Development Scheme located in East Berbice-Corentyne and Mahaica-Mahaicony-Abary Agricultural Development Scheme located in Mahaica-Berbice. There is also a drive to optimize the exportation process to increase the nation’s competitiveness in the global market (Boulay & Nuenninghoff, 2016; OCC, 2010; OP, 2013).

Under the last formulated Low Carbon Development Strategy, the agriculture sector was mentioned by only three (3) subsectors. The sector was explicitly dealt with under Development Objective C – Green and Inclusive Economic Diversification which caters for the Fishing and Aquaculture, Rice and Fruits and Vegetable subsectors.
4.6 Biodiversity incentivisation mainstreaming options

There are a number of biodiversity mainstreaming strategies that can be used in Guyana’s agriculture sector. Multiple issues warrant the incentivization of biodiversity mainstreaming within the sector. On February 5, 2021, the Government of Guyana through the Ministry of Finance signed a Letter of Agreement (LoA) with the United Nations Development Programme (UNDP) clearing the way for the implementation of the Biodiversity Mainstreaming Project which is particularly focused on the mining sector. However, there is a need for a similar initiative in the agriculture sector. Some mainstreaming measures that can be used in Guyana’s agricultural sector are as follows:

- Put legislation in place to mandate farmers to use more local cultivars; Ensure varieties are kept by NAREI/GSA to preserve genetic diversity
- Implementation of integrated land use management policies
• Integration of integrated biodiversity objectives into legislation e.g ecosystem-based management in both inland and marine fisheries
• Strengthening monitoring and evaluation in the agricultural sector
• Establishment of national standards and protocols that recognize the role of biodiversity in the value chain of selected products and services
• The principal areas of work were distributed between the Government and the private sector, in view of the Government’s role in promoting sustainable agriculture and protocols for the incorporation of sustainability practices and standards, joined by the private sector’s work in achieving compliance with market standards and protocols and voluntary certifications.
• Encouraging agencies to do more research and improvement of local cultivars
• Reforming environmentally harmful agricultural subsidies
• Implementation of information and voluntary approaches
• Linking small-scale producers of native varieties directly to various markets

However, although many biodiversity mainstreaming measures can be put in place, there is still the issue of compliance. The majority of the stakeholders in the sector will ask questions about how they will benefit from participating in the mainstreaming activities
Figure 4-10 Biodiversity incentivisation mainstreaming options for Agriculture

**Policy-driven Investments**
- Compensate or reduce agricultural compensation costs
- Regularize agricultural land use and property right with conditions related to biodiversity management
- Taxes or charges that force compliance of biodiversity management in agricultural landscapes
- Implement participatory management in agricultural landscapes
- Compulsory farm set-asides

**Responsible Market-led Investments**
- Cost-sharing for restorative and conservation programmes
- Permits and quotas systems
- Standards and certifications for eco-market labelling
- Promoting green purchasing in the public and private sectors
- Monetary/non-monetary rewards for sustainable production practices
- Biodiversity and greenhouse gas offsets
- Direct payment for ecosystem services preservation (PES) and restoration
- Green and blue subsidies

**Voluntary Investments**
- Boost capacity for income and livelihood diversification
- Rewards for ecosystem services (RES)
- Social marketing
- Sustainable agri-business (green and blue) development grants
- Incorporation of Corporate Social Responsibility (CSR) Investments
4.7 Future commitments in relation to UNCBD

There are no future commitments related to the UNCBD that were made for Guyana’s agriculture sector. However, the following is recommended and needed:

1. Promotion of soil health through the prudent utilization of biological, chemical and physical methods in an eco-system agronomic approach.
2. Development of guidelines for responsible recreational fishing, inland fisheries at scale and better practices in ornamental fish collection and handling.
3. Increase the cultivation of varieties that are based on native cultivars and reduce the use of introduced varieties where feasible.
4. Promote, implement and enforce compliance with the use of advanced productions systems based on landscape features (e.g., agroforestry, agrosilvopastoral systems and silvopastoral systems).
5. By 2030 all fish and invertebrate stocks and aquatic plants are managed and harvested sustainably, and legally and applying ecosystem-based approaches so that overfishing is avoided, recovery plans and measures are in place for all depleted species, fisheries have no significant adverse impacts on threatened species and vulnerable ecosystems and the impacts of fisheries on stocks, species and ecosystems are within safe ecological limits.
6. By 2030 areas under agriculture and aquaculture are managed sustainably, ensuring the conservation of biodiversity.
7. By 2030, the genetic diversity of cultivated plants and farmed and domesticated animals and wild relatives, including other socio-economically as well as culturally valuable species, is maintained, and strategies have been developed and implemented for minimizing genetic erosion and safeguarding their genetic diversity.
8. By 2020, the traditional knowledge, innovations, and practices of indigenous and local communities relevant to the conservation and sustainable use of biodiversity, and their customary use of biological resources, are respected, subject to national legislation and relevant international obligations, and fully integrated and reflected in the implementation of the Convention with the full and effective participation of indigenous and local communities, at all relevant levels.
The Urban & Built Environment of Guyana
The negative impacts of rapid urbanisation on the ecological and social environments have made these become a major social and political issue in the past decades worldwide (Talen, 2003; Mahmoud and Gan, 2018; Ma, et al. 2021). Large populations rapidly shift to cities for better opportunities for employment, education, and medical care, which stimulates a surge in severe operational pressure on urban facilities (e.g., transportation), many environmental issues, ageing infrastructure, disasters, diseases, and underutilized land (e.g., ASCE, 2017; Anderson and Minor, 2019; Wang, et al. 2021). Concurrently, the extension of urban boundaries, another side effect of rapid urbanization, increases travel distance and further intensifies the urban transportation system load (Li, et al. 2018; Liu, et al. 2021). Increased travel distance also aggravates traffic congestion, traffic accidents, and carbon emissions in cities (Liu and Su, 2021; Liu, et al. 2021).

Cities of the developing world, including those in Guyana, exhibit high vulnerability to climate change which are not only hampered by limited adaptive capacity from scarce financial and technical resources but also lack political will at various governance tiers (Mycoo, 2014). Emerging global climate change trends is now a major issue for those living in low-elevation coastal cities which makes them highly vulnerable to flooding and storm surges (Moser and Satterthwaite, 2008; Mycoo, 2014). The Inter-Governmental Panel for Climate Change (IPCC, 2013) noted that ‘‘as the ocean warms, and glaciers and ice sheets reduce, global mean sea level will continue to rise, but at a faster rate than we have experienced over the past 40 years’’. These projections will have an even greater impact on cities of low-income countries that are in the low-elevation coastal zone (LECZ), and in particular, those that are just above or below sea level, of which Georgetown in Guyana and other coastal cities are examples. In these cities, household autonomous adaptation to climate change impacts is driven by protracted state response and an overall lack of confidence in the ability of the state to minimise losses resulting from climate-related hazards (Mycoo, 2014).

The current understanding of urban responses to climate change is largely derived from case-study research on cities in more developed countries, with a focus on mitigation responses, rather than adaptation (Hickey and Weis, 2012; Castán Broto and Bulkeley, 2013). Only in recent times,
studies on adaptation strategies to address growing climate change risks facing cities in the LECZ have gained the attention of some researchers such as Satterthwaite et al. (2009), Hallegatte and Corfee-Morlot (2011), Hunt and Watkiss (2011), Romero-Lankao and Dodman (2011) and Mycoo (2014). Many cities around the world – including those in Latin America and the Caribbean (LAC) – were originally settled on dangerous sites prone to flooding and storm surges, as coastal locations were attractive for purposes of trade and territorial control (Huq et al., 2007). These earlier settlement patterns, accompanied by the development of colonial port cities, occurred when climate change was not a global threat (Mycoo, 2014). Today, many low-income cities, including those in the Cooperative Republic of Guyana, are faced with increasing threats of climate change and are least equipped to deal with the consequences of the now regularly occurring climatic scenarios. Prolonged unsustainable urban management practices such as poorly selected sites for urban settlement, weak enforcement of development standards and policies (Mycoo, 2014), etc. are examples of what built and urban environment face in low and middle-income cities. This section of the report focuses on Guyana’s built and urban environment.

5.1 Socioeconomic Overview of the Urban and Built Environment

5.1.1 Urbanization and Green Spaces in Guyana

In Guyana, there are green spaces that serve as recreational areas for citizens. Some examples are The Botanical Gardens, The Zoological Park and the National Park which also are a part of the national protected areas system and overseen by the Protected Areas Commission (PAC). There also exist privately owned green spaces that are for the use of smaller communities as a form of recreation. Guyana’s LCDS 2030, a document created to guide Guyana’s transition to becoming a green economy speaks to its intent to incorporate more green spaces in that transformation plan.

According to the LCDS 2030, the creation of green urban settlements that will encompass such spaces will require the use of green and sustainable spatial designing and planning that is critical to ensuring human settlements are inclusive, safe and sustainable. Given Georgetown's locality and importance to the daily livelihood of its citizens, it is a crucial service hub. Therefore, it is
important to ensure settlement and housing in this area are well-designed and inclusive to provide sufficient green spaces. As such, it has become a goal of the green state strategy to acknowledge that local populations and low-income families have access to safe and affordable housing, open green space and access to basic services (DoE, 2019; GoG, 2018a).

5.1.2 Capital Expenditure for Construction and Built Infrastructure for Guyana

A significant amount of Guyana’s annual budget is allocated to develop the infrastructure in urban areas, particularly on the low coastal plain which more than 90% of the country’s population inhabits. There are plans to establish more housing schemes within the next five years to satisfy the ever-increasing demand each year and this will require additional land which brings a conundrum, either wetlands and other natural habitats be modified to accommodate the new development or farmlands reclaimed which will cause a food security issue. According to the Central Housing and Planning Authority, there is a backlog of over 62,000 land applications which still must be reviewed and satisfied (Isaacs, 2020; News Room Guyana, 2020). In addition to the establishment of new housing schemes, there is also new development which is associated with the oil and gas sector which opened in Guyana in 2015.

Expenditure on infrastructure has been steadily increasing since 2010. The expenditure on infrastructure has almost tripled over the last 10 years because of new investments and demand in Guyana (Figure 5-1). Most of the expenditure went towards roads and bridges, air and river transport, sea and river defence, drainage and irrigation, energy and housing.

5.1.3 Sector Stakeholders

The Stakeholders that have the most important part to play in this sector are:

- Guyana Lands and Surveys Commission (GLSC) – developers and other government agencies will have to acquire the necessary lands through GLSC since those agencies are the custodian of all state lands and land tenure rights will have to be sorted out

- Central Housing and Planning Authority (CH&PA) – responsible for all forms of planning regarding the establishment of towns, housing schemes, villages, etc.

- Environmental Protection Agency – responsible for mainstreaming environmental sustainability into all large-scale projects to help to maintain or improve the environmental health of the areas selected for the various projects

- Ministry of Public Works – responsible for coordinating and establishing all of the relevant basic infrastructures such as roads, bridges, drainage, electricity, water, etc. through the various agencies that fall within this ministry.
Other stakeholders that would play an important part in the sector are the private actors who bring the majority of the investment and many examples around Guyana can be observed. The private actors are also very important since the public sector alone cannot support all of the necessary infrastructural activity that is required for development.

Figure 5-2 Urban and Built Environment stakeholders

5.2 Community and Institutional Arrangements in the Built Environment

No country has ever achieved sustained economic growth and rapid social development without cities (UN-Habitat, 2011). In a world of liberalized trade and finance, cities are not only national driving forces but are also the focal points for investments, communication, commerce, production and consumption. Evidence from the World Bank indicates that nearly 60 per cent of the GNP (and 80 per cent of the increment in national output) of developing countries is derived from urban areas. At the same time, cities and towns provide employment and education opportunities,
attracting an ever-growing number of migrants and others seeking a better life (Kasim, 2018). Cities are contributing to the national economy as they accommodate both the informal and formal sectors of the economy and it is the opinion of experts that if the urban centres are well planned and managed, they will contribute more to the national GDP (United Nations Economic Commission for Africa, 2014).

In Guyana, the approval of the Minister solely governs community and institutional dynamics in a built environment. There is a joint task that two or more local authorities are desired to manage, however, the Central Authority is in control. Authorities might exercise to impose on that committee any duties that any of the constituent authorities are required to discharge for a specific purpose (Town and Country Planning Act, 1996). The responsibility of carrying out the provisions of this act, including the due execution and enforcement of any scheme in accordance therewith, shall be vested in the central housing and Planning Authority (Town and Country Planning Act, 1996).

Every scheme shall provide for the establishment and maintenance of everything in the act required to be examined by the central government. In the instance where someone owns a building but rents out or is in the renovation, it is, therefore, law for the occupant to write to the Local Authority and establish the project’s purpose. It is then reviewed and then made the public record because of its placement in the official gazette (Town and Country Planning Act, 1996). The power of entry decides the purpose of any entry, examination, survey, or investigation that the Central Authority authorizes and then they consider whether it is reasonable. The act of town and country planning is to order and progressive development of land, cities, towns, and other areas, whether urban or rural, to preserve and improve the amenities thereof and for other matters connected in addition to that.

5.2.1 Legal Framework

The Guyana Constitution made provisions for the right to a safe and healthy urban and built environment. As enshrined in Article 149J, subsections 1 and 2 of the Constitution,
“Everyone has the right to an environment that is not harmful to his or her health or well-being... The State shall protect the environment, for the benefit of present and future generations, through reasonable legislative and other measures designed to (a) prevent pollution and ecological degradation; (b) promote conservation, and (c) secure sustainable development and use of natural resources while promoting justifiable economic and social development”.

The nature of the land administrative framework shapes the built environment. The legal framework for land administration in Guyana is domiciled under the Lands and Surveys Commission which is also the National Focal Point for the United Nations Convention to Combat Desertification (UNCCD), and as such, the key agency for the implementation and collaboration of the implementation of programmes and projects for meeting sustainable urban and built environment goals. The Guyana Lands and Surveys Commission Act, 1999, possesses jurisdiction with regard to land stewardship needed in partnership with other entities for legislation of several of the related land laws. European Commission (2013) carried out a comprehensive review of laws and legislations that formed the legal framework for land administration in Guyana. Benn et al. (2017) also conducted a review of the laws and regulations related to the functioning of the Guyana Lands and Surveys Commission. These reviews came up with a plethora of laws extracted from the Constitution and other supporting laws of Guyana that are relevant to land administration and management. These are:

1. Acquisition of Land for Public Purposes Act Cap. 62:05;
2. Acquisition of Land (Land Settlement) Act Cap. 62:06;
3. Acquisition of Lands (Not Beneficially Occupied) Cap. 62:09;
4. Amerindian Act Cap. 29:01;
5. Caribbean Agricultural Research and Development Institute Act Cap. 63:04;
6. District Government Act Cap. 19:02;
7. District Lands Partition and Re-allotment Act Cap. 60:03;
8. Drainage and Irrigation Acts Cap. 64:04;
9. Environmental Protection Act Cap. 20:05;
10. Forests Act No. 6 of 2009;
11. Guyana Forestry Commission Act No. 20 of 2007;
12. Guyana Geology and Mines Commission Act Cap. 66:02;
13. Housing Act Cap. 36:20;
14. Hydroelectric Power Act Cap. 56:03;
15. Iwokrama International Centre for Rainforest Conservation and Development Act Cap. 20:04;
16. Kaieteur National Park Act Cap. 20:02;
17. Local Democratic Organs Act Cap. 28:09;
18. Mining Act Cap. 65:01;
19. Municipal and District Councils Act Cap. 28:01;
20. National Parks Commission Act Cap. 20:06;
21. National Science Research Council Act Cap. 42:01;
22. Patent and Designs Act Cap. 90:03;
23. Regional Development Authorities Act Cap. 28:08;
24. State Lands Act Cap. 62:01;
25. State Lands Resumption Act Cap. 62:02;
26. Title to Land (Prescription and Limitation) Act Cap. 60:02;
27. Town and Country Planning Act Cap. 20:01;
28. University of Guyana Act Cap. 39:02; and
29. Water and Sewerage Act Cap. 30:01.

5.3 Ecological Impacts of the Urban and Built Environment

Human settlements, at different stages of population growth and economic development, face different environmental challenges and require timely and appropriate approaches to tackle these challenges (Dodman et al., 2013). The environment has been widely recognised as human’s greatest asset. As such, increasing efforts are being made globally to preserve this asset. Planners and policymakers can manage the impact of urbanization on the ecological footprint along three lines: save resources; control sprawl; avoid low densification; and promote reduced emission of greenhouses (Freire, 2006).
The development of the green economy is at the forefront of Guyana’s strategies towards the achievement of sustainable development goals. Guyana has shown various commitments to this course through environmental international partnerships and the signing of various multilateral environmental agreements. Some of the national documents that reflect Guyana’s commitment to the green economy, as highlighted by the Guyana Lands and Surveys Commission (2017), include the National Determined Contribution (NDC), the Low Carbon Development Strategy (LCDS) and Financing Mechanisms, the Low Carbon Development Strategy, the Climate Resilience Strategy and Action Plan (CRSAP), and the National Adaptation Strategy for the Agricultural Sector (2009-2018).

However, the Guyana Lands and Surveys Commission (2017) warns that the current human practices and urban activities are posing increasing pressure on the county’s natural resources, especially through increasing land degradation that could impact negatively ecosystem services and functions. The Millennium Ecosystem Assessment (2005) identifies the major factors that threaten biodiversity sustenance. These, in order of significance, are changes in land use; fragmentation and isolation; habitat change; invasive species; over-exploitation; and pollution. All these factors can be linked to human activities within space, and they also reflect the situation in the predominantly urbanized coastal plain, the home for more than 90% of its inhabitants of Guyana (Nurmahomed and Duin, 2005).

Habitat change/alteration and destruction, which is also linked to land use/land cover change, is large as a result of rural-urban migration and urban expansion to accommodate urban-related development. This is regarded as one of the greatest threats to biodiversity. It is directly linked to human activity in terms of farming and physical development.

Until recently, urbanization and its consequences were neither given priority by national governments nor fully grasped by the population at large. This neglect is revealed in the failure of policymakers to prioritize urbanization challenges and harness cities as drivers of development (Kuddus et al., 2020). Urbanization is carried on without concurrent economic development and systematic urban planning leading to urban poverty and chaotic physical expansion. Urban centres
are expanding without adequate planning and yet there is no appreciable drive for inclusiveness in the urban development challenges.

Urban population in developing countries, Guyana inclusive, was mushrooming dangerously that it became urgently imperative to examine and analyse the increasing population in its various dimensions (Coast, 2005; Gabrielli et al., 2021; Sardon & Robertson, 2006). Thus, the dynamics of population, especially the locational shifts from rural to urban, the nature of this shift in size and location and the associated changes in the pattern, content and aerial extent of settlements have long been neglected. Today, cities and towns, have become parasitic, dangerous, and insecure instead of being engines of growth. This is not surprising because all available indicators and statistics of urban growth single out that most of the cities have been neglected over time. The neglect has a lot of social, economic, demographic and even political consequences.

Urban and built environments are prime areas for the introduction of invasive species into a specific locality (Francis & Chadwick, 2020; Gaertner et al., 2017; Santana Marques et al., 2020). In many instances, exotic species are used for the beautification of urban and built environments in the form of ornamental plants. For example, in the colonial days, the water hyacinth was introduced to Guyana as ornamental species because when it is flowered it provides good aesthetics to the area that it is planted in e.g. botanical gardens, botanical museums, etc. These facilities eventually fall into disrepair and ill maintenance and the species eventually became invasive and spread to the waterways causing numerous environmental problems. These are as follows:

- It reduces the water flow in the irrigation canals by as much as 40-95% and this increases the risk and incidents of flooding in the rainy season (Villamagna & Murphy, 2010).
- In rivers and other waterways that urban centres discharge nutrient-rich wastewater becomes overrun and provides a habitat for various insect vectors that can spread diseases (Mack & Smith, 2011).
- The species can also threaten hydroelectric dams and interfere with their efficiency. Since there are plans to establish a number of hydro dams in Guyana, there is a possibility of this
happening and the spread of the species will be aided by increasing temperatures from climate change (Gopal, 2018; Thomas et al., 2008).

- The species can also reduce the volume of available freshwater through evapotranspiration because of its high-water surface area coverage. Some studies estimate that the increased water loss can be as much as 1 – 9.5% when compared to the losses from open water surfaces. In the face of climate change, these increased water losses can mean the difference between freshwater availability and scarcity (Arp et al., 2017).

- The coverage of the species on the water surface also gives the water a noxious smell, and abnormal colour and increases the suspended particulate matter due to the species producing organic biomass (leaf shedding, whole plants dying because of life cycle completion, etc.) and subsequently decaying and this significantly reduces the water quality ( BK Greenfield, 2007).

- The dense growth of the species also causes major disruption to aquatic life e.g reduced populations of phytoplankton which are the main producers in aquatic systems. This interferes with the food web and causes other organisms higher up in the food chain to disappear from the area (Masifwa et al., 2001; Toft et al., 2003).

- Water bodies have also been known to dry up due to the very high rate of biomass production of the water hyacinth and this can destroy various unique aquatic microclimates (Akendo et al., 2008).

Other invasive species that were introduced to Guyana as ornamental or decorative plants in the urban and built environment (EPA, 2011b):

- **Antidesma ghaesembilla** (Black Currant)
- **Caesalpinia pulcherrima** (Barbados pride)
- **Calotropis procera** (Apple of Sodom/Madar)
- **Casuarina equisetifolia** (Australian-Pine)
- **Hedychium gardnerianum** (Kahili Ginger)
- **Melaleuca quinquenervia** (Niaouli or Broad-Leaved Paper Bark)
- **Terminalia catappa** (Alconorque/Wild Almond)
- **Thunbergia grandiflora** (Bengal Clock Vine)
● *Tithonia diversifolia* (Japanese Sunflower).

The introduced exotics also come in the form of animals as exotic pets. When the pets get to a stage where the owners cannot handle them, they are realized into the surrounding environment and in many cases, they become invasive or hybridize with similar native species.

### 5.4 Policy Outlook for the Urban and Built Environment

Guyana's main urban structure is composed of six municipal centres—the city of Georgetown and the towns of New Amsterdam, Linden, Corriverton, Rose Hall and Anna Regina. Together they had a population of 222,500 in 1991, which is about 30% of the country's population of 750,000. The city of Georgetown is the most populated with figures reaching 158,000. The other urban areas with their respective population are: New Amsterdam, 18,000; Linden, 26,000; Corriverton, 13,000; Rose Hall, 5,300; Anna Regina, 2,200 (MoF, 1997; PAHO, 2003). At that time, there was no land use policy in Guyana although attempts have been made to create land capacity classifications for the country as a basis for zoning and land allocation. This has resulted in a haphazard system of unplanned and wasteful use of land resources. These constraints are a direct result of the lack of a land use policy and are compounded by the complex nature of our land tenure system.

There, however, exists a land use plan that serves as the strategic framework to guide land development in Guyana. The draft land use policy used existing, approved policies and strategies and was first presented to the government in 1998. Subsequently, there was the introduction of the Poverty Reduction Strategy in the year 2000 which saw an update of the plan in 2004 which also served to reawaken the interest in the land use policy. This saw recommendations of NDS in 1996 which were updated in 2001 and reaffirmed in the PRS and concerning natural resource management was a major challenge.

Additionally, the lack of a general land use plan created issues with land use and natural resource management. Further, pressure on land resources increased, and a land-use policy and plan became crucial. As such, in 2004, a further draft of the national land use policy was produced. This was
set within existing broad-based policy documents such as the NDS, the PRS and the Area Development Strategy for Amerindian Communities and took all existing sector policies and strategies into account. The policy highlighted the need for a National Physical Plan, which will incorporate spatial details into NDS. Moreover, it identified criteria for allocating farmlands and allowed for further promotion of multiple land use. While this policy was developed, it was circulated among Ministries and agencies but was never ratified.

The Implications of a lack of pre-existing LUP policy:

- Lack Of Zoning
- Haphazard system of planning
- Wasteful use of land resources
- Complexities from Land Tenure System
- Issues of Natural Resource Management

Provisions in Guyana's Current Land Use Plan on the Urban and Built Environment:

- Road
- Water
- Housing
- Water
- Agriculture and livestock
- Energy Resources
- Geology and Minerals
- Waste
- Tourism
- Recreation

The coastal area comprises most of the country’s concentrated population, with approximately half of the farms being freehold properties. Therefore, for purposes of defining policies for this
National Development Strategy, it is necessary to distinguish several classes of interest in land:

**Figure 5-3 Land Classification in Guyana**

**A** – Holder of state leases • Those who are legal occupants & possess lease documents issued by GLSC

**B** – Sub-leases of state land • Leases who rent land from principal leases. Under the present lease arrangement, they are considered illegal occupants of state lands

**C** – Unregularized occupants of state lands • Those who have applied for the lands they occupy while waiting for the applications to be approved

**D** – Squatters on state land • Those who are illegal occupants of state lands, not including sub-leasees

**E** – Owners of freehold lands • Those who have purchased lands

**J** – The sugar industry • Lands cultivated & occupied by the Guyana Sugar Corporation (GUYSUCO)

**K** – Lorem ipsum dolor amet at nec at adipiscing • Those who seek to possess lands for agricultural and other purposes

**L** – The landless • Low-income citizens who seek land for various purposes but deterred by cost, laborious processes & associated arrangements

5.5 Biodiversity incentivisation mainstreaming options

Guyana's coastland is home to approximately 90% of the country's population, necessitating the need for ongoing development, whether it be infrastructural, economic, or social. However, as a result of these advancements, a number of difficulties may occur that will have an impact not only on the people as a whole but also on the biodiversity that lives in or borders the region. Some of the difficulties connected with this urban and built environment that might have an impact on biodiversity are as follows:

- Improper disposal of Waste (Land and Water)
- Water contamination from various sources (Factory and household discharges and agricultural runoff)
- Air emissions from factories and vehicles
- Clearance of habitats for infrastructural development

Nonetheless, the Government of Guyana has adopted a number of incentive strategies to reduce biodiversity loss, two of which will be addressed in this discourse:

5.5.1 Disincentives (Fines for damage)

The Environmental Protection Agency (EPA) was formed in recognition of the critical importance of the environment and its biodiversity. It was created in response to the Environment Protection Act of 1996 to urge all residents to conserve the environment. Due to various economic growth, whether through old or new industries, large or small commercial businesses, local business areas will create waste, nuisance, contamination, and other forms of pollution by their very nature. As a result, regulations were created. These regulations are as follows:

i. *Environmental Protection (Water Quality) Regulations 2000*: The EPA establishes waste discharge parameters for any coastal or inland waterways. It further specifies that no facility may release any chemical at amounts greater than those established by the EPA. Failure to comply will result in a GYD$500,000 fine and a 6-month jail sentence.

ii. *Environmental Protection (Air Quality) Regulations 2000*: No one is permitted to participate in construction activities that may result in an increase in air pollutants that exceeds the limit specified for an area. To reduce contaminant emissions, people must use caution when storing, handling, and transporting chemicals. Those who fail to comply may face a punishment of up to GYD$80,000.

iii. *Environmental Protection (Hazardous Waste Management) Regulations 2000*: An offence is committed by anybody who intentionally causes pollution of a location unless it is a certified environmentally hazardous site. The punishment is a fine of up to GYD$2,000,000 and up to 5 years in jail. In addition, any individual who accumulates hazardous waste in amounts more than
the level specified by the EPA in the Environmental authorisation commits an offence. The punishment is up to GYD$500,000 in fines and up to six months in jail.

iv. *Environmental Protection (Litter enforcement) Regulations 2012* – there are four offences within EPA’s Litter regulations, and these include:

1. Depositing litter in a public place- the penalty is a fine of GYD$50,000 for an individual and GYD$100,000 in the case of a company.
2. Disposal of litter from motor vehicle or trailer- the penalty is a fine of GYD$50,000 for an individual and GYD$100,000 in the case of a company.
3. Failure of the owner of the bus to provide a receptacle for litter- the penalty is a fine of GYD$15,000
4. The offence of littering premises- the penalty is a fine of GYD$30,000.

5.5.2 Removal of Perverse Incentives (Full cost pricing water services).

Urban development has been rapidly increasing, owing to the myriad of opportunities that those areas provide. Unfortunately, with this shift in population density comes an increasing demand for various services including water. Such demands can lead to constraints such as water scarcity may occur; with this happening other freshwater systems will be explored as an alternative, which may threaten aquatic biotas.

*Table 5-1 Domestic Unmetered Customers*

<table>
<thead>
<tr>
<th>Domestic Unmetered Customers</th>
<th>Yearly (GYD$)</th>
<th>Monthly (GYD$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rural</td>
<td>$ 8,900.00</td>
<td>$ 742.00</td>
</tr>
<tr>
<td>Urban (Low Ratable Value)</td>
<td>$ 8,900.00</td>
<td>$ 742.00</td>
</tr>
<tr>
<td>Urban (Medium Ratable Value)</td>
<td>$ 13,800.00</td>
<td>$ 1,150.00</td>
</tr>
<tr>
<td>Urban (High Ratable Value)</td>
<td>$ 16,000.00</td>
<td>$ 1,133.00</td>
</tr>
</tbody>
</table>
As seen in Table 5-1 above, it is evident that urban areas pay a higher tariff than those rural areas. This can encourage the following:

1. To deter persons from migrating to urban areas given that the tariffs are so high in that region which can help keep overpopulation in check and reduces the need for urban expansion.
2. To promote sustainable usage of water resources, hence the high tariff in urban areas. This is also good since not only the human population depends on water resources, the biodiversity population as well.

For many nations, this technique of biological incentives has shown to be extremely effective. Singapore's water pricing strategy is one such example. Singapore is a city-state with a population of roughly 5 million people and an area of about 700 square kilometres (as of 2009). Singapore's water usage has increased and continues to rise as a result of ongoing development and population expansion. However, due to the country's geographical position, it has historically been largely reliant on imported water and has frequently faced chronic water scarcity within its limited freshwater resources.

To solve such a problem, the government raised the price of water for families by 120% in 1997. As a result, the average monthly domestic cost, including taxes, had risen from S$13 in 1996 to S$30 in 2000. To avoid such expensive water prices in the city, the majority of the people began to cut back on their water use. From 1994 to 2005, residential per capita water usage was reduced from 176 to 160 litres per day. Singapore’s water security has improved as a result of the implementation of such a plan, with the percentage of imported water decreasing from more than 50% in 1994 to 33% in 2008 (UNESCAP, 2012).

LCDS 2030 recognises the importance of holistically managing freshwater resources in the country. Hence, there will be a shift in Integrating water resource management which necessitates a comprehensive assessment of the hydrological, topographical, socio-cultural, economic, political, environmental and institutional factors that influence the use of water across all sectors.
in Guyana, according to the LCDS 2030 report. The strategic vision of the LCDS 2030 intends to address:

1. issues on water rights and allocation;
2. water supply and sanitation;
3. issues with water and the environment;
4. water allocation and challenges for the agriculture sector;
5. water for energy;
6. wastewater management;
7. water governance
8. the role of public-private partnerships.

As water resources straddle across all economic sectors and are essential for ecological health, recognising the LCDS water resource management strategies is necessary within the national biodiversity assessment context.

5.5.3 Other incentivization measures

Other incentivization measures that can be implemented for biodiversity mainstreaming the urban and built environment are:

- Within the urban areas, there are many landless people, so they do not have any obligation to help to conserve biodiversity and lack of tenure is one of the most common problems in natural resources management overall (Lin, 2012; Wily, 2011). When some form of tenure is given, people see it as an incentive to put measures in place to help mainstream biodiversity into whatever activity they choose to get into within the space they have legal tenure.

- A model for progressive tax rebates for residents that engage in biodiversity mainstreaming activities on their properties can be developed and implemented. These can be simple things such as using lawns instead of concrete surfaces, planting and maintaining trees and other vegetation that can provide habitats for birds and other species, avoiding the use and improper disposal of products that might hinder biodiversity survival, etc.
Tradeable development rights can also be implemented. In areas within the urban space which are seen as ecologically or environmentally important areas such as the seaside (mangrove stands and marshes), developers can exchange their development rights to develop alternative areas instead of destroying the seaside habitats.

5.6 Future commitments in relation to UNCBD

The UNCBD parties are moving ahead to adopt the Post-2020 Global Diversity Framework (GBF) which replaces the Aichi Biodiversity Targets. In keeping with the post-2020 framework, the following are commitments that can be made and incorporated into national plans:

1. By 2030, at the latest, incentives, including subsidies, harmful to biodiversity are eliminated, phased out or reformed to minimize or avoid negative impacts, and positive incentives for the conservation and sustainable use of biodiversity are developed and applied, consistently and in harmony with the Convention and other relevant international obligations, taking into account national socio-economic conditions in urban and built environments across Guyana.

2. By 2030, the rate of loss of all natural habitats, including forests as a result of the expansion of the urban and built environment in Guyana is at least halved and where feasible or brought close to zero, and degradation and fragmentation are significantly reduced.

3. By 2030, pollution, including from excess nutrients being discharged from urban and built environments in Guyana, has been brought to levels that are not detrimental to ecosystem function and biodiversity through the establishment of green treatment facilities where necessary.

4. By 2030, invasive alien species and pathways for their introduction into the urban and built environment are identified and prioritized in the short term. In the medium to long term,
the priority species are controlled or eradicated, and integrated green measures are in place to manage pathways to prevent their introduction and establishment.

5. By 2025, develop a model to incentivize urban biodiversity conservation and their associated habitats at the national level.
The Tourism Sector of Guyana
6. The Tourism Sector in Guyana

The tourism sector in Guyana has been tagged alongside the country’s drive towards a sustainable economy as the administrations of the country have identified tourism as a sustainable industry in line with the goals of both the Low Carbon Development Strategy (LCDS). In 2003, the Tourism Unit of the University of Guyana coordinated a roundtable discussion looking at the development of tourism in the Guianas mainly looking at the challenges for developing sustainable tourism. The discussions culminated with the consensus that commonalities exist in the historical experience and tourist products offered in the Guianas and the roundtable identified the need for a policy agenda to foster the development of a sustainable tourism industry (Sinclair & Jayawardena, 2003). Guyana’s tourism sector has evolved quite differently from the rest of its CARICOM neighbours. Tourism is synonymous with most Caribbean economies, particularly for the sun, sand and sea tourism, with the region investing in developing its infrastructure and tourism since the early 1960s. Guyana on the other hand had a different outlook from President Burnham in the 1970s calling tourism ‘parasitic’ and a detriment to social development (Meislin, 1982). Despite this position by the administration at the time, the country’s vast green spaces provided an opportunity based on comparative advantage, in developing its nature-based tourism product which has flourished in the country to date. The country has now invested in infrastructure and services geared towards its nature-based tourism product. Presently, increased growth in the tourism industry can be linked to the country’s oil boom (UN Migration, 2021). The resulting boom has seen the development of new hoteliers, restaurants, and transport services businesses all benefit from the anticipated surge in foreign visitors coming into the country.

6.1. Socioeconomic Overview of Tourism in Guyana

Guyana has many natural attractions that allow it comparative advantages in nature-based and adventure tourism when compared to the other Caribbean and Latin American countries. However, Guyana is still at a nascent stage of nature-based development, relying heavily on the inane attributes of attractions for its development rather than thorough planning, investments, and marketing efforts (Wenner & Johnny, 2015). Wenner and Johnny (2015) further report that Guyana's tourism industry provides basic accommodation and rudimentary service standards.
Nonetheless, Guyana is still a destination of choice for many travellers, with the number of travellers steadily increasing between 1990 and 2018 (see Table 6.1). In the year 2000, 105,000 visitors arrived in Guyana, followed by a growth to 151,000 persons in 2010 (Caribbean Tourism Organization, 2010). In recent years the growth of inbound travellers has seen further growth, with a total of 286,732 persons visiting Guyana in 2018 (Guyana Chronicle News, 2019).

Table 6-1 Arrival and Average Revenue from Tourism for Guyana (1996-2018)

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of Arrivals</th>
<th>Average Income Spent Per Visitor (US$)</th>
<th>Average Income Earned Nationally</th>
</tr>
</thead>
<tbody>
<tr>
<td>1996</td>
<td>92,000</td>
<td>1,217.00</td>
<td>111,964,000</td>
</tr>
<tr>
<td>1998</td>
<td>66,000</td>
<td>1,682.00</td>
<td>111,012,000</td>
</tr>
<tr>
<td>2000</td>
<td>105,000</td>
<td>762.00</td>
<td>80,010,000</td>
</tr>
<tr>
<td>2002</td>
<td>104,000</td>
<td>510.00</td>
<td>53,040,000</td>
</tr>
<tr>
<td>2004</td>
<td>122,000</td>
<td>221.00</td>
<td>26,962,000</td>
</tr>
<tr>
<td>2006</td>
<td>113,000</td>
<td>327.00</td>
<td>36,951,000</td>
</tr>
<tr>
<td>2008</td>
<td>130,000</td>
<td>454.00</td>
<td>59,020,000</td>
</tr>
<tr>
<td>2010</td>
<td>152,000</td>
<td>526.00</td>
<td>79,952,000</td>
</tr>
<tr>
<td>2012</td>
<td>177,000</td>
<td>362.00</td>
<td>64,074,000</td>
</tr>
<tr>
<td>2014</td>
<td>206,000</td>
<td>383.00</td>
<td>78,898,000</td>
</tr>
<tr>
<td>2016</td>
<td>235,000</td>
<td>443.00</td>
<td>104,105,000</td>
</tr>
<tr>
<td>2018</td>
<td>287,000</td>
<td>98.00</td>
<td>28,126,000</td>
</tr>
</tbody>
</table>


According to the data on tourism revenues from World Data, Guyana has seen a fluctuation in tourism revenue despite an increase in the overall volume of visitors in the country. Despite the increase in the number of visitors, the average expenditure per visitor has decreased significantly reaching an average low of US$98.00 per visitor in 2018. It should be noted that a large percentage of the inbound travellers are expatriate visitors returning to Guyana to visit friends and relatives and, therefore, will not expend as much on accommodation and food compared to non-expatriate visitors. Generally, the expatriate visitor would stay in the homes of relatives, and generally spend less on a per capita basis, when compared to that a visitor on business or for the tourism products.
in the country. This may be attributed to the relatively larger expenditures a business traveller would incur for lodging, food, and beverages. Disaggregating the daily expenditure of visitors based on the purpose of their trip, visitors who travel for nature trips spend the most days for the duration of their trip. This is followed by visitors on business and visitors conducting scientific research (see Table 6.2).

Table 6-2 Average Daily Expenditure for the Various Types of Travelers to Guyana

<table>
<thead>
<tr>
<th>Expenditure\Reason for Trip</th>
<th>Vacation</th>
<th>Business</th>
<th>Family Visit</th>
<th>Nature Trip</th>
<th>Scientific Research</th>
<th>Adventure Tourism</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accommodation</td>
<td>16.94</td>
<td>104.00</td>
<td>5.32</td>
<td>66.50</td>
<td>65.14</td>
<td>27.78</td>
</tr>
<tr>
<td>Meals</td>
<td>59.63</td>
<td>18.50</td>
<td>7.92</td>
<td>35.71</td>
<td>35.71</td>
<td>7.04</td>
</tr>
<tr>
<td>Ground Transportation</td>
<td>5.57</td>
<td>19.05</td>
<td>5.25</td>
<td>3.00</td>
<td>3.00</td>
<td>11.27</td>
</tr>
<tr>
<td>Car Rentals</td>
<td>2.28</td>
<td>1.18</td>
<td>0.7</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Tours</td>
<td>5.79</td>
<td>0.59</td>
<td>2.03</td>
<td>70.08</td>
<td>3.50</td>
<td>0.69</td>
</tr>
<tr>
<td>Entertainment/Recreation</td>
<td>3.81</td>
<td>3.91</td>
<td>3.33</td>
<td>0.00</td>
<td>0.00</td>
<td>13.33</td>
</tr>
<tr>
<td>Shopping</td>
<td>9.50</td>
<td>11.97</td>
<td>7.86</td>
<td>8.33</td>
<td>14.29</td>
<td>10.04</td>
</tr>
<tr>
<td>Property Repair</td>
<td>4.78</td>
<td>0.57</td>
<td>1.83</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Other</td>
<td>1.76</td>
<td>4.87</td>
<td>6.17</td>
<td>11.04</td>
<td>0.00</td>
<td>0.56</td>
</tr>
<tr>
<td><strong>Average Total Spent/Day (US$)</strong></td>
<td><strong>110.07</strong></td>
<td><strong>164.65</strong></td>
<td><strong>41.41</strong></td>
<td><strong>190.58</strong></td>
<td><strong>121.64</strong></td>
<td><strong>70.72</strong></td>
</tr>
</tbody>
</table>

Source: Bureau of Statistics Guyana

In addition to the economic contributions made to Guyana’s GDP which stands around 7.7% (Knoema, 2022, the tourism industry also provides socio-economic benefits to the state. In 2012, the government of Guyana estimated a total number of 3200 room accommodations, and an additional 197 rooms were added to the stock with the opening of the Marriott in 2015; contributing to 8,500 persons being directly employed by travel and tourism. Turner (2015) forecasted that the tourism industry will potentially support 18,000 jobs (7.3% of total employment) by 2025.

6.2. Community and Institutional Arrangements for Tourism
The main agency responsible for the promotion, development, and management of tourism in Guyana is the Guyana Tourism Authority (GTA). The GTA is a semi-autonomous governmental organization established in June 2002 and is responsible for promoting and developing sustainable tourism in Guyana. The authority is governed by a Board of Directors comprising the government and private sector representatives and operates under the banner of the Ministry of Tourism, Industry and Commerce. The objectives of the GTA are 1) to raise the profile and impact of GTA; 2) to optimise nationwide socio-economic and conservation outcomes of tourism; 3) to champion the value of tourism; and 4) to support and empower Guyana’s tourism industry and communities. The GTA provides training and makes licensing accessible for accommodation establishments, interior lodges and resorts, tour operators, and tour guiding. It also partners with several stakeholders including Conservation International Guyana, the Department of Environment and Climate Change, the Department of Tourism, the Ministry of Amerindian Affairs, and the Protected Areas Commission in shaping policies and research to develop sustainable tourism.

In 2017, Guyana drafted the National Tourism Policy which defines the path it has chosen for the development of the industry and the strategic objectives needed to meet these development targets. The targets outlined in the draft policy include the growth in tourism's contribution to the GDP, the generation of increased employment in the tourism sector, and the meaningful and beneficial involvement of rural and hinterland communities in tourism enterprises (Wichita, 2020). One of the core areas the policy focuses on is Human Resources. It suggests the importance of education and training in enhancing the quality of service. Several institutions are offering training and capacity development for various services offered in the tourism industry. The University of Guyana in response to the national need for skilled workers in the sector offers a Bachelor of Science in Tourism Management. The Guyana Carnegie School of Home Economics is Guyana's only culinary school and offers hospitality training. Air Services Limited, and Art Williams and Henry Wendt Aeronautical Engineering School provide training for pilots to service the air travel requirements to the tourist attractions in the hinterland of the country. The Guyana Harbour License provides basic training to speed boat operators who service local water-based transport along the country’s many rivers. In addition to the various capacity-building opportunities, the policy outlines a managing the destination section whereby the necessary measures are required to improve destination management, including the relevant legislation and the institution standards.
and regulations to ensure developments are keeping with international standards. These standards apply to accommodations, resorts, public attractions and tourist venues, catering establishments, transportation, and other standards (Wichita, 2020).

The tourism industry in Guyana has managed to benefit from the ecotourism niche market within the past 10 years. Guyana consists of over 80% forest cover with a high abundance of flora and fauna and is channelled by many rivers and tributaries. The vast area of green spaces bolsters the country with a comparative advantage in ecotourism for which Guyana was recognized as the number 1 destination for ecotourism in 2019 by the International Travel Agent Magazine. The ecotourism products of Guyana closely involve the numerous indigenous communities within the country. The involvement and support of the indigenous communities living in the hinterland areas of the country are necessary when developing effective national park systems and attracting and supporting tourism. The challenge in Guyana is the legislative and policy framework to effectively incorporate indigenous communities, particularly in developing indigenous tourism (Wenner & Teneisha, 2015). Sinclair (2003) outlined that for Guyana to effectively develop an indigenous tourism product, it must be driven by the principles of indigenous sovereignty for its resources and culture. The main concern with indigenous tourism as outlined in the paper by Sinclair (2003) is that this form of tourism often results in a change in the traditional way of life of indigenous communities as they often adjust it to accommodate mass tourism. Though indigenous tourism is not the main tourism product for Guyana, indigenous communities are involved in numerous ecotourism activities in the country.

One of the unique attributes of Guyana’s ecotourism is that some of the country’s main attractions occur in areas declared as protected. The creation of protected area systems in places with unique natural characteristics plays a vital role in tourism development. The Protected Area Act (2011) established Guyana’s Protected Areas Trust (PAT) in 2014 to mobilize and allocate finances for the management of the protected area system. Through the Protected Area Commission (PAC), PAT supports projects that contribute to the conservation and preservation of biodiversity and ecosystem maintenance services of protected areas. Some of Guyana’s protected areas include Kaieteur National Park, Kanuku Mountains Protected Area, Shell Beach protected area, and Kanashen Amerindian Protected Area (see Figure 6.1). Partnerships are encouraged between
indigenous peoples, potential ecotourism investors and the PAC, allowing the communities to access capital and have direct involvement in the industry (National Development Strategy (Guyana), 1996). Examples of the involvement of indigenous communities are in the Shell Beach Protected Area. The communities surrounding the Shell Beach area in Region 1 facilitate tourism activities in collaboration with the PAC. The Surama Community, located in the southern part of Guyana operate an ecotourism enterprise in the North Rupununi area. Residents of Santa Mission Community gain income through local crafts and services offered to the tourists visiting the nearby Arrow Point Nature Resort. The Iwokrama Forest Reserve and Nature Centre offers several ecotourism packages at their nature lodge for which they work alongside the surrounding communities in the management of the area which is partially funded through tourism activity. These sort of arrangements, especially, the model operated by Iwokrama demonstrates the principles and benefits that best defines sustainable tourism. The participatory approach in tourism management involving the indigenous communities in the management of ecotourism ventures has immense potential for the country.
Figure 6-1 Map of Protected Areas in Guyana

Source: Conservation International, Guyana, 2015
6.3. Ecotourism Prospects and Challenges

Guyana’s ecotourism also possesses great potential for community-based tourism which is the utilization of persons within the community to oversee and run tourism activities. Guyana also has two exemplary sustainable tourism models whereby the tourism revenue sustains conservation efforts within a protected area. The Iwokrama International Centre for Rain Forest Conservation and Development is a non-profit organization that incorporates a participatory approach using sustainable ecotourism and sustainable logging to fund conservation efforts in the Iwokrama Forest. This area is currently a leading tourist destination site in Guyana and accounts for 22% of the site’s generated income (Raquel Thomas, 2020). Iwokrama is home to the Makushi indigenous group which is supported by the site for employment and entrepreneurship opportunities. Entrepreneurship is created through the capitalization of natural resources from the preserved forest to create and sell handmade arts and crafts, local food items, clothing, and by-products of those items (Kochrekar, 2016). These products in turn accumulate foreign and local currency and foster awareness and a greater appreciation of the environment and biodiversity for locals. Other than the benefits to the people who reside in these areas the forest is notable for being one of the four last immaculate or intact tropical forests on the earth. The conservation efforts in the forests protect numerous endemic and flagship flora and fauna which bolsters the ecotourism product as a tourist often travels to Iwokrama to experience the opportunity to view Jaguars, River Otters or the Harpy Eagle that strive in these protected habitats. The tourism revenue generated from Iwokrama partially funds research, training, staffing and management efforts in conserving the forest reserve. The Iwokrama centre offers its facilities as a research station for scientist who researches forest and river ecology and wildlife. In addition, the Centre also partners with institutions such as the University of Guyana, Conservation International and the World Wildlife Fund on joint-funded projects to research the forest reserve. Iwokrama also works closely with the Guyana Forestry Commission and Protected Areas Commission to guide and enforce policies geared towards conservation in the forest reserve. Similarly, the Kaieteur National Park managed by the PAC facilitates charted visits to the park whereby visitors can view the Kaieteur Falls and the biodiversity surrounding the falls including the endemic Golden Rocket frog. The tour to Kaieteur Falls creates several service-based business opportunities and employment via the
numerous chartered tour services that facilitate transportation to the falls. The revenues made by PAC from visitors to the falls are used in the management of the Protected Area. Guyana has the opportunity to build upon this model of tourism, but the right policy environment is needed. The examples of Iwokrama and Kaieteur epitomize the concept of sustainable ecotourism. According to Funnell and Bynoe (2009), the ecotourism model demonstrated in the country can satisfy the livelihood, indigenous communities, and environmental needs of the protected areas in the country.

As a rainforest haven, ecotourism in Guyana has contributed to the advancement of the country's economy as of late. This is credited to the inherent beauty of the country's natural attractions that offers a chance for tourists to encounter raw nature. Another potential opportunity recommended for Guyana’s unique natural habitats and indigenous communities is the development of Eco museums. Eco museums are museums primarily focused on the identity of a place and often involve the communities that inhabit the space. Bowers (2013) outlined that in the Rupununi area, the principles and philosophy of eco museums are already in place with the current tourism activity in the area but it is not systematic, planned or regulated.

Although the scope of ecotourism in Guyana continues to increase, Guyana is faced with many challenges primarily due to the lack of adequate legislation and effective monitoring (Wenner & Teneisha, 2015). The primary issue with ecotourism in the country is directly linked to the absence of a comprehensive policy that guides the activity of tourism operators, particularly ecotourism operators (Vaughn, 2022). There are two dimensions to analyze this issue form:

1) Tourism operators functioning unsustainably without consequences – Many operators function for profit maximization and either would use cost-cutting measures or promote mass tourism marketing. This is particularly detrimental for the ecotourism industry as operators operate in the natural environment with activities that can disrupt the natural balance of ecosystems. Examples include noise disturbances from boats and off-road vehicles in areas like the Rupununi wetlands. Another example can come from unregulated eco-based lodges that have a large ecological footprint in terms of energy use and waste generation. Finally, unmonitored activities such as illegal hunting or illegal fishing of endangered species are facilitated by operators who receive unaccounted payments directly from visitors.
2) Tourism carrying capacity – in the absence of a comprehensive policy framework, the country has never engaged in assessments on the tourism carrying capacity of its varying tourism destinations. The tourism carrying capacity is important in sustainably managing tourist flows and guides policymakers in managing the impacts of mass tourism. Though the country is seeking to expand its tourism industry, the country needs to be mindful of the impacts of mass tourism, especially in the ecotourism sector. According to Lee and Syah (2018), this issue can have detrimental impacts on biodiversity as mass tourism, directly and indirectly, contribute to land, water, and noise pollution.

Tourism in Guyana is in its infancy of development, but the industry has immense potential, particularly in its ecotourism product. The models of Iwokrama and Kaieteur National Park can readily be adapted to the various other protected areas in the country such as Shell Beach and the Rupununi wetlands. The challenges faced by the tourism industry are mainly based on the lack of a comprehensive policy framework to deal with industry-specific needs and management, particularly when it comes to managing independent ecotourism operators who run inefficient and environmentally degrading services.

6.4 Tourism Policies and Regulations

Within the LCDS document for Guyana, ecotourism is identified as an area of priority in the development and diversification of the economy. Within the past decade, the country has bolstered its infrastructure including upgrading its international airport, expanding the road infrastructure between the capital and the airport and increasing the number of hotel accommodations. According to Wenner and Johnny (2015), tourism in Guyana, both business and leisure remains rather underdeveloped and constrained. Wenner and Johnny (2015) highlighted that tourism products are limited, services are subpar, international marketing is absent and despite the initiatives by the Guyana Office on Investment, the investment in the diversification of the industry is minimal (see Figure 5.1). Even with the immense potential of the ecotourism products in Guyana, the industry
is capital intensive predominantly because of the infrastructure and service management needed to access the ecotourism attractions which are relatively isolated and have a significant travel cost from Georgetown.

Environmental regulations need to be adopted to guide the activities if sustainable tourism is to be achieved (Lewis, 2019). Moreover, clear policies are needed to address institutional strengthening, and community empowerment (Connelly & Sam, 2018). Haphazard growth in Guyana's tourism

*Figure 6-2 Challenge of Underdevelopment in Ecotourism in Guyana*

Source Wenner and Johnny (2015)
sector points to a need for greater coordination between policymakers and the tourism industry (Department of Tourism, 2017; Ministry of Business Guyana, 2018).

In response to the growing needs of the industry, the country developed its Draft National Tourism Policy which is the governing policy that describes Guyana’s path for the development of its tourism industry alongside the country’s green economy agenda. The strategic objectives of this policy seek to create an increase in employment from the tourism sector, expansion in tourism's involvement in the country, and the beneficial involvement of indigenous communities in tourism activities. The first phase of this policy was implemented in 2017-2019, while its second phase will be implemented in 2020-2021 (Department of Tourism, 2017; Ministry of Business, 2017).

Added to that, the Living Guyana Tourism Strategic Action Plan Draft seeks to ensure that Guyana becomes one of the primary tourist destinations in Latin America. This policy spans a period of 2018-2025 and was created by the Department of Tourism and Guyana Tourism Authority under the Ministry of Business. This policy seeks to achieve its objectives through the use of collaboration and involvement at all levels, through the development of regional strategies, national policies, and sector-based action plans. Thus, tourism will be used to foster national development (Ministry of Business Guyana, 2018). Compared to the 3 strategic objectives outlined in the national tourism policy, the Guyana Tourism Strategic Action Plan has four strategic goals.

These are
1. Improve nationwide conservation outcomes in the tourism industry
2. Empower the tourism industry and communities
3. Support the worth of tourism (by addressing issues and maximizing opportunities)

In terms of the legislative regulations for the tourism industry, Chapter 91:13 of the Guyana Tourism Authority Act of 2002 establishes regulations for some of the operations within the tourism industry. These include the Tourism Accommodation Establishments Regulations (Regulation 16 of 2008), Tour Operations Regulations (Regulation 17 of 2008), Tour Guides
Regulations (Regulation 18 of 2008), and Lodges and Resorts Regulations (Regulation 19 of 2008) (Chapter 91:13 - Guyana Tourism Authority (Guyana), n.d.). These regulations cover components such as registration of a lodge or resort, license establishment and fee for accommodation, tour operators’ license and their emergency plan, equipment utilized during the operation of the tour, and tour guides training among others (Plans and Policies, 2020).

The present policy and regulatory framework for Guyana cover the industry as a whole which can provide a basic framework for developing the industry, but the policies and regulations lack depth in facilitating multiple facets of growth. For example, in the realm of international marketing, no provisions are observed to facilitate international certification such as Green Globe which is the leading international certifying body for sustainable ecotourism. Green Globe certification can transform the ecotourism product for Guyana from benefiting from its comparative advantage to an industry that can develop based on its competitive advantage. Additionally, the quality standards that operators must meet to be Green Globe certified can transform operators to function more efficiently increasing profit margins and minimising their ecological footprints. Another example is the policies and regulations’ inability to manage tourist inflows to specific sites. Monitoring and research needed in tourist capacity assessments and tourist ecological impacts are not readily observed as objectives nor is it invoked in the policies and regulations for developing a sustainable tourism product. Monitoring tourism activities are critical in protecting the industry for the long term as it directly relates to protecting the integrity of the attractions themselves. It is these gaps in the policies and regulations for the country whereby most of the literature cited on Guyana’s tourism outlines the lack of a comprehensive policy framework as the primary inhibiting factor in developing the industry.

6.4.1 Tourism in the Low Carbon Development Strategy

Guyana is currently updating its Tourism Strategic Plan to align with the goals of the LCDS. According to the LCDS report, presently, the country is working to have 2,000 additional hotel rooms by 2025 that will be operated by global brands. As part of the LCDS, from 2022, there will be an increased focus on ensuring greater opportunities for the tourism sector through:
1. Improving tourism infrastructure – The actions to improve the infrastructure of tourism are multipronged. These include i) the invitation from investors to bid for the development of ecotourism lodges which will see a collaboration between the investors and local communities; ii) assisting local communities with digital finance structures for selling their tourism products; iii) identifying ecotourism zones within existing and new protected areas; iv) digitizing processes for the tourist, business visitor or returning diaspora and for participants in the sector in terms of visa applications, immigration matters and licensing.

2. Improving community capacities – A community-led tourism model was piloted in Guyana with enterprises such as the Surama, Rewa and Yupukari. These models showed a lot of potential and success and therefore, within the LCDS framework, plans to scale these models further across the country will be undertaken.

3. Expanded Sub-sectors – Studies done in 2006 showed promising results from various sub-sectors of the country’s ecotourism product. The studies identified two tourism niche markets: i) Birdwatching and wildlife spotting, and ii) sports fishing. Stemming from these potential niche markets, the LCDS outlines six(6) sub-sectors with the potential for maximizing tourism benefits: i) Heritage Tourism; ii) Entertainment and Events; iii) Sports Tourism; iv) Agri-tourism and Culinary Tourism; v) Diaspora and Domestic Tourism; vi) Duel Destination Tourism (for example Beach and rainforest tour packages by partnering with countries like Barbados).

6.5 Biodiversity incentivisation mainstreaming options

The biodiversity of Guyana is a vital ecosystem service for which the ecotourism of the country is built as the country’s many rivers, forests, mountains, and wildlife offer various attractions for tourists. Biodiversity plays both the role of offering natural resources for food and water supply as well as contributing to the quality and attractiveness of tourist destinations. Mainstreaming biodiversity means the responsibility is not just placed on one specific group e.g., the government, but every individual has a role to play in the conservation and sustainable use of each ecosystem within the various biome. Incentives are introduced to foster this holistic approach to conserving
the country’s biodiversity which is appealing to the public to get on board with the efforts and reduce instances of illegal practices and exploitation. The objective of mainstreaming biodiversity is to aid in reducing the negative impacts of human activities on biodiversity by highlighting its contribution to socioeconomic development and human well-being (Unit, 2019). Mainstreaming can, therefore, be done through the integration of policies, technology, research, land use planning, and or capacity building (Environmental Protection Agency & Ministry of Natural Resources and the Environment Georgetown, 2014). Some of the mainstreaming approaches utilized by Guyana include:

6.5.1 Mainstreaming of the National Biodiversity Strategy and Action Plan (NBSAP)

The NBSAP was updated to 2012-2020 through collaborative efforts of Guyana’s Environmental Protection Agency and the United Nations. This upgrade included national targets and an approach for implementation which involved consultations at both the sub-national and national levels. Moreover, the NBSAP now clearly identifies the roles of governmental organizations in protecting biodiversity. It also states the duties of the citizens to sustainably use, conserve and divide biodiversity-derived benefits. The NBSAP fosters partnerships at various levels to assist the country in fulfilling its UNCBD obligations, and the state’s biodiversity target. To this end, the Aichi 2011-2020 targets along with the LCDS were incorporated (Environmental Protection Agency & Ministry of Natural Resources and the Environment Georgetown, 2014). This plan has aided the tourism sector in highlighting the importance of sustainable tourism, along with promoting ecotourism activities within Guyana. It also mentioned the need for public consultations, training, and research before promoting tourism activities, especially within Amerindian/Indigenous communities to foster community involvement and benefits, and sustainable tourism practices among tourists.

6.5.2 Arapaima Conservation & Research Initiative

In the village of Rewa, the Arapaima, a critically endangered species and the largest freshwater fish in South America, plays an essential role in maintaining the balance of the ecosystem and as a key ecosystem indicator species, ensuring the sustainability of the Arapaima population is critical
for the health of the entire ecosystem. Conservation biologist, Dr Lesley De Souza, along with other stakeholders monitors the Arapaima population. Among these stakeholders are persons from Rewa. There are also enforcement regulations for Arapaima fishing. These efforts have helped to restore the arapaima population to roughly 4,000 and the founding of Rewa Eco-lodge (Unit, 2019). The Arapaima is also the centre of Rewa's sustainable ecotourism initiative. In addition to being able to see these species firsthand, tourists are encouraged to be a part of the catch-and-release fly fishing adventure for one of the world's largest freshwater fish. This initiative is monitored by Indifly Foundation among others to ensure the fish are caught and safely released without any harm. The purpose of this experience is that it helps to build an appreciation for this species of fish visitors to the lodge.

6.5.3 The South Rupununi Conservation Society

South Central Rupununi, between 2000 and 2018, after many years of effort by the South Rupununi Conservation Society, got the country’s first designation of an Important Bird and Biodiversity Area (IBA), predominantly due to the efforts in conserving the endangered Red Siskin. The South Rupununi Conservation Society is developing opportunities to work with local communities in mainstreaming biodiversity incentives to protect Rupununi wildlife and habitats. This involves the creation of sustainable ways to benefit the people living in this biodiverse landscape. As it relates to tourism, the SRCS trained community members as rangers, tour guides, and researchers to not only protect the vast biodiversity within the community but also to generate an income for conservation from ecotourism. Many tourists travel to this location to experience the pristine ecosystem and enlighten themselves about the importance of protecting these species. Tourists often make special contributions to this venture since they are allowed to name a few of the animals as an incentive. (CLP-Backed NGO Helps Establish Guyana's First Important Bird & Biodiversity Area, 2021).

6.5.4 The Iwokrama Forest Reserve

As mentioned prior, the Iwokrama Centre operates a tourism product that can be seen as an exemplary model for sustainable ecotourism. The Centre is a non-profit organization governed by
an international board of trustees and staffed with a personnel size of 70. The Iwokrama Centre focuses on three pillars: 1) Sustainable Tourism; 2) Sustainable Forestry and 3) Climate Change Mitigation and Adaptation. The mission of Iwokrama is to show how to sustainably and inclusively operate a business model in the tropical rainforest that will not jeopardize the ecological integrity of the forest and maintain the livelihoods of the communities that depend on the forest. The centre is funded through its ecotourism product and sustainable forestry activities. The funding generated is used to support the research, conservation, and community outreach projects of the centre.

6.4. Future commitments in relation to UNCBD

Since Guyana signed onto the UNCBD, it has had several obligations to fulfil. According to the assessment policy framework (2018) for the country, Guyana has committed to developing plans, programmes and strategies for the conservation and sustainable use of biological diversity. As part of the UNCBD commitment, the country is required to monitor biological diversity including the development of database systems and networks on biodiversity. This is done to ensure that all species are properly accounted for and managed within the system to ensure that any new updates about said species can be readily accessed by various agencies along with tour guides and tourists. The country in response to the commitments of the UNCBD created the Protected Areas Commission in 2014 and the Guyana Wildlife Conservation and Management in 2017 which are the agencies that oversee the tasks required to fulfil the UNCBD commitments.

Plans are also being made for restructuring and reorienting the Zoological Park's representativeness of ecosystems in Guyana to increase and expand awareness of biodiversity, particularly among children, increasing learning outdoors, and increasing schools' abilities to teach outdoors (Guyana’s National Biodiversity Strategy and Action Plan (2012–2020), 2014). This is saying that the zoo will be upgraded for educational purposes to raise awareness of the various species residing in Guyana. In addition, as it relates to Research and Training, Guyana is required to establish and maintain programs for education and training in the identification, conservation, and sustainable use of biological diversity; as well as promote and encourage research that contributes to the conservation and sustainable use of biological diversity. Guyana is also required to commence Public Education and Awareness, to highlight the importance of, and the measures
required for the conservation of biological diversity, as well as its dissemination through media, and the inclusion of these topics in educational programs. Ecotourism models in a country such as the ones demonstrated by the Arapaima Conservation and Research Initiative, Iwokrama Forest Reserve Centre and the Kaieteur National Park are essential in Guyana meeting their UNCBD commitments. Many examples worldwide have shown sustainable ecotourism as a vital conservation tool especially when the livelihood activities of communities have negative impacts on biodiversity. Ecotourism maintains the livelihood of communities which is dependent on the health of the ecosystem and biodiversity which turns out to be a symbiotic arrangement that maximizes and sustains benefits to society.

The LCDS 2030 captures the importance of protected areas in biodiversity conservation and ecosystem services preservation. The report emphasises the need for biodiversity research and the integration of sustainable business models to support conservation efforts, particularly ecotourism. Protected Areas in Guyana comprise ecosystems that are both terrestrial and coastal. As part of the country’s conservation efforts, the expansion of protected areas for Guyana includes more terrestrial and coastal protected areas especially to preserve the forest stock, indigenous lands and landmark sites. Additionally, the expansion of protected areas will also include the marine ecosystems of the country as well. Though within the National Context Analysis report, the role of protected areas was well established, the perspectives presented from the context of the LCDS framework need to be included so that the biodiversity national context aligns with this green economic framework.

6.6.1 Habitat Restoration

In the LCDS 2030, habitat management has been recognized as one of the priorities in improving Guyana’s forest climate services mechanism. ART-TREES was identified as the central goal in the forest climate services mechanism and an expansion of the REDD+ programme. The benefits and economic opportunities stemming from the ART-TREES plans will then be used in habitat restorations. The LCDS outlines that these plans include the reclamation of mine sites with the document outlining several land reclamation projects undertaken already since 2014. Apart from the mine site reclamation aspects, continued work is expected in mangrove restoration with the
country having conducted a major restoration project since 2015. The restoration of habitats has direct impacts on biodiversity health and therefore will be an important component of the LCDS to capture in the National Context Analysis report.

6.6.2 Low Carbon Economic Growth Pillars

The cutting theme throughout the LCDS 2030 is the recognition of clean energy and ecosystem services in driving economic growth and this is also key to biodiversity protection and conservation in Guyana. Using these principles, the LCDS 2030 outlines the following interlinked elements of the economy that the country intends to transform by 2030:

1) Waste management in a circular economy

2) Sustainable homes and communities

3) Expanding sustainable economic sectors (agriculture, tourism, forestry, mining etc.)

4) Low carbon infrastructure

5) Climate-compatible social services

6) Protection from climate change and biodiversity loss

6.6.3 Aligning with Global Climate and Biodiversity Goals

Within the LCDS report, Guyana has outlined a policy directive to align with international agreements on climate change and biodiversity. The country has a policy position to achieve a net zero target set through the Paris Agreement. The country outlined a net zero target by 2050 despite its new boom in oil and gas resources. To achieve the net zero target, the country has outlined several fiscal measures to manage the carbon output of the oil and gas industry. In addition, Guyana has also committed to a wide array of international treaties that relate to biodiversity and ecological management. The LCDS has a comprehensive list of the biodiversity-related treaties Guyana has ratified and for which guides the LCDS policy actions. The National Context Analysis report should therefore reflect the array of international treaties alongside the LCDS action items that align with these international treaties.
Concluding Remarks
7. Concluding Remarks

Biodiversity provides a plethora of ecosystem services and manifold benefits to human well-being, including but not limited to food provision, maintenance of soil fertility, aesthetic appreciation, clean drinking water, regulation of climate and regulation of pests and diseases. However, humanity has transformed the majority of the earth’s surface to meet its immediate needs with a resultant effect of a serious decline in the abundance and distribution of biodiversity species and compositions, as well as the disruption of ecological functions within the ecosystems. As the United Nations' (UN) Decade on Biodiversity draws to a close and the stark reality of the ongoing crisis of biodiversity loss is at the forefront of the international community’s attention, there is indeed for transformative changes. For these transformative changes to be effective, the fundamental organization and re-organisation across the socio-economic sectors must be guided by robust evidence. The review and report presented here have highlighted the diverse roles and contributions of biodiversity to Guyana’s economy. Specifically, in this report, we presented an overview of the socioeconomic contributions of mining, forestry, agriculture, urban and built environment and tourism sectors to Guyana. We also summarily documented the community and institutional arrangements for each of these sectors and emphasized the ecological impacts that they have on the country. This report also reviewed the policy outlook for the sustainability of each of the sectors identified for this report (that is, mining, forestry, agriculture, urban and built environment, and tourism), in addition to biodiversity mainstreaming incentivisation options for each of them before summarily documenting the future commitment of each of the section to United Nations Convention on Biological Diversity (UNCBD). There is evidently a greater need for biodiversity concerns to be included within the management plans of each of these economic sectors as this would offer a future where mainstreaming is achieved for the Cooperative Republic of Guyana.

With the commencement of the process towards and the drafting of the post-2020 Global Biodiversity Framework which is currently underway as agreed by Member States of the UNCBD in 2018, the coming years could mark a turning point for global biodiversity conservation – and Guyana has a significant role to play. The new targets and goals will frame the actions of governments, non-governmental organisations, other stakeholders, and decision-makers over the
next decades. The themes and sectorial priorities reported here for Guyana, although local in their contexts are global in their application.

National Engagement was also identified as one of the key processes that need to happen to meet our commitments. The LCDS 2030 outlines that this can be done through collective action and a comprehensive plan to engage stakeholders at all levels of society including the government, policymakers, civil society and the communities. The LCDS 2030 also recognises the importance of gender and youth empowerment and has an objective to integrate these social dimensions at all levels of engagement in shifting towards the low carbon economy. The need for stakeholder engagement and participatory management is vital in ensuring a smooth transition to a green economy and therefore, the level of stakeholder engagement needs to be reflected in the National Context Analysis report.
Bibliography
8. Bibliography

8.1. Chapter One References


8.2. Chapter Two References


Soto, J., Álvarez, R., Loredo, J., Iglesias, J.G., 1975. Pollution Associated to Artisanal Gold Mining in Ayacucho Department. PERÚ.


8.3. Chapter Three References


Da Fonseca, G. A. B., Rodrigues, C. M., Midgley, G., Busch, J., Hannah, L., & Mittermeier, R. A.


FCPF (Forest Carbon Partnership Facility), 2017. REDD+ Country Participants. https://www.forestcarbonpartnership.org/redd-countries-1


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189

Popradit, A., Srisatit, T., Kiratiprayoon, S., Yoshimura, J., Ishida, A., Shiyomi, M., Murayama, T., Chantaranothai, P., Outtaranakorn, S., & Phromma, I. 2015. Anthropogenic effects on a tropical forest according to the distance from human settlements. *Scientific Reports, 5*(1), 14689. https://doi.org/10.1038/srep14689


8.4. Chapter Four References


https://ohiostate.pressbooks.pub/sciencebitesvolume2/chapter/1-5-non-native-mongoose-herpestes-javanicus-a-threat-to-hawaiian-islands/


adaptation to climate change and its potential contribution to the UN’s sustainable development goals of zero hunger and no poverty. J. Clean. Prod. 281, 124999.


Environment, Epidemiology and Information Systems (ICENIS).
https://doi.org/10.1051/e3sconf/202020206016


OP. (2013). LOW CARBON DEVELOPMENT STRATEGY UPDATE.


Chapter Five References


Thomas, R., Kane, A., & Bierwagen, B. G. (2008). Effects of Climate Change on Aquatic Invasive Species and Effects of Climate Change on Aquatic Invasive Species and Implications for Management and Research Implications for Management and Research. https://digitalcommons.unl.edu/usepapapers/51


8.6. Chapter Six References


Chronicle News. (2019, May 25). Visitors Arrival is up by 6.4%. Downloaded from https://guyanachronicle.com/2019/05/25/visitor-arrivals-up-by-6-4/.


Kaieteur News. 2021. UK congratulates Guyana on joining Global Oceans Alliance. Kaieteur News. Retrieved from: https://www.kaieteurnewsonline.com/2021/06/08/uk-congratulates-guyana-on-joining-global-oceans-alliance/?__cf_chl_jschl__tk__=0b2e782b4316b1bf46c2f60e269add2bebde8c2-1626253116-0-ASO4ndGZSDra5oB08eAWL1mLM45Vctjgdk6B7TCQIoxvRZ3dBLknntXTIqevL14Gemt222XFVgUC5b7NNyzMuREGRSEXwaps6I6u7XL0sgXEO9vFGSuVe3niboeF-O7ktNjuuSnJyVgmrQqpm6t0bo618UR4w1hR5YKRY8qQNSJtY2dgeqda9ZP1tMrz6c1CjHy31mkIKwQF6TRCxBqaskyM0v8dvnOPIHCUmCl0jcnmrphypFuaAXKVZVqHIqk6O4Qih4wA6NEDR7bbA_UJ2uGEg4mVssyW1Z4RcdENmwT1GsgO8E-CoQqtJrx3kqG6f1gUryqCus0DiOPr2avnyD8q4Qx086Z_OO_pBG0kX1Mk9zATR

207


Thomas, R. J. 2020. From Mountains to Mangroves - The importance of Biodiversity to Guyana’s Future Webinar.


Wenner, M. D., Johnny, T. 2015, December. Tourism and Ecotourism Development in Guyana - Issues and Challenges and the Critical Path Forward. Downloaded from