



Commonwealth Futures Climate Research Cohort

Reducing Ocean Pollution for Climate Change Adaptation and Mitigation: Perspectives from South Africa, Seychelles, Jamaica, eSwatini and Barbados.

Andrea Clayton (Caribbean Maritime University); Danielle Etongo (University of Seychelles); Henri Count Evans (University of eSwatini); Marium Alleyne, University of the West Indies, Cave Hill; Refilwe Mofokeng (University of KwaZulu Natal); Tracy-Ann Hyman (University of the West Indies, Mona).

Executive Summary

The United Nations has declared plastic pollution ‘a planetary crisis’ (Harrabin, 2017). Plastic production requires a large portion of the oil produced, and transportation and consumption add to the energy cost, making plastic a significant contributor to climate change, while littering and the permeation of the environment with microplastics have growing environmental and health costs.

This review applies a ‘ridge to reef’ approach to understanding the impacts of plastic production, use and waste management, and the alignment with climate change issues.

Current initiatives on climate change and plastic pollution are largely separate in terms of activities and financial and human resource allocations, which means that these issues are generally treated as competing demands with the overall policy framework. This paper therefore recommends a multi-sector response that combines behavioural change mechanisms primarily through community engagement tools, alongside policy and legislative initiatives. By engaging local communities from ridge to reef, it would be possible to reduce ocean pollution, increase resilience to climate impacts and reduce overall greenhouse gas emissions (GHGs).



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1 INTRODUCTION

Plastic is a synthetic material which includes a wide range of organic polymers such as polyethene which is critical in food, transport, packaging hygiene and pharmaceutical practices (UNEP, 2018a; UNEP, 2018b). While plastic is important, its production, transportation, usage and disposal possess several challenges to the environment that in turn hampers the provisioning of ecosystem goods and services.

Most plastic items end up as waste, and plastic pollution has a range of negative impacts, including economic (coastal tourism), social (food safety and quality, human health), and environmental (climate change). Plastic pollutants in the marine environment have been a problem since the mass production of plastics began in the early 1940s (Cole et al., 2011). Approximately 8 million tonnes of plastic is deposited in oceans every year, which accounts for approximately 80% of all marine debris. In Durban Harbour, South Africa, 80% of ocean debris consists of plastics in terms of numerical value and 45% in terms of weight. The primary sources of marine pollution are land-based, from urban and storm runoff, sewer overflows, beach visitors, inadequate waste disposal and management, industrial activities, construction, and illegal dumping (IUCN, 2021). It is currently estimated that 12 billion metric tonnes of plastic will be in landfills or the environment by 2050 (Parker, 2018). Most regions are expected to generate more mismanaged plastic waste in future due to increased demand without commensurate infrastructure improvements (Jambeck et al., 2018).

Plastic is flexible, lightweight, durable, and relatively inexpensive which has contributed to it becoming ubiquitous over the years (UNEP, 2018a) and its presence in the environment is exacerbated by poor waste management practices (Henry et al., 2006, Clayton et al., 2020). Plastic wastes end up in drains, rivers, gullies, beaches and, ultimately, the ocean. On land, they block drains, which results in severe flood impacts that damage property and bring potential loss of life. Once in the sea, they are distributed along coastlines, damage coastal and marine ecosystems and create an unhealthy environment for local populations. The consumption of microplastics by smaller marine organisms moves them into the food chain, as the smaller organisms serve as bio accumulators. Phytoplankton are also an important carbon sink; they take up carbon which then falls to the sea floor in their excreta and dead bodies and is then buried in the ooze and remains there. However, the microplastics they ingest make them and their excreta more buoyant, so it takes longer for them to sink, slowing the rate of removal of carbon.

National responses to plastic pollution to date have primarily taken a top-down approach grounded in policy and legislation focused mainly on the consumer, in the form of bans and market-based instruments such as taxes and levies. Current research and policy responses focus on legislative and market-based instruments, with little reference to the important potential role of communities and their potential to minimise waste generation while concomitantly adopting disposal responses that are effective and in keeping with the Sustainable Development Goals.



There are therefore clear gaps in the current response and this study addresses this from five case study countries.

1.1 Need for Research-to-Action

Consumption patterns across the world have meant the production and distribution of massive quantities of plastic waste across all coastlines. The accumulation of toxic waste in the oceans has reduced the oceans' ability to support marine life. Local and indigenous communities, whose livelihoods directly depend on oceans, have seen their incomes erode. Coupled with dwindling livelihoods, these communities are also among the most exposed to the worst impacts of climate change.

However, there are significant challenges in reducing the flows of plastic waste on land and into the oceans (sanctions, public awareness, Recycle Partners), let alone recovering the wastes already there.

The need, however, is clear. Oceans are central to climate action and support all forms of life. The IPCC (2019) noted that the ocean provides "the uptake and redistribution of natural and anthropogenic carbon dioxide (CO₂) and heat, as well as ecosystem support. Services provided to people by the ocean and cryosphere include food and water supply, renewable energy, and benefits for health and well-being, cultural values, tourism, trade, and transport".

While oceans have long provided energy, tourism, transportation, and food security support systems to humans, their role in carbon absorption and climate mitigation has had far less attention to date. But now, as oceans have been permeated with plastic waste, their capacity to absorb carbon is weakening (Dundas et al. 2020). Most approaches have sought to preserve oceans as 'habitat preservation and conservation' without allowing for these other benefits to all forms of life. Climate policies therefore need to capture the idea that maintaining ocean health generates multiple benefits ranging from habitat preservation, energy, transportation, food security, and climate balance.

1.2 Objective(s) of the R2A Project

Further increases in plastic production, transportation, consumption, and littering will worsen the impacts of climate change on land, humans, and the marine environment. This review applies a ridge to reef approach to plastic production, use and waste management as an important component of climate change alignment. The main objective of the project is to reduce plastic pollution through a multi-pronged response including the enforcement of suitable regulatory and regulatory frameworks, capacity building and sensitisation efforts, identification of lessons learnt, and best practices in order to address waste generation and climate change adaptation in developing countries. This approach also allows plastic waste to be used as a gateway to communicate issues of ocean pollution and climate change impact with stakeholders. Specific objectives include:



- i. Improving the understanding of the vulnerabilities in coastal communities and informing the concerned policymakers and practitioners to enhance on-the-ground climate action based on good and best practices.
- ii. Analysing climate policies/plans of countries and regions and recommending possible actions to improve implementation of such policy instruments to meet global commitments (e.g., Paris Agreement, SDGs).
- iii. Identifying common climate challenges (e.g., disaster risks) and opportunities for local and international collaboration and facilitation of actors to agree on further collaboration beyond COP26.
- iv. Enhancing the trust among different stakeholders (i.e., government, corporate, and CSOs) for collective climate action.
- v. Identifying entry points (e.g. institutional and policy arrangements; the relevant actors; the financial and human resources) and proposed solutions/actions to support sustainable Ocean and Climate Action Acceleration.
- vi. Engaging community groups in the solution framework for local climate change adaptation action.



2 METHODOLOGY / APPROACH

The study utilised both quantitative and qualitative methodologies in a mixed methods approach. First, the qualitative approach was used in the review of literature to contextualise the study, followed by survey methods including questionnaires and interviews. The combined approach helped to reduce the risk of speculation in the analysis phase and in the explanation of the findings.

2.1 Literature Review

A literature review was conducted to:

- Investigate the GHG emissions and associated issues related to the carbon footprint in the production, manufacture, and transportation of plastics.
- Review the importance of the ocean to climate change and the impact of plastics on general ocean health.
- Develop a hybrid Ridge-to-Reef approach to better understand the journey of plastic waste from land to sea and the resultant negative impacts on land, agriculture, water quality, human life, buildings / infrastructure, marine life, and human health in developing nations
- Assess the current policy and enabling environment and how it impacts disposal and management practices. Formulate response matrix for developing countries.
- Review the implementation success of previous Adaptation and Mitigation action related to addressing plastic pollution, identifying strengths and weaknesses. Identify recommendations to support sustainable ocean and climate action acceleration, including new measures and adapting previous measures to suit the localised context. In addition, provide practical and relevant mitigation measures for long-term solutions.

2.2 Stakeholder Analysis and Engagement

A detailed stakeholder analysis was also conducted, and a stakeholder engagement modality framework was developed to understand stakeholders' relationship with their ocean environments and the benefits derived from such a relationship. The key stakeholders engaged included:

- Community groups (fishermen/ residents)
- Civil Society Groups and Policymakers (Environmental Policy Makers)
- Academics and non-governmental organisations (NGOs)

2.3 Fieldwork

The fieldwork followed the observational and data collection style/approach based on the journey of plastics related to their movements from source to disposal. This took the form of a ridge-to-reef perspective that follows the movement of plastics from land to the coastline and then the sea. This perspective can be used across communities within developing nations, as seen in Figure 1.



The data collection method and the combination of stakeholders engaged were determined by the Ridge-to-Reef Approach. The literature helped to determine key stages in the linear flow of plastic, which provided an opportunity for us to examine the problem alongside the climate change implications at each stage. The key stages determined are as follows:

1. Manufacturing, production and transportation of plastics.
2. Impact of plastic use on land and its related consequences
3. Impact of plastic on the marine environment.
4. Solutions and policy implications.

This approach helped to highlight a gap in the current literature. While plastic has been extensively examined as a pollution/waste issue, relatively little attention has been given to the impact that plastic is having on global warming and subsequently climate change. Furthermore, until recently, climate change has been discussed as a problem for the future. However, developing countries, particularly small-island states are already living with the impacts of climate change. The gap is even wider when one considers that the link between these two key variables are almost entirely missing from policy and/or legislative frameworks in developing countries.

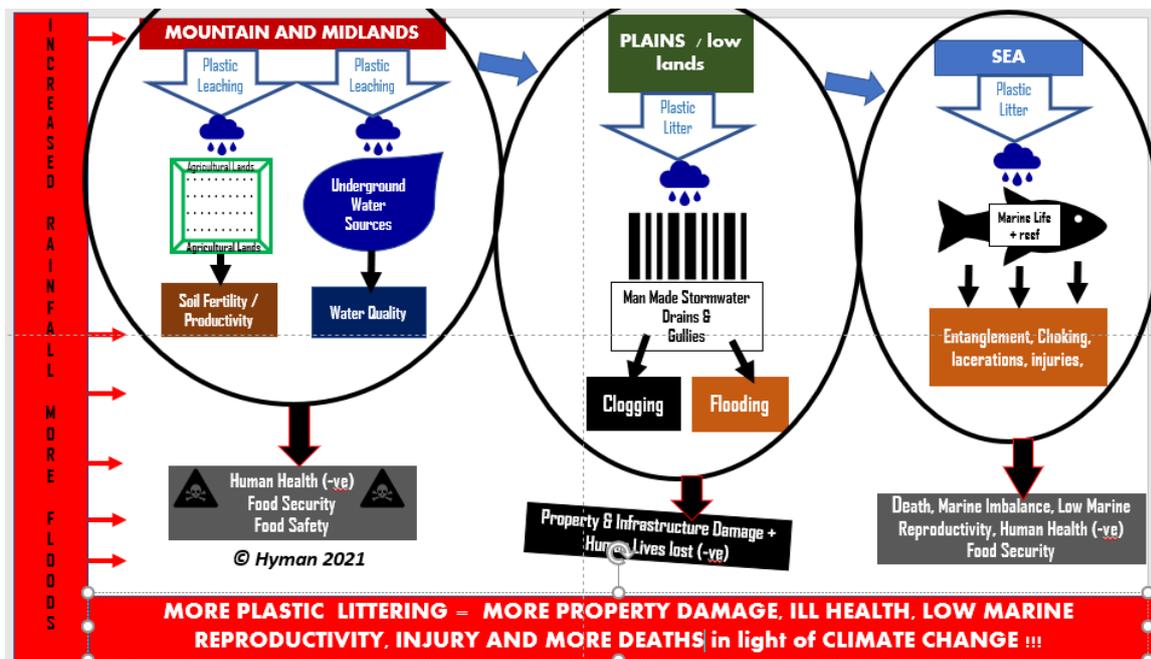


Figure 1: Ridge-to-Reef approach to plastic production from Land to Sea. Source: Tracy-Ann Hyman

2.3.1 Surveys

The data collection was designed around the four key stages identified above. While all five countries in the study had essentially the same problem with the use and disposal of plastics, there were also important differences. For example, South Africa is the largest country in the group, and the only one directly involved in fossil fuel mining. This made it the choice to examine the plastic problem in the first stages, that is, manufacturing, production and transportation. In the four other countries plastic was primarily a problem from production (primarily packaging) to waste. This similarity allowed us to examine the other three stages with a focus on developing a framework that could be applied in all jurisdictions. Questions for the fieldwork can be found in Annex 8.1



2.3.1.1 Interviews

2.3.1.2 *Stage 1: Plastic Manufacturing as a Driver of Climate Change – Perspective from Seychelles and South Africa*

Since plastics are not manufactured in Seychelles but instead imported, the interviews focused on supermarkets, grocery stores, and hotel establishments. As a result, 20 interviews (grocery stores (4), hotels (6), and supermarkets (10)) were conducted during October 2021 across these three groups on Mahe Island, Seychelles, as seen in Table 1.

Table 1: List of Respondents Interviewed related to Plastics Manufacturing as a Driver for Climate Change in Seychelles

		Interviewee			
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1 Grocery store	4	20.0	20.0	20.0
	2 Hotel/Guesthouse	6	30.0	30.0	50.0
	3 Supermarket	10	50.0	50.0	100.0
	Total	20	100.0	100.0	

In South Africa, 114 persons were engagements in the data collection phase. This included six producers for interviews, 50 local residents for questionnaires, and 50 participants for clean-up activities (Annex 8.2).

2.3.1.3 *Stages 2 and 3: Impact of Plastic on Land and Ocean – Jamaica*

Four parishes (Westmoreland and St. James (west), and St. Mary (northeast) were covered in Jamaica's data-collection. Jamaica is an island, and all parishes involved in the study have coastal regions. As time and resources did not allow for a broader study, purposeful sampling methods were applied, and interviews were conducted with a focus on communities with water-bodies that lead to the ocean.

All three parishes depend heavily on tourism, with St. James being the most tourist dependent. Eighty percent of the parish's economic activities are built around this one industry (St James Municipal Cooperation, 2021) while Westmoreland and St. Mary's also have economic activities built around agriculture and fishing. Additionally, Westmoreland also possesses some manufacturing capacity. The communities of Bluefields, Cave, Savannah-la-mar, Belmont and Scotts Cove in Westmoreland along with Freeport Harbour in St. James formed the geographical locations that were examined in the western region (Annex 8.3). The objective in visiting these communities was to observe local household and commercial garbage disposal practices, including the types of waste and the presence of these on land as litter, their impact on local infrastructure such as drains and other water bodies, as well as to determine respondents' awareness of the possible link between plastic waste, flooding and climate change. This is particular important given the many waterways and the regions' heavy dependence on the ocean.



In St. Mary, the focus was on the impact that plastic was having on the marine environment and the lives and livelihood of persons who are dependent on the ocean. Like the western region, Jamaica's north coast host Jamaica's primary tourism destinations with many hotels, beaches and citizens who depend on a healthy marine environment. Residents of the Port Maria coastline where the Otram River runs into the Caribbean Sea and fishermen from the Pagee Beach Fishing village at the mouth of the Pagee River were included in the data collection (Annex 8.4).

Kingston, which is in the south-east of the island, was not included, despite being the most populated. This is because it would be harder to trace the waste deposited in Kingston as the parish is by far the largest settlement, and has multiple possible sources from four neighbouring parishes. By focusing on communities where waste could be more easily tracked, the process allowed for observation of the connection between plastic littering on land and the coastline, as well as an assessment of the respondents' awareness of the possible connection between plastics, pollution, flooding and climate change.

It is also important to note that oceanic currents play a major role in the movement of plastic waste across geographical boundaries and even between oceans. However, that was beyond the scope of this study.

2.3.1.4 Stage 4 - Solutions and Policy: Plastic Management and Disposal Institutional and Legal Frameworks

2.3.1.4.1 Perspective from eSwatini

Interviews were conducted to assess the philosophy and motivation behind the regulations that eSwatini has implemented to address plastic pollution. In addition, respondents were asked about the key legislative frameworks to deal with plastic management in the country.

2.3.1.5 Perspectives from Barbados

Questionnaires were distributed to members of eight civil society groups with responsibility and a direct mandate related to pollution management. The main aim of the survey was to determine the type of work that has been undertaken related to plastic pollution reduction and management, the successes and challenges experienced, and the results directed towards climate change adaptation and mitigation. The questionnaire was administered online, via Google Forms, and members of these groups also submitted videos on their perspectives based on questions from the survey.



3 FINDINGS / UNDERSTANDING THE LANDSCAPE

3.1 Literature Review

Plastics have become essential components of products and packaging because they are durable, lightweight, and cheap (UNEP, 2018a). Despite these benefits, plastics originate as fossil fuels, involve the release of greenhouse gases from production to disposal (CIEL, 2019) and therefore contribute to climate change, and are now of the world's most intractable pollution problems (Harrabin, 2017).

3.1.1 Stage 1: The Production, Shipping and Transportation of Plastic

Over 300 million tonnes of plastic are produced each year and this figure is expected to increase to 540 million metric tonnes by 2040 (Bassetti, 2020). Plastics are a wide range of synthetic or semi-synthetic materials that use polymers as the main ingredient. Plastic is highly durable, and it can be moulded, extruded, or pressed into solid objects of various shapes (Patil, Patel and Purohit 2017). Owing to its unique combination of features such as elasticity, hardness, lightweight, and inexpensive manufacturing techniques (Cole et al., 2011), demand for plastic has increased steadily. Since its introduction in the 1940s, plastic mass production has increased from 1.5 million tonnes (Plastics Europe, 2017) to 368 million tonnes in 2019 (Plastic Soup Foundation, n.d.). Vidal (2020) estimates that a cumulative total of 9 billion metric tonnes of plastics have been produced and current projections show an expansion of 20% by 2050, with the industry accounting for 50% of the increase in demand for oil.

In 2015 emissions from manufacturing ethylene, the building block for polyethene plastics, were from 184 to 213 million metric tonnes of carbon dioxide equivalent, which is about as much as 45 million passenger vehicles emit for one year (CIEL, 2019). Globally, carbon dioxide emissions from ethylene production are projected to expand by 34% between 2015 and 2030. This, in turn, will contribute to increasing global temperatures.

The disposal of plastic materials is an environmental concern because of its durability and corrosion resistance. Plastic compounds can take many years to degrade into smaller fragments or microplastics (fragmented plastic with a size smaller than 5 mm).

According to the CIEL report, U.S. emissions from plastics incineration in 2015 were 5.9 million metric tonnes of carbon dioxide equivalent. Based on the World Energy Council projections, if plastics production and incineration increase as expected, greenhouse gas emissions will increase to 49 million metric tonnes by 2030 and 91 million metric tonnes by 2050.

3.1.2 Stage 2: Plastic on Land: Ridge to Reef Analysis

Almost all aspects of human life involve the use of plastics that have different applications relating to packaging (especially for food), building and construction, household and sports equipment, vehicles, clothing, footwear, fishing gear, electronics, and agriculture (IUCN, 2018;



Andrady and Neal, 2009). Plastics are convenient, non-corrosive, lightweight and can be produced at relatively low unit costs and are therefore highly favoured by manufacturers and consumers (Shah, Niles, Ali, Surroop and Jaggeshar, 2019). In addition, plastics offer many public health as well as sanitation benefits. For example, they facilitate clean drinking water supplies by using plastic pipes that are not easily corroded. They are used for many medical devices, ranging from surgical equipment, drips, aseptic medical packaging, and blister packs for pills (Andrady and Neal, 2009).

Over half of the plastic produced each year is designed for a single use such as shopping bags, cups, and straws (IUCN, 2018). This leads to an environmental nightmare as less than 12% of all plastics made is recycled and the rest is either incinerated, sent to landfills, or discarded informally and penetrates the soil and ends up in waterways and the ocean. Each of these disposal options contributes to climate change.

Most plastics produced remain on land, filling up landfills, dumps, drains and sewers (UNEP, 2018a). Plastic pollution has therefore become a persistent/constant nuisance that societies across the world face today (especially in developing nations)

Plastic pollution on land and in water bodies has detrimental impacts on land, agriculture, water quality, human life, buildings/infrastructure, marine life, and human health. Specifically, toxic substances from plastic decomposition in the ground can leach into the soil, negatively impacting the fertility of agricultural lands. This can ultimately affect the amount of food produced with implications for food security.

Plastic leaching into the soil not only impacts the fertility of the soil, but this type of contamination can impact human health through the consumption of agricultural produce. This, therefore, has implications for food safety. Often overlooked is that plastic leaching into the soil can also impact underground water supplies, reducing water quality for human consumption and the water used on agricultural lands.

3.1.3 Plastic use and waste management in developing countries

The same reasons that cause plastics to be versatile and popular, i.e., durability, cost, and weight, cause the plastic to be problematic in the environment, i.e., unlike other industrial materials, plastic degrades very slowly. Plastic can take up to 1,000 years to fully disintegrate (Eich, Weber and Lott 2021). However, due to mechanical abrasion and U.V. radiation, most plastic breaks down into smaller fragments commonly referred to as microplastics.

Developing countries are inundated with plastic products, primarily single-use plastic (SUP) items. The lives of many within developing countries are entangled with plastic products. Many more people are in small businesses in the informal sector. SUPs are particularly challenging since they are designed to be used once and discarded and can spend years, decades and even centuries in the environment (Adam et al., 2020). The problem is further compounded by the lack of adequate waste management systems in many developing countries (Clayton et al.,



2020). Developing countries cannot often collect and dispose of their solid waste efficiently and environmentally friendly. Throughout Latin America and the Caribbean (LAC), only 54% of the region's solid waste is disposed of in sanitary landfills, and the area lacks the means to recycle its plastics. The extremely high per capita consumption rate of plastic in developing countries and the lack of adequate infrastructure to manage plastic waste have exacerbated the negative environmental impacts of plastic marine and terrestrial pollution.

Once there is a heavy rainfall, plastics are washed into storm water drains, ditches, gullies, sewers, and waterways on land. This causes significant clogging and blockage, resulting in a considerable build-up of water on the ground that leads to flooding (Table 1). Flooding, in turn, leads to severe damage to buildings, property, infrastructure and roadways, and loss of life on land (Kushwaha, 2017). Much SUP waste eventually ends up in the sea, threatening marine ecosystems and livelihoods that depend on fishing and tourism (Kildow and McIlgorm, 2010).

Table 2: Impact of plastic on land, sea, and the underground water supply

Action	Result
Accumulation of plastic litter on land	Artificial nuisance, not aesthetically appealing
	Rodents and mosquito breeding grounds- implications for human health, e.g., dengue
	Leaching of toxins / toxic chemicals from plastics into the soil; implications for farming, produce, harvesting and human health
	Pollution of underground water sources; leaching of toxins from the soil into the water table; implications for agriculture and human health
	Clogged drains, culverts, and waterways, which lead to flooding; flooding destroys property, infrastructure, roadways and even loss of life
	Destruction/ Injury to marine life; when plastics are consumed by marine animals or destroy coral reefs; implications for human health

Source: Tracy-Ann Hyman (summarised)

Drains, culverts, and gullies on land are connected to inland water bodies such as rivers, streams, and lakes, so plastics are transported by these water bodies to the sea. Plastics constitute about 80% of all marine debris from surface waters to deep-sea sediments (IUCN, 2018).

3.1.4 Stage 3: Plastic and the marine environment

The ocean covers over 70% of the Earth's surface. It is the planet's largest carbon sink and plays a crucial role in regulating the Earth's atmosphere by absorbing carbon dioxide. About 40% of the additional carbon dioxide deposited in the atmosphere by fossil fuel burning since the beginning of the industrial era has been taken up by the ocean, so we would now be experiencing catastrophic climate change if some of the excess carbon dioxide had not been absorbed.

Plastic waste is now abundant in every ocean and creates several serious problems for the marine environment. For example, marine animals, fish, and seabirds have died after mistaking plastic bags for jellyfish and eating them.



There are also concerns about the impact of plastic waste on the single-celled phytoplankton and zooplankton which are at the base of the marine food web. Phytoplankton generates about half of Earth's oxygen and sequesters as much carbon dioxide as all terrestrial plants. They take up carbon, and the carbon is then transferred to other animals up the food chain when they are eaten. This carbon then settles into marine sediments on the ocean floor in the form of phytoplankton aggregates, faecal pellets, and animal carcasses (Septania, 2021), where it remains indefinitely. Through this process, the ocean regulates the Earth's climate. This process is called the biological pump, as the ocean effectively pumps carbon out of the atmosphere into stable storage. This is one of the primary mechanisms by which the ocean regulates the Earth's climate (Shen et al., 2020).

The presence of microplastics in the ocean is therefore a complex problem with the potential to interfere with fundamental biological processes deeply implicated in the global carbon cycle. All plastic waste begins on land. Most marine litter cannot be recovered and recycled, so the solution must include finding less harmful substitutes and reducing waste to manageable volumes. A framework for developing countries must therefore include a multifaceted approach that includes producers, policymakers, manufacturers, and users.

3.1.5 Stage 4: Country responses to the plastic problem

Under the banner of environmental stewardship and climate change mitigation, solutions to address the effects of poor plastic management systems have been considered and implemented. There is no universally accepted response to the plastic nuisance due to plastic debris' varied sources, pathways, and persistence. However, numerous tailored approaches have been developed and implemented to tackle this issue with specific aims and varying degrees of success. These include general global instruments geared towards environmental protection, regional plastic pollution reduction strategies, and national-specific product bans. The quest to develop practical solutions to the plastic nuisance is embodied in the U.N. 2030 Agenda for Sustainable Development, which addresses marine debris and pollution through Goal 14, focusing on land-based activities.

3.1.5.1 The Caribbean – Barbados and Jamaica

The Governments of the Caribbean have adopted policies to reduce the effect of plastic pollution on their socio-economic well-being. Most of the policy and regulative action focuses on single-use plastics and polystyrene. In addition, the Caribbean Region's commitment to addressing the anthropogenic causes of solid waste has resulted in the adoption of the Regional Solid Waste Action plan by CARICOM countries (Clayton et al. 2020). Each country is specifically responsible for developing its national framework for solid waste management from land-use sources.

Another notable regional policy is the Caribbean Regional Node for Marine Litter, supported by the Cartagena Convention Secretariat and the Gulf and Caribbean Fisheries Institute (Clayton et al. 2020). Despite the commitment to the Cartagena Convention and the collective adoption of regional interventions and planning, the progress made to eradicate plastic



pollution nuisance is limited. The focus of some of these initiatives has encompassed reduction strategies, market-based instruments, and penalties for non-compliance. For example, in 2019, Barbados instituted a national ban on the import of single-use plastic containers and cutlery, progressed into a ban on the distribution, and finally in one year later, in 2020, a ban on the import or manufacture of any Petro based bag. Under The Trade-Plastic Packaging Materials, Prohibition Order 2018 and The Natural Resource Conservation Authority, Jamaica banned single-use plastics' importation, manufacture, and distribution. These interventions are recent, and the impact cannot be effectively assessed (Clayton et al. 2020). The success gained through these initiatives in the Caribbean Region involved a comprehensive multi-pronged approach of awareness and collaborative engagement. Non-compliance penalties also provide the backing that the legislation enacted requires. In Barbados, under the Control of Disposable Plastic Bill, a fine of up to the U.S. \$25,000 and one-year imprisonment is meted out to anyone guilty of importing, selling, or using single-use plastics (Clayton et al. 2020).

Lessons learned are that measures should be less abrupt and coercive and should be introduced through stages and progress through phases. For example, the collaborative efforts of the Caribbean Youth Environment Network, Caribbean Network for Integrated Rural Development and UNEP, launched the Regional Clean Seas Campaign in 2019 with the main aim of building capacity, supporting advocacy and resource mobilisation, and strengthening the development of new project proposals for reducing marine litter and plastics. In addition, public-private partnerships have been developed. For example, the Recycling Partner of Jamaica was designed to eliminate plastics from the Jamaica environment through consistent stakeholder participation in national and public awareness.

3.1.5.2 eSwatini

Waste management in eSwatini falls under the eSwatini Environment Authority (EEA), a parastatal that reports to the Ministry of Tourism and Environmental Affairs. Among its duties, the Authority is responsible for helping the Ministry develop policies and legislation that address environmental management in the country. Waste disposal and management are governed by the Environmental Management Act (2002) and the Waste Regulations of 2000. The EEA, after every five years, carries the state of the environmental assessment and recommends policy change to address the problems identified during assessment.

Plastic waste in eSwatini is driven by consumer use and hospital disposal. The Swaziland State of the Environment Report: Consequences of Inaction report of 2014 noted that as the country's population increases, "it is anticipated that the percentage of plastics in the waste stream will continue to grow" (p. 187). Municipalities have the responsibility, guided by EEA regulations, and according to the Environmental Management Act of 2002, to collect and dispose of waste, including plastic waste. The state of the environmental assessment report of 2014 noted that waste disposal was not coherent and consistent across municipalities. Municipal councils dumped waste at dumpsites and often burnt the waste without separation.



The Environmental Management Act (2002) was enacted with its underlying principle that the environment is "the common heritage of the present and future generations". As part of the principles of environmental governance, the Act, in section 5(e), stipulated that "the generation of waste should be minimised wherever practicable; waste should, in order of priority, be reused, recycled, recovered and disposed of safely in a manner that avoids creating adverse effects or if this is not practicable, is least likely to cause adverse effects". In section 5(d), the Act lays out penalties for illegal waste disposal: "the polluter pays principle, which requires that those causing adverse effects shall be required to pay the entire social and environmental costs of avoiding, mitigating, and remedying those negative effects. Section 41 (subsections 5 & 6) set the fine and prison commitments for littering and pollution: 41(5) A person shall not dispose of waste in such a manner that it becomes litter or is likely to become litter. 41(6) A person who contravenes subsection (5) commits an offence and shall, on conviction, be liable to a fine not exceeding E5, 000.00 or to imprisonment to a term not exceeding six months or to both.

- The Waste Regulations of 2000 give practical details on the implementation of the EMA as amended in 2002. In terms of waste disposal and littering, the regulations (in Part XI) state the following:
- No person shall dispose of waste in such a manner that it becomes litter or is likely to become litter.
- The driver and the vehicle owner from which litter is discarded in contravention of sub-regulation (1) shall be strictly, and jointly and severally, liable for the offence.
- Every person shall take reasonable measures to prevent any infringement by any other person of sub-regulation (1).
- Any person who contravenes sub-regulation (1), (2) or (3) commits an offence and is liable on conviction to a fine not exceeding twenty-five thousand Maldivian Rufiyaa and on a second or subsequent conviction, to a fine not exceeding fifty thousand Maldivian Rufiyaa and, in the case of a natural person, to imprisonment to a term not exceeding two years, or to both imprisonment and a fine.

The grassroots innovations and transition initiatives of community-based contributions towards a transition to a low-carbon society should serve to address large-scale policy changes as well as bottom-up social practices and behaviour. Engaging local communities from ridge to reef can reduce ocean pollution, preserve ocean health, and reduce overall GHGs emissions.

3.1.5.3 *Seychelles*

Seychelles currently has the most significant waste management problem as there is no available land/space for solid waste storage, and the ever-increasing landfilling rates are a concern. In response to this challenge, the Seychelles government has been very active in policy development around plastic pollution, including the development of the Environmental Protection Act of 2016, which banned the import, manufacture, distribution or selling of plastic bags, plastic utensils, and polystyrene boxes (Environmental Protection Act, 2016).



Jambeck, Brooks and Youngblood (2019) presented the Circulatory Assessment Protocol to the World Bank after studying the behaviour and social aspects of using and disposing of plastics by local communities. The findings show that the ban on single-use plastic retail bags and expanded polystyrene to-go ware was very effective as few plastic bags were found in the environment. In addition, very few items made of expanded polystyrene were found (Jambeck, Brooks & Youngblood, 2019).

Other non-governmental organisations like The Ocean Project (TOP), the SIDS Youth Aims Hub and the Seychelles Islands Foundation joined together to combat the deadly impacts of plastics in the Indian Ocean through education, research, and action. Other initiatives aiming to eliminate plastics on the surface are The Biggest Beach Clean Up campaign and The Last Straw Campaign, which aims to reduce plastic straws in Seychelles.

In 2017 Seychelles banned the sale, manufacturing, and importation of some plastic items such as plastic bags, Styrofoam boxes, some plastic utensils, and single-use plastic straws (Barrowclough and Eugui, 2021). A civil society such as S4S, SIDS Youth AIMS Hub (SYAH) Seychelles, and The Ocean Project has committed to supporting coastal protection initiatives and supporting education and awareness campaigns on the importance of environmental protection. A consistent initiative by The Ocean Project is the monthly cleans which started in 2017. In addition, S4S has developed and implemented a campaign on waste sorting complemented by creating and distributing educational materials and tailored advice on household waste sorting. SYAH launched a Blue Economy Internship Programme to help focus young people interested in ocean-related careers. The goal is to create healthy, sustainable environmental behaviour to help stem the current issues (Victoria 2018).

3.1.5.4 South Africa

South African has taken a strong stance on plastic pollution and is considered instrumental in leading other African countries towards this goal. As early as 2003, South Africa implemented regulatory and economic instruments such as bans and levies on plastic carrier bags and regulations to the waste facilitates and waste management standards. Furthermore, all coastal African States, including South Africa, are parties to the United Nations Convention of the Law of the Sea (UNCLOS), which regulates activities carried out at sea. UNCLOS stipulates that preventative, reduction, management, and control measures towards pollution in the marine environment should be developed (Jambeck et al. 2018). However, the limited effectiveness of the national and regional policies to address plastic pollution has implications for the sustainability of the blue economy principles and, by extension, the achievement of the sustainable development goals.

The National Waste Strategy (NWMS) of 2020 indicates that South Africa produces 1 099 254 tonnes of plastic waste alone, of which about 43.7% is recycled, and 56.3% is permanently disposed of in landfills, burnt or absorbed by the country's marine systems and other environments. This plastic debris is reported to cause severe pollution of the coastline and oceans with severe negative impacts on marine life (NWMS, 2020)



Scholars such as Khangale, Ozor and Mbohwa (2020) and Ayeleru et al. (2020) attribute the increase in plastic waste to the rapid rise in population, economic development, season change, lifestyles and consumption patterns which in turn increases consumption of plastic materials. The Constitution of South Africa in Section 24 of the Bill of Rights in the Draft Final Constitution guarantees the environmental rights to the citizens that everyone has a right to an healthy environment, to a preserved environment for future generations to use, to a pollution and ecological degradation free environment, conservation promotion and secure ecologically sustainable development and use of natural resources (Environmental Policy of South Africa, 1996). To ensure this premise, the Government of South Africa and various stakeholders initiated different policies, acts, and initiatives to reduce the negative impacts of waste on the environment.

A Waste Act (Act No. 59 of 2008) was developed for aligning waste legislation to the common goals and understanding of how South Africa's waste should be managed (DEAT, 2011). In 2011, the National Domestic Waste Collection Standards was developed to improve past imbalances in waste collection services and reduce the risk of environmental and human health problems associated with improper and illegal dumping of waste (DEAT, 2011).

The National Waste Management Strategy is a policy implemented as an update of the 2011 strategy, which provides the government of South Africa with policy and strategic advances and interventions for the waste sector aligned in response and achieving the Sustainable Development Goals and to the South African National Development Plan of 2030 (NWMS, 2020).

The policy outlines three pillars that will help achieve zero waste in landfills, cleaner communities, financially stable and well-managed waste services, and adaptation to a culture of zero tolerance to pollution, litter, and illegal dumping shortly. The strategic pillars are namely: waste minimisation, effective and sustainable waste services, compliance, enforcement, and awareness.

The Plastic Bag Regulations Act was implemented in 2003 to address a rising concern of pollution and land degradation caused by increased plastic use in South Africa. The Act imposed certain minimum restrictions on the designs of the plastic bags, aimed at encouraging the production and use of recyclable plastic bags.

Significant support is provided through non-profit organisations such as USE-IT in South Africa applying a holistic approach, including numerous recycling programmes and the ETheKwini Waste Materials Recovery Industry Development Center (Jambeck et al. 2018). Turning plastic waste into valuable retail opportunities is another essential motivator that has experienced some success in South Africa. For example, as the name implies, All Women Recycling is a women empowerment initiative that uses plastic bottles to make the Kliketyklikbox sold globally. The success of this initiative is evident by the fact that more than 500,000 plastic bottles were upcycled while building capacity among marginalised women



(Jambeck et al. 2018). In addition, South Africa Repurpose Schoolbags designed school bags for needy children made from plastic bags and billboard materials.

The circular economy framework has been adopted in South Africa to support climate change mitigation efforts, which focuses on imitating the function of nature and contributing to restorative and regenerative initiatives. To support this framework, voluntary agreements have been piloted. For example, the South African Plastics Pact launched in January 2020 creates a suitable platform to facilitate multiple stakeholder engagements involved in the plastic value chain and public reporting of progress made (de Kock et al. 2020). Unfortunately, the reduction in plastic pollution as environmental and climate change solutions based on a survey conducted in 2019 indicated that it is a relatively common concern compared to the other prevailing issues that South Africans face (de Kock et al. 2020).

Civil society is mainly engaged in advocacy work pertaining to plastic reduction solutions. However, faith-based organisations such as the Green Anglicans and the Southern African Faith Communities Environment Institute (SAFCEI) are focusing their efforts on raising their awareness of issues related to plastic pollution such as sustainable development, eco-justice, and climate change. Their awareness campaign's central theme is to turn the tides on the increasing levels of plastic pollution (Sadan and De Kock 2020).



3.2 Interview Results / Stakeholder Consultation Outcomes

3.2.1 Stage 1: Plastic manufacturing, production and use as a driver of climate change

3.2.1.1 *Manufacturing - South Africa*

Following multiple outreach and request for interviews/engagement with producers, it was clear that producers are reluctant to commit to engagement around plastic and its impact. A few manufacturers consulted responded with no permission for interviews citing COVID-19 regulations, while others objected to being recorded. It appears, therefore, that the issue of plastic within the manufacturing sector is a sensitive one and not very high on the radar for producers in South Africa. There is a general sense of lack of urgency by producers relating to the plastics crises, with most producers' pushing the buck to either consumers or the government.

Producers highlighted the need for consumers to use plastic items for as long as possible before discarding them. They also pointed out that consumers have the primary responsibility to recycle their waste and to check their clothing labels before buying apparel to ensure that the items do not contain high amounts of plastics in them. Additionally, there was no expressed willingness or desire to move away from plastics. However, some producers agreed that the responsibility for the plastic pollution problem should not rest solely with any one group; they are in favour of shared ownership among stakeholders such as, the government, consumer, and manufacturer. It was also identified that direct linkage is in the manufacturing of plastics where biofuels are used.

The Ministry of Environment and Fisheries (MEF) has already announced Extended Producer Responsibility (EPRs) mandates for companies to be registered with. This was to be in full effect from November 5, 2021, to encourage support demand and recovery of plastics. The MEF reiterated that moving away from plastics is not an option, mainly because there are no apparent, viable alternatives. It was posited that the legislation is becoming increasingly strict on producers, but little has been done on consumer and management fronts. Producers are therefore working with plastic recycling companies to subsidise recycling to support the plastics recycling value-chain. Some producers claimed to work with NGOs to support education and awareness programs.

3.2.1.2 *Production and use - The Seychelles*

As is customary, all grocery stores in Seychelles use plastic bags for packaging food items to their customers. However, grocery stores are moving towards the use of bags made from biodegradable materials. For the supermarkets, 60% do not use plastics anymore, but biodegradable bags, while the other 40% use plastics bought from intermediaries. For example, one of the supermarkets, the Seychelles Trading Company (STC) Ltd, imports plastics from India.



The STC took over some of the activities and assets of the Seychelles Marketing Board (SMB), such as wholesale, retail, and manufacturing operations. STC is now a trading company, with its core business being the imports, storage, and distribution of essential and fundamental foods. Although the STC encourages reusable and biodegradable bags, plastic is still used in its operation, especially with repackaging their products, e.g., rice, milk, toilet tissue, etc.

Fifty per cent of the hotels interviewed have phased out the use of plastic bottles and now serve water to their customers with reusable bottles. Conversely, the other 50% still provide water to their customers in plastic bottles. The Seychelles Sustainable Tourism Label also promoted good practices, including eliminating plastic bottles in the tourism industry. This was done alongside a ban on plastics, which came into effect on July 1, 2017, in the Republic of Seychelles. The Cabinet of Ministers of Seychelles reacted to the environmental crisis by approving two sets of regulations imposing restrictions on importation, manufacturing, distribution, and sale of plastic bags and plastic utensils and polystyrene boxes.

3.2.1.3 Use and treatment - Jamaica

In Jamaica, plastic products are made locally from imported pellets by a small group of approximately 45 manufacturing companies (S & P Global, 2021). They are primarily used for packaging of products and for transportation. At the consumer level, this is estimated at approximately 600 million polyethylene terephthalate (PET) bottles annually (Cross, 2018). There is no recent data on this but for the purpose of this study, the amount used was deduced from the amount of waste that is generated. Jamaicans generate approximately 2,192 tonnes of residential waste, of which 15% (329 tonnes) are plastic (UNEP, 2021a; UNEP, 2021b). However, Jamaica currently lacks the necessary capacity to collect and dispose of its solid waste in an efficient and environmentally sound manner (CAPRI, 2017). Like other developing countries, this area has not been given the attention it requires as it has to compete with other pressing economic and social issues such as fiscal deficits, poverty and unemployment.

The country's latest initiative is built on recycling. However, this keeps the focus on plastic as a waste problem. The initiative is being promoted through a public-private partnership initiative involving the government and 7 corporate entities, namely, Wisynco Group Limited, Pepsi Cola Jamaica Bottling Limited, Grace Foods & Services Limited, Jamaica Beverages Limited, Lasco Manufacturing Limited, Trade Winds Citrus Limited and Seprod Limited. This is being considered as a part of the extended producers' responsibility. However, the collected plastic is exported so one is not too sure if the objective of removing plastic from the environment is being met or whether it is simply being relocated.

3.2.2 Stage 2: Impact of Plastic on Land

3.2.2.1 Perspectives from Western Jamaica (Westmoreland and St. James)

Respondents in Westmoreland and St. James consisted of farmers, environmental consultants, parish coordinators (disaster preparedness), and retired government workers. Findings from the



interviews and through observation highlighted the most common items of household and commercial garbage, in order of dominance as (Figure 2):

1. Plastic Bottles (PET)
2. NON- PET plastic bottles
3. Lunch Boxes
4. Plastic Bags (SUP)
5. Straws, forks,
6. Cans
7. Cardboard boxes
8. Glass bottles (alcoholic drinks)
9. Paper
10. Food Wrappers
11. Napkins
12. Personal protective equipment (PPE) masks



Figure 2: An open garbage pile near the Sawmill River in the Cave Community. It comprises of a lot of plastic waste materials

The municipal authorities are the primary avenues for garbage collection. In a few cases, however, this is supplemented with services from private contractors. Composting of organic material appeared to be a common practice among the respondents who withhold vegetable and fruit peels from their general garbage for use in their home gardens. Respondents primarily agree that plastics present a problem on land, particularly as some members of the local community do not dispose of their garbage in the receptacles provided. These include regular household waste, but extend to large household items such as used refrigerators and stoves which are left on roadways, in drains and at illegal dumping sites.

Jamaica has no waste separation system in place. This means that all waste is treated the same and local communities in question have not taken steps to change that practice, despite the direct results that are visible to respondents in St. James. Respondents were knowledgeable about the flow of their garbage through the water channels (drains, gullies and rivers) and the impact improper disposal of plastic had in their immediate environment. Furthermore, as garbage is carelessly treated, when there is heavy rainfall, garbage is washed from the inland communities into the Freeport harbour.

The problem is further exacerbated by poor drain maintenance (overgrown vegetation) which creates clogging and blockage of drains. However, the respondents were not all immediately aware of the direct relationship between plastic waste and possible flooding. The reason for this perspective could be because flooding (and its related causes) was not a major issue for some of the respondents in their communities. In the literature, the connection between plastics, flooding and climate change is not usually highlighted, but plastics contribute to climate change which will increase flood risk. Respondents were aware of the connection between plastics and climate change through the effects of burning plastics as a disposal method that contributes to GHG emissions. However, current climate change projections need to be considered, as the Caribbean is slated to experience an increase in Categories 4 and 5 hurricanes (Climate Studies



Group Mona, 2020), which can lead to more flooding. When this is combined with improperly discarded plastic waste, the flood risk profiles of local communities, particularly those in low-lying areas increases.

3.2.2.2 South Africa

Water quality and scarcity are primarily how climate change is being measured in South Africa. However, according to the National Department of Water Affairs, changes in rainfall patterns and floods have also been documented in South Africa. Additionally, the frequency of extreme storms in some regions and prolonged drought in others have been reported in recent years. Increases in persistent organic pollutants in some estuaries, including Durban Bay, Swartkops, Sundays and Buffalo systems, have also been attributed to anthropogenic impact, mainly influenced by climate change and plastic pollution.

South Africa generates 108 million tonnes of waste per annum, 90% of the waste is disposed of at over capacitated landfill sites (Figure 3). More than 300 illegal dumpsites are in KwaZulu-Natal alone and up to 200 000 tonnes of debris enter the ocean annually, 80 to 90 % of which is plastic. More than 1.7 million tonnes of plastics are produced each year: 1.4 million virgin materials and 300 thousand recycled materials. Packaging at 53% is growing as the area which utilises the most plastics, especially with increasing population and COVID-19 concerns. Transportation and medical health also consume sizable percentages.

Some of the plasticisers used can be harmful. However, the concentrations applied are not harmful to consumers and are per WHO stipulations. The concern comes from plastics that tend to be in the environment for prolonged periods. As a result, they can either attract other contaminants, thus increasing concentration above the recommended threshold or volatilise in warm temperatures, increasing the atmospheric concentration of GHG. These contribute to health issues such as cancer, but they also form part of greenhouse emissions, thus contributing to climate change. Plastic is durable, lightweight and convenient, which allows for its use in most innovative applications to mitigate climate change. However, it was also noted that plastic waste emission and biofuel consumption in making plastics do contribute to climate change.

Awareness survey results

The Durban Harbour map (Annex 8.5) shows the area where the questionnaires were distributed as well as the intervention area where the beach clean-up and workshops were



Figure 3: Durban Harbour Clean Up Report Statistics



conducted. The bar graph shows before intervention results in KwaZulu-Natal (KZN), South Africa. Before the awareness initiative, consumer surveys showed that participants who were likely to see litter in their environment were also not so likely to pick it up. Further analysis showed that participants in townships and urban areas were likely to see litter in their environment instead of rural and suburban areas. Some of the frequent responses given for littering were: scarcity of bins and lack of care. Post intervention results showed that people were more aware of the impact of plastic pollution but there was still reluctance to opt for alternatives. Single use packaging was prioritised over environmental health following the COVID-19 pandemic. Policy making and management were also outlined as significant contributors to debris abundance in KZN.

3.2.3 Stage 3: The impact of plastics and the ocean

The impact plastic has on the environment, and its contributions to climate change are beyond the apparent use of fossil fuels along its linear path from extraction to waste. Within our oceans, (Figure 4) plastic is increasingly affecting the function of the ocean, the planet's largest carbon sink, i.e., Earth's blue lungs. This section highlights the less obvious contribution plastic makes towards climate change and how this one product impacts the lives and livelihood of those in coastal communities. The focus is on reducing plastic use which will result in less plastic reaching the oceans.

Engagement with the stakeholders in coastal communities revealed the following:

1. All plastic in the ocean originates from land.
2. Plastic is a problem for both large and microscopic marine life.
3. Plastic in the ocean is impacting the lives and livelihoods of those along the coastline.
4. Fishermen nets are being filled with plastic instead of fish.
5. Plastic is in the intestine of the fish being caught in local waters.
6. Plastic in the ocean is most observed after heavy rain, and the rivers and water channels deposit their contents into the ocean.
7. Plastic on the coastlines is not representative of the volume of plastic in the ocean. Within local waters, there are miles of visible plastic on the ocean surface.
8. Plastic is also buried at sea as bottles fill with sand and water and do not float.
9. Single-use plastic items represent the majority of the waste collected in beach clean-up activities. Recent clean-up data from Pagee Beach shows plastic as the dominant waste material collected (Annex 8.6)
10. Coastal communities do not see beach clean-up activities as the solution. They see them as treating the symptoms of a larger problem.
11. Behavioural change mechanisms which begin with the people inland (at the ridge) are strongly recommended in order to reduce the impact on the sea (reef).
12. Citizens embrace community engagement and education. Education and engagement with the citizens of the Pagee Beach community began during the project. The initiative



Figure 4: Plastic debris along Jamaica's coastline



is being led by a local volunteer environmental organisation, Earth Ambassadeurs in conjunction with the community based group, One Love Outreach. The community embraces the intervention which is focused on behavioural change and environmental stewardship through education, citizen science and relationships.

13. Improved coastal waste management systems are recommended. The Pagee Beach fishing community was not included in the municipal waste management system. Community engagement includes implementing waste collection units within the area and establishing an agreement with the municipality to routinely collect the debris collected.

Data on the role and functions of microscopic organisms in the ocean is generally limited and even more so within the territorial waters of developing countries. However, interviews from those who depend on the ocean highlight the impact of the problem. In many instances, residents cannot explain the science of what is happening, but they understand the evidence. Their lives and livelihood are at risk. Plastic has blanketed their fishing space. Plastic is present in their equipment. Plastic is present in the bellies of the catch. This provides first-hand insight into the problems being experienced locally within the country's territorial waters. This investigation provides much-needed baseline data, which provides a platform for future work. Plastic in the waterways changes and degrades marine and coastal systems, which have socio-economic effects on local communities and national economies. They impact tourism, fisheries, shipping, and human health. However, other critical negative impacts such as damage to subsistence fisheries and the impacts of plastics on soft sediments, reefs and rocky substrata have received less attention. Subsequently, these communities suffer from:

- Lack of support – No support to remove the debris
- Fish and fish habitats - Plastic contaminated catch; Reduced catch – loss of livelihood.
- Plastic debris – beach attractiveness; Rivers and water channels dump waste into the Ocean; Sea takes back plastic to the coast.
- Lack of proper waste management systems.
- Lack of multi-sectoral approach to solving the problem.

In response, and to begin the path to a viable solution for the communities, the first set of knowledge exchange activities were initiated during this project. This began with educating the local communities on their roles in addressing the pollution problem, while simultaneously working towards building climate change resilience among these vulnerable communities (Annex 8.7).

3.2.4 Stage 4: Policy and Solutions: Plastic Management and Disposal Institutional and Legal Frameworks

3.2.4.1 Perspectives from Barbados

Civil society respondents were divided as to whether plastic disposal and management have been a problem in communities in Barbados. Various reasons were sighted for justification for the response. Three notable responses were:



- Inadequate data, research and monitoring of the amount of waste to adequately address the problem even though beach clean-ups recorded 1,000 pieces of plastic recovered in 2020.
- Relative to its size and population, Barbados generates significantly higher waste per person than expected.
- The government has been delayed in operationalising its intention of launching a waste to energy project.

Respondents mentioned that the aspects taken into consideration in the development of solutions and interventions included:

- Financing,
- Public Awareness
- Research requirement and data collection
- Community involvement and ownership
- Physical scope of the intervention and the extent of the benefits.

The results suggest that the successes with selected solutions to reduce and manage plastics and their impact are attributed to:

- Companies have a greater awareness of the dangers of plastics to the environment. As a result, they have increased their support through human resources for these initiatives and have explored other innovative programmes for future application.
- Some form of monitoring has been set in momentum; however, further improvements are required to reflect a more significant reduction in the number of plastics recorded during regular clean ups.
- Efforts have succeeded in keeping the beaches clean, and a significant number of plastics have been removed from the environment. However, the sustainability of these efforts needs to be enhanced.

The same traditional problems were identified with the support required for initiatives within the Caribbean region were identified, including:

- Lacking financial and other resources.
- Despite increased awareness, the plastic pollution issue is not something new and is not seen as a priority to the general citizen within this current climate. Too many competing issues that deserve attention.
- Support for activities varied depending on the economic and personal value placed on the area, such as receiving the assistance or for which the intervention was being implemented.

Members of civil society appeared knowledgeable of the impact of plastics pollution to exacerbating the effects of climate change from a mitigation perspective. Still, there is a disconnect as it relates to adaptation measures. Climate change and environmental initiatives related to environmental plastic pollution appear to operate within silos from the physical implementation of activities and financial and human resource issues. If synergies are not



established, these issues will continue to be treated as competing issues with the policy framework. The steps to move forward sustainably on both issues will continue in business as usual.

3.2.4.2 Perspective from eSwatini

The plastic management and disposal policies in Eswatini are coordinated by the Ministry of Tourism and Environmental Affairs (MTEA), and compliance with most regulations is done by the Eswatini Environment Authority (EEA). However, local municipalities, companies and individuals have a responsibility under the law to dispose of waste in ways that are consistent with the Environmental Management Act (EMA, 2002), the Waste Regulations (2000) and the Plastic Waste Regulations (2021). Therefore, in-depth interviews were conducted with one policymaker from the Ministry of Tourism and Environmental Affairs (legal department) and one supervisor of waste disposal at a municipal town council. The interviews sought to understand how plastic management and disposal were dealt with at policy and implementation levels.

Respondents were asked about the key legislative frameworks in place to deal with plastic management in the country. Respondents noted that while most of the legal and regulatory instruments dealt with waste in general, the country has made great strides in including provisions that deal with plastics. These provisions are in the Environmental Management Act (2002), the Waste Regulations (2000) and most recently, the Plastic Regulations (2021). However, as the country continues to fight against plastic pollution, interviewees noted that the EMA (2002) and the Waste Regulations (2000) were insufficient, mainly because the plastic problem continued. Consequently, as a corrective measure, the government through the MTEA promulgated the Plastic Control Regulations in 2021. These new regulations were explicitly introduced to deal with plastic pollution. In addition, it was revealed that the government had started consultations on the possibility of a complete plastic ban. If it comes in, the ban will be in the form of a ministerial gazette according to the EMA (2000) provisions.

To complement the regulatory frameworks, it was noted that the government was working tirelessly in finding solutions, strategies and plans for dealing with plastics and made an example of a Solid Waste Management Strategy that was developed in 2004, which was a key milestone. As provided for in the EMA 2002, the strategy is revised after every five years. The Solid Waste Management Strategy gives a hierarchy on dealing with waste generally, including reusing and recycling. This is where the issue of reusing plastics comes in. The National Solid Waste Management Strategy implemented projects including the buyback centres, established in Mbabane Town, Sidvashini and Matsapha. They dealt with reuse and recycling issues and made sure that waste was contained at production, usage, handling, and finally disposed of appropriately (Sizwe et al., 2021).

Interviewees were asked about the philosophy and motivation behind the regulations that Eswatini was putting in place to address plastic pollution. Answers revealed that contextual issues, significantly improved livelihoods, and population increases were responsible for the



added consumption. This consumption amplified the plastic problem by using plastic shopping bags, plastic bottles, and another packaging. One interviewee argued that the development of the regulations "was a sign of concern about the rate of plastic waste in the country" and further mentioned that "the level of worry was escalating to everyone who pays attention". To address the increased use of plastic, especially in retail shops, the government banned the production and importation of single-use plastic bags and promoted reusable plastics. It was noted that the fight against plastics was a collective effort between the government, producers, and consumers. As such, all were encouraged to abandon plastics, especially the single-use ones. Producers were encouraged to diversify their products and be involved in recycling and reuse practices. One interviewee mentioned that the Plastic Control Regulations (2021) motivation was not to punish producers and users but to encourage plastic users to purchase or use reusable plastics. Manufacturers were urged to manufacture plastics on the acceptable threshold. A levy was placed for manufactures who defy.

The Plastic Control Regulations (2021) also aimed to encourage businesses to recycle and for consumers to separate waste in their homes and make it easy for waste collections authorities to send plastic materials to recycling companies. The provisions on reusing and recycling plastics in the Plastic Control Regulations are complemented by the Waste Regulations of 2000, the Solid Waste Management Strategy and the EMA of 2000. While these laws and regulations do not impose a complete plastic ban, they all worked to deter the production and distribution of "a certain type of plastic which was non-re-usable".

"Phatsa Sakho Nawe" – Campaign to End Retail Use of Plastics as seen in Figure 5.



Figure 5: Campaign to End Retail Use of Plastics

Interviewees noted that in February of 2021, the Eswatini government, working with the United Nations Development Programme (UNDP), introduced the 'Phatsa Sakho Nawe (Bring your Bag)' campaign with the view of encouraging shoppers to use reusable bags and abandon plastics. One respondent mentioned that the campaign was still at a pilot phase to understand how consumers were aware of the damage caused to the environment by plastics and bring



them closer to the issue of reducing plastic use. The government "observed a generous receptiveness as consumers are working with them and submitting ideas on eliminating the issue of plastics. The pilot phase has produced positive results, and a total plastic ban is in the pipeline". The campaign is meant to get buy-in from users and ultimately to have consumers spreading knowledge on the benefits of a plastic-free society. The programme was popularised through awareness campaigns on national radio and other mediums. The interviews revealed that all retail shops in the country have embraced this initiative and are no longer giving shoppers plastic bags between Thursday and Monday. Plastics are only given on Tuesday and Wednesday. One interviewer noted that the campaign had become successful beyond what the government had imagined.

The 'Phatsa Sakho Nawe' campaign was seen as proving beneficial to plastic management and the environment and has contributed to economic benefits for small-scale cooperatives that have started producing reusable plastic bags for shoppers. These bags are now sold in all major retailers, and shoppers can use hand-made and beautiful, environmentally friendly shopping bags.

Plastic Regulations and Link with National Climate Policies

Eswatini submitted its National Determined Contributions to the United Nations Framework Convention on Climate Change (UNFCCC) on October 12, 2021. Interviewees were asked the extent to which the country aligned its waste and plastic regulations and ambitions to its climate change action ambitions. One interview responded and said that the country's NDCs "were committed to mitigating the adverse effects of climate change. The Ministry anticipates a dramatic decrease in emissions from the waste sector after implementing the plastics waste management regulation".

3.2.4.3 Perspectives from Jamaica

The legal framework of solid waste management is composed of the National Solid Waste Management Policy and the National Solid Waste Management Act, along with the Public Cleansing Regulations, the Public Health Act of the Ministry of Health and the Trade Act, which regulates the scrap metal industry (recycling initiatives).

The National Solid Waste Authority is responsible for collection, transport and disposal of waste island-wide and simultaneously acts as regulator of the sector. Plastic is considered an environmental matter and falls under the purview of the National Environment and Planning Agency.

The Government of Jamaica took the initiative to implement two Orders which are intended to ban the importation, distribution, manufacture and commercial use of certain types of single use plastics beginning January 1st 2019. First, The Trade (Plastic Packaging Materials Prohibition) Order, 2018, and second, The Natural Resources Conservation Authority (Plastic Packaging Materials Prohibition) Order, 2018. The ban was implemented in phases starting January 1, 2019 to include:



- Phase 1
 - single use plastic bags made wholly or in part of polyethylene or polypropylene of dimensions 610mm X 610mm (24" x 24") and 0.03mm (1.2 mils) in thickness or less;
 - drinking straws, made wholly or in part of polyethylene or polypropylene, manufactured for single use.
- Phase 2 (Implemented January 1, 2020)- Packaging made wholly or in part of expanded polystyrene foam used for food and beverage containers;
- Phase 3 (implemented January 1, 2021)- Single use drinking straws made wholly or in part of polyethylene or polypropylene used for juice boxes or drink pouches and plastics bags with dimensions of 610 mm x 610 mm (24" x 24") and 0.06 mm (2.5 mils) thickness.

Certain types of plastics are excluded from the ban including plastic packaging for certain foods, the medical field and straws for persons with disabilities. Recognising that the ban does not cover all types of plastics and more comprehensive measures are required to adequately manage and regulate plastic pollution, the Government of Jamaica continues to explore additional feasible policy options. Immediate future measures under consideration include the introduction of new solid waste management regulations inclusive of requirements for sorting at source and a voluntary Deposit Refund Scheme for PET plastic bottles.

3.2.4.4 Perspectives from the Seychelles

The regulations on plastic bags forbid the importation, manufacture, or distribution of plastic bags for use in Seychelles unless the object is listed in the regulations as exempted (Regulations on Bags, art. 3.) As an alternative, biodegradable bags are to be used instead. In addition, the regulations allow some exceptions to the ban. Therefore, Seychelles has recorded significant progress in plastic pollution, which used to be a significant problem before the year 2017. However, biodegradable, and reusable bags are being promoted by the Department of Climate Change and Energy and the progress made is not evident.

3.2.4.5 Perspectives from South Africa

Southern Africa, a region with high urbanization, leading to increased resource use and plastic consumption, heavily reliant on tourism, an industry highly impacted by plastic pollution. Waste management emerged as the most important policy driver and over 55% of SADC members (including South Africa) adopted a top-down approach in developing these policies to address these environmental challenges.

South Africa passed a law to ban single-use plastic bags in 2002 yet plastics remain one of the popular waste streams found in illegal dumping sites, landfill sites and oceans. For example, the latest National State of Waste Report indicates that over 50% of plastics in South Africa still end up in landfill sites. The current policy instruments have proven to be ineffective in delivering the expected results. There are persistent challenges with respect to compliance and enforcement. South Africa also witnessed the increase in plastic bag use over time, since the promulgation of the above policy instruments.



4 SYNTHESIS OF THE FINDINGS

4.1 Our common linear plastic problem

Stage 1: Manufacturing and Production

Each country involved in the study possess unique characteristics which allowed for a more deliberate stakeholder strategy along the linear plastic life-cycle. Since South Africa is the only fossil fuel mining country in the group, the study targeted manufacturers and producers within that jurisdiction. It is assumed that the position taken by the respondents reflects to some degree the general sentiments of some primary producers. Plastic production is expected to more than double by 2040 and oceanic plastic pollution is expected to triple. At that point plastic will account for up to 20% of the entire global carbon budget. There is clearly little effective drive to introduce alternative materials to plastics, as plastics are still seen as essential for hygiene and packaging purposes, particularly following the COVID-19 pandemic.

At the production level, consumers are perceived as driving plastic demand as reflected in Seychelles and Jamaica (Annex 8.8), as consumers seek out inexpensive and light weight packaging products. In 4 of the 5 countries, producers mainly use plastic as input, primarily for packaging. Across developing countries, poor product design and lack of infrastructure means that the majority of the plastic waste ends up in landfills or in the environment. This failure on the part of manufacturers effectively shifts the responsibility to consumers, who have little flexibility in their choices.

Stage 2 – Impact on Land

Across all the countries in the study, there is a general acknowledgement that plastic is problematic and that there needs to be some intervention to stop plastics from entering the environment. However, there seems to be very little understanding of the impact of plastics on marine life, nor of the connection to climate change. This could be as a result of the lack of communication around the subject and the failure of all countries to implement behavioural change mechanisms that could stimulate the desired response to the current problem, and reduce the overall use and impact of plastic. A decline in demand could translate into a reduction in its direct contribution to climate change at Stage 1 and an even further decrease as waste. As waste, plastic is costly. Managing plastic waste costs some US\$32 billion annually and developing countries bear a disproportionate share of this cost. These countries lack the facilities to separate or process this waste and so other social and economic problems emerge.

Stage 3: Impact on the ocean

Oceans play a central role in climate change mitigation as they act as carbon sinks and absorb harmful toxins. Beyond their role in acting as carbon sinks, oceans play an essential role as essential habitats for sea life and form a vital part of the terrestrial life support systems for humans. Commitments to ocean preservation are reflected in the Paris Agreement Article 6 (especially the implementation of subsection 8 - on collaborative non-market approaches, to matters relating to adaptation under the Katowice Committee of Experts, matters relating to



Local Communities and Indigenous People's Platform (LCIPP). Initiatives that support sustainable Ocean and Climate Action Acceleration, implemented in developing countries, empowering local communities, indigenous populations and focusing on women, directly contribute to the Sustainable Development Goals 2030 Agenda. SDG 13 (Action for Climate) can be used as a vehicle for channelling the contribution to other SDGs such as Gender Equality (SDG 5), Poverty Reduction (SDG 1), Clean Water (SDG 6) or Decent work and economic growth (SDG 8), among others.

Stage 4: Response

All five countries have adopted a one size fits all top-down legislative approach to addressing the plastic problem. However, each country has unique aspects of culture and institutional structure which require tailored responses.

While the scope of the study did not allow a fully detailed examination of the reasons for all of findings, the investigation revealed three factors that do much to explain the challenge that exists for developing countries.

4.1.1 The complexity of the problem

Climate change is a complex matter when compared to more visible cause-and-effect environmental issues. It is hard to see the connections between fossil fuel production in one part of the world, plastic manufacturing in another part, and hurricanes and floods somewhere else. This contributes to the problem of jurisdiction.

4.1.2 The problem of jurisdiction

We currently attribute greenhouse gas emissions to individual countries under the United Nations Framework Convention on Climate Change but plastic production, like aviation and global shipping is not included. Furthermore, there is no *legal architecture* that sanction those who increase their greenhouse gas emissions. The Paris Agreement and pledges made at the recent COP26 are just that - pledges. There is still ongoing debate about when GHGs will peak since the Paris Agreement stipulates that it should 'peak as soon as possible' but there is still no plan to leave fossil fuel in the ground (and given the \$5.9 trillion worth of subsidy which the industry received last year, there is little real intention either).

Under the general heading of environmental stewardship, various solutions to address the problems of plastic waste have been considered and some have been implemented. There is no universally accepted response due partly to the varied sources, pathways, and persistence of the different forms of plastic debris. Regulatory approaches have been the norm. Some civil society groups have acknowledged that plastic pollution exacerbates the effects of climate change from a mitigation perspective, but few see plastic waste management as adaptation measure. So climate change and environmental initiatives related to plastic pollution appear to operate largely within silos. If synergies are not established, these issues will continue to be treated as competing issues with the policy framework.



Measurement and attribution is a first step towards accountability. But measurement without accountability is pointless, especially where people are skeptical of cause and effect. Greenhouse gas emissions affect people thousands of miles away from their source which makes it easier for people to believe that the problem is not the fossil fuels or plastic at all, just the weather pattern or an act of God. Hence, the link between jurisdiction and accountability is weak.

4.1.3 Tragedy of the Commons

This concerns the lack of collective action and trust. People may understand what they should do, but as individuals, they are not always willing to act on that understanding because they believe no one else will. This is why government legislation is the default response to problems requiring collective action. Clearly, however, this does not work in this area.



5 RECOMMENDATIONS

The solution to all three of the above issues would involve a methodical approach that would encompass all aspects of the problem. This would require determining the baseline conditions; evaluating the enabling environment, assessing the sustainability of the proposed actions, conducting significant stakeholder engagement, carrying out extensive education and awareness-raising initiatives; ensuring the availability and accessibility of sustainable alternatives, providing incentives for behavioural change, and investing in environmental programmes that promote international cooperation and innovation. Measures should not be abrupt or coercive, but introduced through stages and progress through phases.

Not all developing countries are involved at the fossil fuel stage of the plastic life-cycle, but all of them are involved at the other stages, and they contribute to climate change. The climate challenge for them lies in their particular vulnerabilities. It is therefore incumbent on each country to begin to identify ways to reduce their contribution to climate change and address the climate related problems stemming from their plastic use and treatment. Based on the experiences from the country case studies and the literature, a four-pronged framework is being recommended as a guide to streamline and reduce plastic use and ultimately its impact on the marine environment (Figure 6).

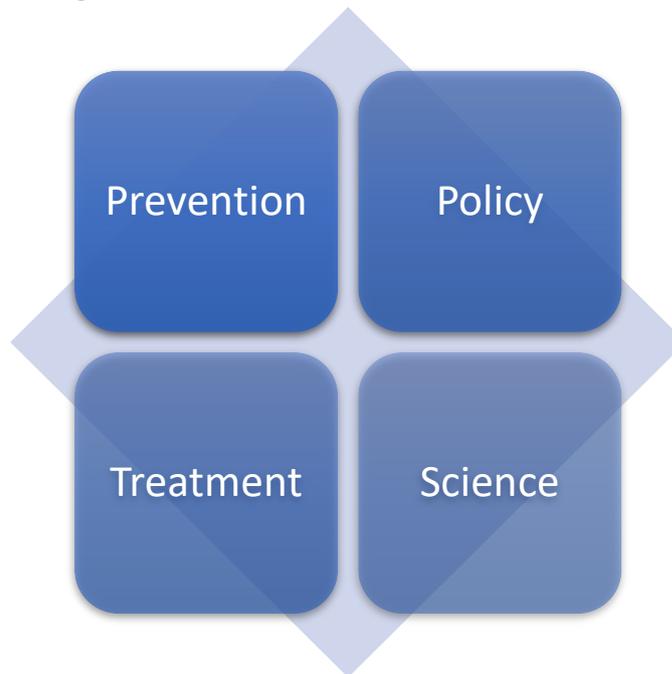


Figure 6: Developing Country Solution Framework

These broad headings can be further broken down into strategies and policy interventions. These proposed strategic measures and policy interventions are aimed at providing a holistic response to mitigating the flow of plastics into the ocean along the plastic life-cycle, including reducing plastic use, plastic waste, and improving waste management to reduce plastic leakage. This approach is not a one-size-fits-all solution. Each country will need to design the required time-frame and related actions needed to for their local situations.



Addressing climate change at any level requires that all people participate in processes that lead to planetary restoration. People's actions are heavily guided by culture and traditions. Specific to the developing countries, new approaches need to be developed that are culturally focused. This would require extensive stakeholder engagement than what is being done currently. In most instances, community involvement is more superficial than genuine.

Prevention

The key to prevention is behavioural change. It is only when people change their behaviour based on an understanding of consequences to action that change is sustained. This means that any initiative aimed at prevention must include an understanding of human behaviour. This again will be based on local customs and culture and will therefore take a hybrid approach. Other factors to consider include:

- Better infrastructural planning and implementation
- The introduction or enforcement of anti-litter legislation
- A change in the conversation from waste management to waste prevention
- Raising awareness of social, economic and environmental cost of plastic.
- Introducing messages on plastic packaging
- Documenting and sharing best practices across communities
- Strengthening community based systems for waste reduction

Policy

All countries already have some form of policy in place which focuses on treating plastic as waste, with no connection between plastic and climate change being made. Further revision is necessary to improve on the foundation that is already laid. Where plastic legislation already exists, the focus - for example in Jamaica and in the Seychelles - is on trade (e.g. imports). However other policy mechanisms could take account of:

- Plastic littering being included in the overall waste management policy and planning
- Establishment and implementation of the Extended Producer Responsibility system
- Gradual removal of consumer based subsidies on plastic and transfer of subsidies to plastic alternatives to encourage a change in consumer behaviour.
- Introducing mandatory plastic waste separation and collection
- Setting targets for plastic waste separation and collection
- Standardising separated plastic waste collection and transportation

Treatment

Policy interventions can have immediate impacts on plastic use. However, in order to create a long term solution, policy makers and practitioners need to establish sustainable (economically viable, environmentally friendly and socially acceptable) treatment models which include recovery and recycling. This might include, for example, plastic waste recycling into new resins that can be returned into the value chain, reduce the carbon footprint and yields energy savings, although it can be very challenging to make these solutions work at the small scale of island nations at the far end of global supply chains.



Science

Missing data is a problem across all countries. For example, it is difficult to trace the effectiveness of established policies, as baseline data was never recorded. It is important therefore for countries to:

- Develop baseline data and an affordable methodology for assessing and monitoring the plastic problem.
- Engage a multisectoral approach for problem assessment and solution identification which is based on research.

6 CONCLUSION

Current responses to the plastic issue focus primarily on the consumer, which results in plastic being treated as a waste problem, rather than a production and consumption problem. Developing countries are ill-equipped to deal with the waste, and should therefore focus on a more holistic response to the plastic problem. A multi-sector response that combines behavioural change mechanisms primarily through community engagement tools, alongside policy and legislative initiatives, is more likely to be successful. The grassroots innovation and transition initiatives of community-based contributions towards a transition to a low-carbon society serve to inform larger-scale policy changes as well as delivering bottom-up improvements in social practices and behaviour. By engaging local communities from ridge to reef, we can reduce ocean pollution, preserve ocean health, increase resilience to climate impacts and reduce overall GHGs emissions.



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8. ANNEXES

8.1 Interview and Survey Question

Aspects of Plastic Pollution

- Demographics - Age, Gender, Employment, Occupation, Income level, number of persons in household
- Educational level, name of community they live in
- How long have you lived in this area?
- What are the items used by your target audiences that require plastic packaging?
- Are plastics a nuisance in your case area?
- If yes, which plastics are a nuisance in your case area? Specifics or break down
- Are there any stats available with the breakdown of plastics use in your case area?
- What are these plastics used for in your case area? Food, drink, furniture, stationery etc.
- How do persons dispose of the plastics?
- Do you separate your garbage?
- Do these plastics litter roadways or drains? Has this led to flooding?
- Does the community experience flooding related to plastic use?
- If there is flooding or water build up what types of damage or loss is experienced in the community?
- Has the plastic litter ended up in the ocean?
- Has that done anything to marine life? If so, what?
- Is there any impact to livelihood or human health?
- What is the plastic policy for your region, case area? i.e., are their restrictions allowances?
- Are there redemption programmes?
- What laws exist for manufacturers or importers of plastic in your case area?
- What laws exist for retailers, wholesalers, or user of plastic products in your case area?
- What public awareness campaigns exist?
- Do you experience flooding in your community?
- Are there areas that water accumulate / build up when there is a heavy downpour?
- Do plastics contribute in any way to flooding?
- Has the community done any beach clean ups?
- What are the most common items of garbage that you can identify along the coast?
- When is debris along the shoreline most noticeable?
- Is your waste collected by the Solid Waste Agency? If yes, how frequently? If not, what happens to the garbage?
- Does the community organise any activity to reduce/remove the garbage present?
- What are some of the problems that you can identify as a result of the garbage on the shoreline?
- What happens when the garbage goes out into the ocean?
- Have you noticed plastic in the sea?
- Describe the impact you've observed. How is plastic affecting life in the sea (how plastic affects the fish, reefs, etc.)
- How would you describe the impact plastic has had on your livelihood as a fisherman?



- Are you seeing plastic in your catch? If yes, please describe the types and what is being affected by the plastic that you are collecting.
- What do you do with the plastic that comes up with the catch?

Community Based Approaches/Civil Society Organizations - Best Practices

How long have you lived in the community?

- Less than 1 year
- Less than 5 years
- Between 5 to 10 years
- Between 15 to 20 years
- More than 20 years
- Other

What type of livelihood are you engaged in?

- Agriculture/Farming
- Fishing
- Construction
- Education/Research
- Office/Administration
- Environmental
- Law/Political
- Medical
- Other_____

How long have you worked with the organisation?

- Less than 1 year
- Less than 5 years
- Between 5 to 10 years
- Between 15 to 20 years
- More than 20 years
- Other_____

How long have you worked with this community?

- Less than 1 year
- Less than 5 years
- Between 5 to 10 years
- Between 15 to 20 years
- More than 20 years
- Other_____

What is your role and responsibility? (Open ended)

Has plastic disposal and management been a problem in your community?

- Yes
- No



If yes,
why _____

- When was the first time you noticed that it was a problem? (Open ended).
- What steps have been taken to help to address the management and disposal of plastics in your community? (Open ended- Examples and Dates).
- What role have you played in the implementation of these activities? (Open ended)
- What aspects did you consider in producing these interventions? (Open ended)
- What have been some of the challenges in implementing these activities? (Open ended)
- What have been the successes with implementing these activities? (Open ended - Specific examples)
- Has external support outside of the community been provided to help the situation? (Open ended)
- Have the measures undertaken been adequate?
 - Yes, why? _____
 - No, why? _____
- What would your recommendations be as to the best way forward? (Open ended)
- Have these activities helped the community and environment in any way?
 - Yes, why?
 - No, why?
- Are you aware of any policies, regulations, and laws in place to deal with waste management and disposal?
 - Yes, Examples? _____
 - No
- What is the extent of the community's involvement in policy formulation? (Open ended)

Policy Approach to Plastic Management and Disposal

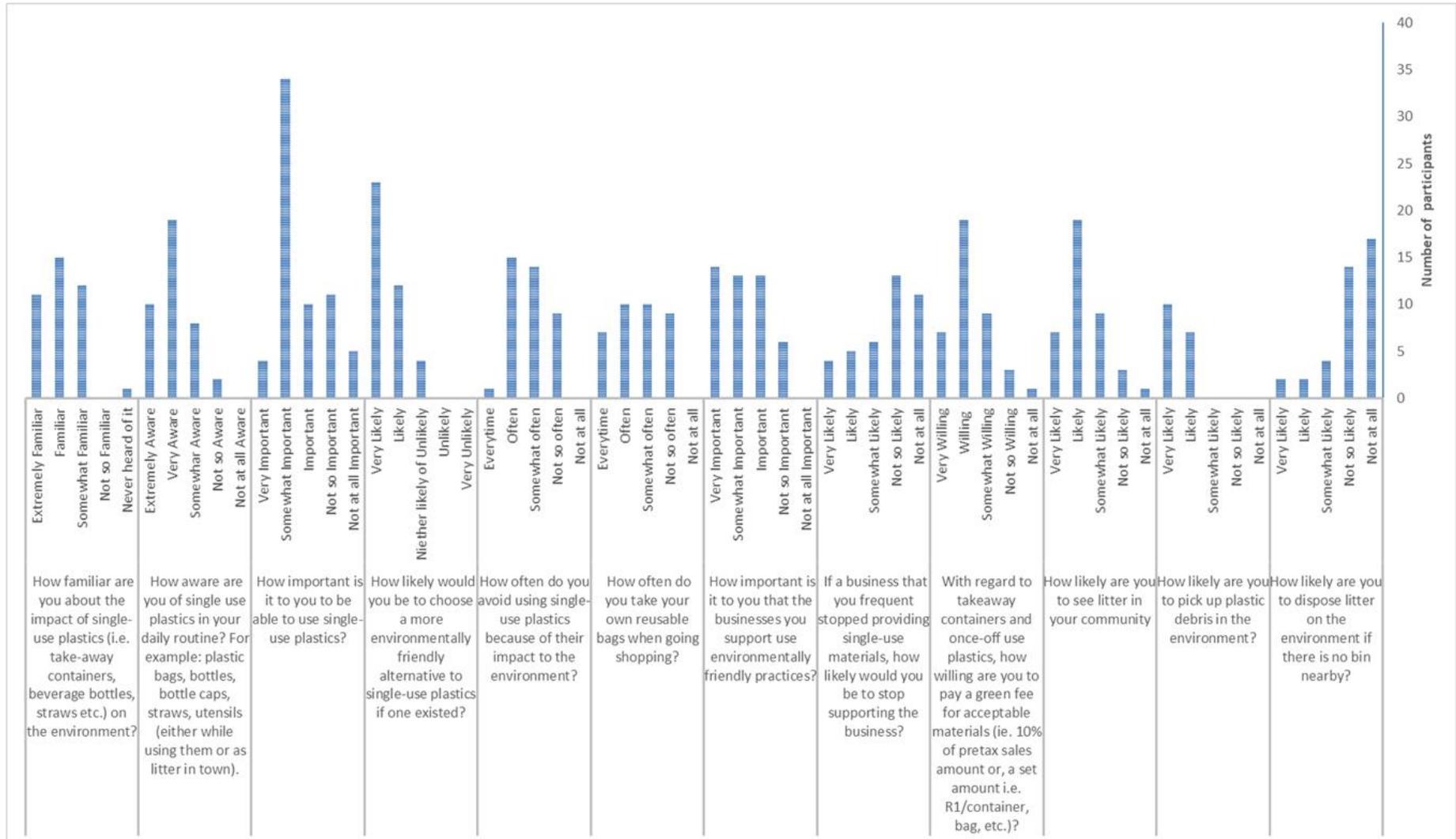
1. Demographic Data: What is your role and responsibilities in plastics waste management & disposal?
2. How long have you served in this capacity?
3. What policies, regulations and laws are in place to deal with waste management and disposal?
4. From the policies you mentioned, are there any policies that seek to provide alternatives to plastics?
5. What policy is available to ensure their sustainability?
6. Do you have recycling and re-use programs?
7. What aspects did you consider in producing these interventions?
8. What must be done for your country to improve waste management and disposal at the policy level?
9. Are there adequate institutional frameworks responsible for waste management and disposal?
10. If you were to suggest or recommend a policy, regulatory and legal intervention, what will that be? Why?
11. How far does the government go in ensuring citizens' involvement in policy development and formulation?
12. Does the public understand the government's aspirations and how is this communicated?



13. What is being done to reduce plastic from the point of production? Are there programs to create alternative jobs and businesses for the business and individuals involved in the production of plastics?
14. How much is plastic waste regarded as a climate problem in your country?
15. Has there been any link between policies aimed at curbing plastic use and the country's efforts towards emissions and pollution reduction?
16. What policies are in place to reduce/limit plastic production?
17. Are there policies that regulate the importation of plastics?
18. Are there tax rebates to ensure reduced production?
19. Which actors/sectors of the economy consume plastics the most?
20. What is being done to reduce plastic consumption, especially from the identified sector?
21. What policies, if any, to provide alternatives to plastic use?
22. How effective and sustainable are these?
23. Are there any policies to increase the price of plastic packaging? How far have these gone reducing plastic consumption?
24. Are there deposit refund schemes?
25. Disposal
26. Are there specific policies to regulate the disposal of plastics?
27. What is the level and frequency of monitoring for compliance?
28. Are there tax rebates or reliefs for companies that have the best plastic disposal strategies?
29. Do you have any tax rebates to encourage investments in recycling?
30. Do you have specific policies to ensure waste separation at the source?
31. Are there any plastics meant to substitute plastic packaging with paper or cloth packaging?



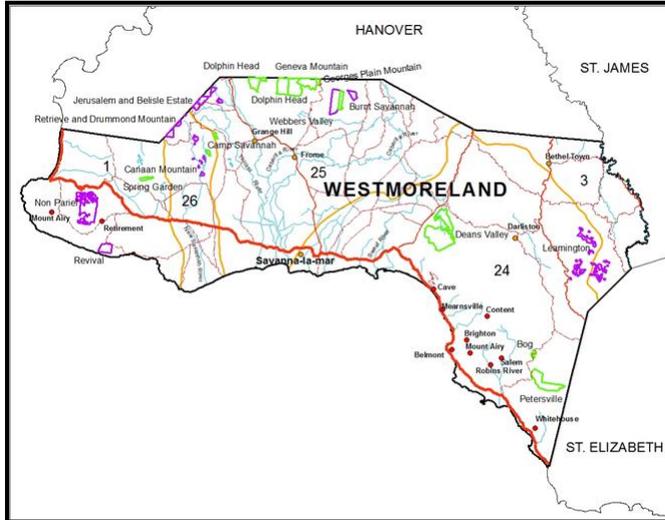
8.2 Results from Consumer survey conducted in South Africa





8.3 Maps of Western Jamaica

8.3.1 Westmoreland Parish in Jamaica, highlighting areas visited and where residents were interviewed



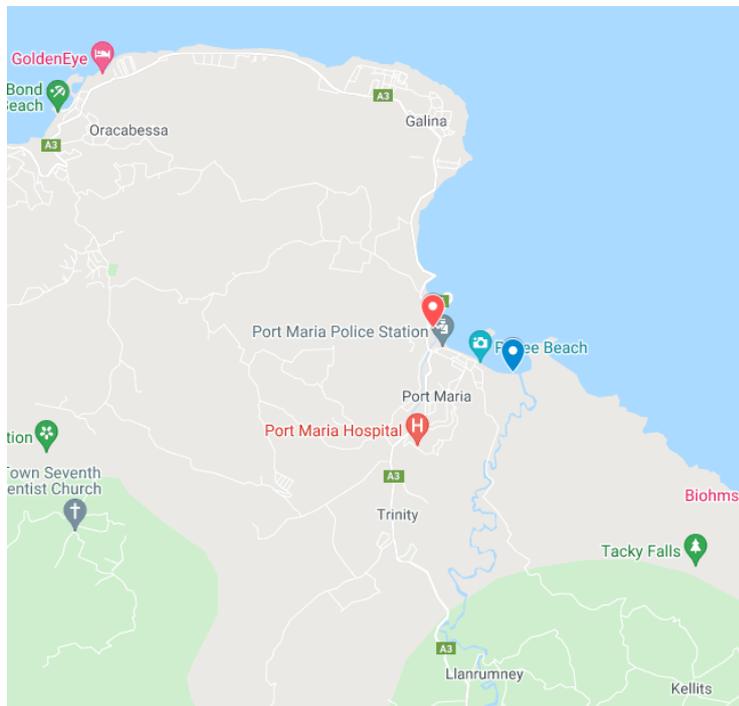
8.3.2 Map of St. James Parish in Jamaica, highlighting areas visited and where residents were interviewed



Source: St. James Municipal Cooperation



8.4 Areas in St. Mary where data was collected

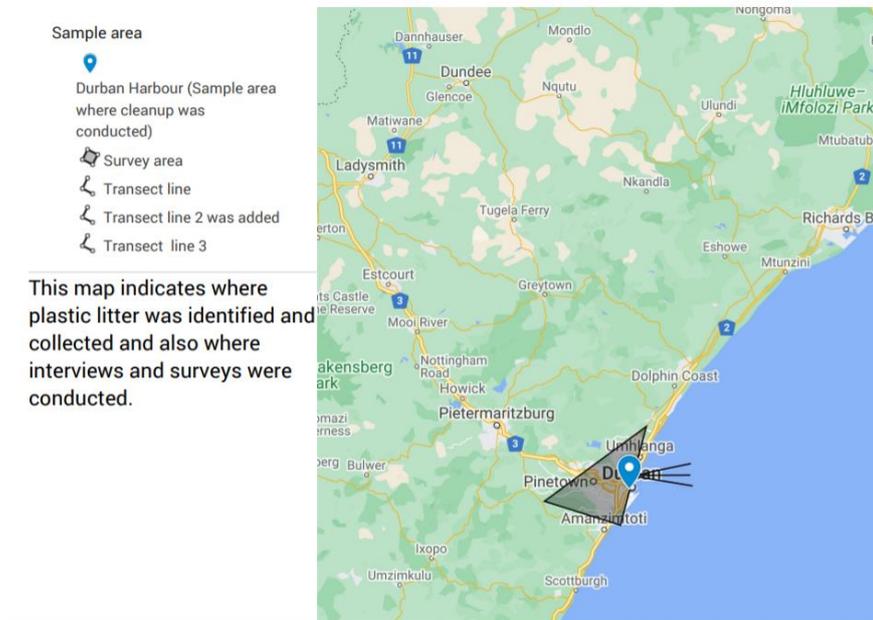


 Coastal community Port Maria

 Fishing community Pagee



8.5 Durban Harbour survey map



Welcoming and introduction of project



Signing in for registration



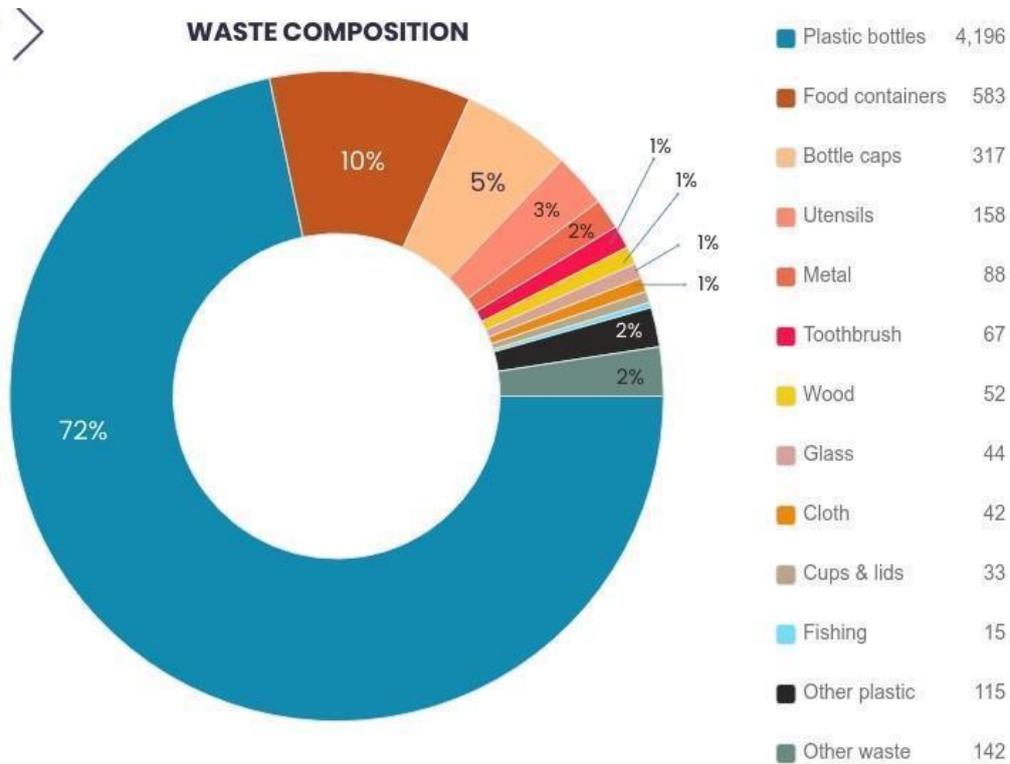
Presentation of Project aims, objectives and workshop



Equipment distribution



8.6 Pagee Beach collected waste composition (units)





8.7 Pagee Beach community engagement



Knowledge exchange session registration (August 2021)



Briefing the attendees



3 of 6 garbage collection drums donated to the community drums



Community members accepting ownership of the drums



8.7 Plastic and Climate Change: The case of plastic in Barbados, Jamaica and South Africa

DESCRIPTION	BARBADOS	JAMAICA	SOUTH AFRICA
LITERATURE REVIEW			
Plastic Manufacturing	Like its Caribbean counterpart Barbados does not mine fossil fuels so it would serve mainly as a distributor of plastics.	Fossil fuel is not mined in Jamaica and therefore the building blocks for making plastic are not immediately available.	There is a total of 52 plastics manufacturing companies in South Africa. They include Sasol and Safripol which are fossil fuel mining companies. These two companies dominate plastics producers in South Africa. Other plastics companies include Berry Astrapak, (RPC Astrapak), Nampak, Transpaco, Mpack and Polyoak Packaging and other players such as NCS Resins
Plastic Production	Plastic products are made locally from imported pellets. The research reveals approximately 5 or 6 suppliers and manufacturing. These products are mainly used for packing (including use in the supermarket) and plastic bottles.	Plastic products are made locally from imported pellets. There are approximately 45 registered manufacturing companies (S & P Global, 2021) who collectively employ approximately 1500 individuals. These products are used primarily for packaging (in addition to transportation packaging). The primary product being produced is plastic bottles. SUP bottles for water and juices represent the primary demand, followed by those for bulk liquids (1.9 litres/2 and 3.78 litres) (Conversation with local producer).	According to Plastics South Africa, South Africa uses 8 billion plastic bags a year. only a few companies are involved in the manufacturing of plastics but a large number of companies convert micro pellets into final products (Research and Markets, 2021). The South African government announced regulations banning the production of thin-film plastic shopping bags. The government pronounced that thin-film plastic shopping bags had no economic value and were discarded. This led to reductions in overall plastic production and job losses.
Plastic Consumption	In 1993, 2005 and 2015 plastic waste amounted to 9 16.8 and 12.2 tonnes per day (Solid Waste Management Programme 2016). The International Coastal Clean-up in Barbados in 2019 reported collection of 34,105 pieces of plastic. Studies have found as many as 200,000 pieces of plastic per square kilometre in the Caribbean Sea –	It is estimated that 600 million PET bottles are used each year (locally) (Cross, 2018).	South Africa ranks as the 11th country (out of 192 countries) with the highest level of mismanaged plastic waste entering the ocean (Jambeck et al., 2015). It is third in Africa after Egypt and Nigeria. In South Africa, plastic bag use is still widespread despite intervention efforts based on levying taxes.



	estimated at 3 times the global average (UNDP, 2019).		(JoshuaO'BrienGladman 2019). Single packaging constitutes upwards of 54% and is also increased by the impact of COVID-19. Consumers have increasing driven the consumption of single use higher and higher since the onset of the COVID-19 pandemic.
Plastic Disposal	The Returnable Containers Act (1986) an Act to provide for the control of the sale of beverages in beverage containers, the payment of a deposit on beverage containers, a refund for the return of those containers and the final disposal of unused or usable containers, has worked well to reduce the amounts of plastic beverage containers entering the landfill.	Plastic is disposed of as a part of the regular garbage. Approximately 15% of residential waste is plastic (CAPRI, 2017). There is no documented amount for commercial waste. Approximately 66,000 tonnes of residential waste is generated monthly, of which, approximately 15% of is plastic (CAPRI, 2017).	Disposal in South Africa has been largely mismanaged. The informal sector plays a critical role in proper waste disposal in South Africa. Separation into different types of plastics is normally done by informal workers (also not as waste pickers).
Waste Treatment	The Integrated Solid Waste Management Programme includes a Waste Management Centre at Vaucluse St. Thomas which represents a Public Private Partnership (PPP) initiative called the Sustainable Barbados Recycling Centre or SBRC. After processing at the SBRC Facility, the amount of waste that leaves the Facility for disposal is reduced to approximately 670 tonnes of which 300 tonnes goes to landfill. All household and institutional waste collected is taken to this Facility to be processed.	Jamaica currently lacks the necessary capacity to collect and dispose of its solid waste in an efficient and environmentally sound manner. It has not been given the attention it requires as it has to compete with other pressing economic and social issues such as fiscal deficits, poverty and unemployment. Consequently, only 75% of Jamaica's solid waste is disposed of in legal dumpsites. The uncollected waste is either buried, burnt or littered, often ending up in drains, rivers, gullies, beaches and ultimately the ocean. In recent years several reports in the Jamaican media have highlighted the resource deficiencies of the National Solid Waste Management Agency (NSWMA) citing shortages of trucks for garbage collection and frequent garbage pile-ups. NEPA (2021) points out that “there has not been a recent waste characterization study since the implementation of the ban so it is not clear whether the ban has resulted in a reduction of the banned items in the waste stream. Despite this, data from the 2019 Jamaica Environment Trust International Coastal Cleanup Day indicates that plastic bags collected in 2019 increased by 8.2% when compared to 2018, plastic straws collected in 2019 decreased by 33.4% when compared to 2018 and Styrofoam collected in 2019 increased by 1.6% when compared	Historically, much marine debris has been disposed of in landfills in South Africa. Companies are becoming aware of their environmental responsibilities and are including recycled plastics in their products, creating a market for these materials (The Coca-Cola Company, 2019). A relatively new concept for the use of marine plastics is in the construction industry. Some companies use plastic products as part of building material (Sasidharan et al., 2019)) Reclaimed mixed plastics are used to create plastic lumber products through partial-melting and extrusion processes. Types of plastics that can be used include polyethylene (PE), polypropylene (PP), polystyrene (PS) and polyvinyl chloride (PVC) (English and Falk, 1996).



		<p>to 2018.” (p. 31) This is not necessarily an indication of a worsening problem, but may be a reflection of an increased number of volunteers, allowing for more waste to be collected. “A waste characterization study will need to be carried out to confirm if there have been actual reductions in the waste stream” (NEPA, 2021, p.31).</p>	<p>A portion of the binder in roads is replaced with reclaimed mixed plastics including PE, PP, PVC, ethyl vinyl acetate (EVA) and tyre rubber (Brasileiro et al., 2019).</p> <p>These plastic bricks also known as ‘green bricks’, contain recycled multi-layer post-consumer plastic waste and glass.</p> <p>Refuse derived fuels (RDF) made from dirty, non-recyclable waste, can be used in the place of coal. There is no mention of the feedstock composition. Pyrolysis Group operate and construct pyrolysis units that convert mixed plastic waste into high grade fuel. To date this process has only been used on a commercial scale for the production of diesel fuel from PP recycling is driven by ‘economic principles’, and therefore, if a waste management technology is unable to make a profit.</p>
<p>Land-based related consequences</p>	<p>Studies have shown that tourists are unwilling to return to areas with poor water quality and degraded beaches. Schumann et al. (2017) reported that tourists in Barbados indicated strong preferences for clear water, healthy coral reefs, and high-quality beaches—all of which may suffer due to pollution—and were unwilling to return to the country if these conditions worsened. The tourists interviewed were also willing to pay considerably more for improved marine and coastal resources including wider beaches, better water quality, and greater coral and fish diversity</p>	<p>In October 2020, the National Works agency stated that plastic bottles were partly responsible for flooding in sections of St. James. Two critical drains, Chelsea and Blue Diamond, were blocked due to plastic bottles and other debris, which resulted in flooding, particularly in the Green Pond area and the main road leading to Montego Bay. In some areas, persons in buildings experienced calf-high water (height of water). (The Den News 2021).</p> <p>In cases like these, when the water level is that high (calf length) there is also the possibility that humans can become electrocuted, especially if electricity lines are on the ground or underground. This was the case in the Greenvale community in Trinidad and Tobago and can occur in Caribbean nations or developing nations faced with similar conditions / circumstances (Cross, 2018).</p>	<p>Numerous formal solid waste and waste-water management facilities in South Africa are partially functional, which leads to plastic releases to the environment. Illegal dumping also adds to land waste pollution. Once in the environment, plastic can be transported and distributed by air, into various parts of the land depending on the size and type of plastic and environmental factors like wind action and run-off (Verster and Bouwman, 2021). Key reasons considered for the loss of plastics to the environment were lack of waste removal infrastructure, logistical challenges in informal settlements and out-lying communities, poorly managed waste, and littering.</p>



		<p>A flooding incident on Marcus Garvey Drive, one of Jamaica’s busiest thoroughfares, in September 2016 resulted in J\$200-J\$300 million loss for the Sugar Company of Jamaica; the company suffered damage to their building and much of their equipment was severely damaged or destroyed. A flooding incident in Montego Bay in November 2017 caused significant damage to infrastructure, buildings and personal property, the cost of which was estimated to be J\$1 billion CAPRI 2017)</p> <p>No local information on plastic in the soil.</p>	<p>Solid waste removal is primarily a function of local government. According to the 2018 <i>South African State of Waste</i> report (SoWR), total non-mining waste generated in South Africa for 2017 was 54.2 million tonnes, which is 1.0 tonne per capita of 56.5 million people. South Africa generated 1.1 million tonnes of plastic waste in 2017 equating to 19 kg plastic per capita per year, or 53 g per person per day.</p> <p>SoWR reported that 43.7% of plastic waste is recovered and/or recycled, with the remainder disposed of (618 880 tonnes). Assuming that 29% of the 12.7 million tonnes of household waste does not enter the formal waste management stream, 3.67 million tonnes of waste is mismanaged plastic in South Africa. Of the domestic waste handled, 11% per mass is plastic and tyre waste. Assuming a similar proportion of unmanaged waste is plastic and tyre waste, South Africa releases 440 000 tonnes of unmanaged plastic waste into the environment South African Department of Environmental Affairs (DEA). (Department of Forestry, Fisheries and Environment, 2022).</p>
<p>Ocean-based related consequences</p>	<p>The impact of plastic on commercially valuable fish species coupled with overexploitation pose significant challenges to blue economy livelihoods – fishers, vendors, processors, restaurateurs and others.</p>	<p>SUPs and Styrofoam items tend to be the top 10 items collected from coastal areas on International Coastal Cleanup Day. In 2018 and 2019, the top 10 items collected were plastic bottles, plastic bottle caps, foam pieces, plastic pieces, other plastic bags, foam cups and plates, food wrappers, plastic cups and plates, glass beverage bottles, foam takeaway containers. The type of plastics that tend to accumulate in the coastal areas are Type 1 (PETE), Type 4 (LDPE), Type 5 (PP) and Type 6 (PS) Plastic Pieces could be a combination of the different types of plastics.</p>	<p>Jambeck et al. (2018) ranked South Africa 11th in a list of countries contributing an estimated 90 000 to 250 000 tonnes to marine plastic in 2010, based on an estimate of 56% mismanaged waste with little actual supporting data.</p> <p>South Africa is predicted to be the 11th worst global offender in terms of leaking land-based plastic into the ocean, ranking third in Africa after Egypt and Nigeria.</p>



		<p>Plastics that enter the marine environment are often mistaken as food by marine animals who ingest it and may suffer death or internal injuries. Other marine animals may become entangled in plastics, and even suffocate to death because of it (IUCN, 2018). This can have negative impacts on marine animal reproductivity or marine eco-systems disturbing the natural balance of the ocean.</p> <p>Research from the University of the West Indies has shown that plastics in mangroves is a significant threat to the growth and regrowth of mangrove forests. “Experiments in the nursery show that many mangrove seeds and seedlings covered by plastics are prevented from germinating, or do not grow. Plastic bags in a range of densities had the worst effect, followed by PET bottles at high density”. So plastics in the mangroves will not only kill adult trees but prevent natural recovery (Webber 2021)</p> <p>Mangroves form a barrier between the land and the sea on the coastline and have numerous purposes, one of which is to reduce storm surge effects on land due to hurricanes / storms. If Mangrove growth is negatively impacted by plastics / microplastics, then there are serious implications for buildings, property and lives on land.</p> <p>Furthermore, warming waters, along with an increase in marine heat waves, ocean acidification and the spread of diseases, will lead to mass coral bleaching and mortality throughout the ranges of most coral species. Additionally, forceful changes in current biodiversity patterns are also expected which could cause a 30–70% average increases in potential fish production at high latitudes and decreases of up to 40% in tropical regions ((Barange et al. 2018; Cheung et al. 2010) cited in Gains et al 2019)).</p>	<p>Most marine plastics are assumed to derive from land-based sources in South African shores.</p> <p>Amongst plastic categories, cotton bud sticks are disproportionately abundant on beaches as most come from wastewater treatment facilities rather than street litter. Lids and hard plastic fragments are also more common on beaches, probably because they disperse well and have long lifespans (in part because they are small, and thus less likely to be removed by cleaning efforts than larger items such as bottles and bags, and in part because their greater thickness than flexible packaging makes them more resistant to UV and/or mechanical degradation).</p> <p>Polystyrene trays are the most common macroplastic item on beaches, greatly outnumbering their occurrence in urban litter, largely because they tend to break up in the environment, thus inflating the number (but not mass) of items.</p>
Legislation/Policy Response	Notable regional policy is the Caribbean Regional Node for Marine Litter, supported by the Cartagena Convention Secretariat and the Gulf and Caribbean Fisheries Institute (Clayton et al. 2020). Despite the	The legal framework of solid waste management is composed of the National Solid Waste Management Policy and the National Solid Waste Management Act, along with the Public Cleansing Regulations, the Public Health Act of the Ministry of	Southern Africa, a region with high urbanization, leading to increased resource use and plastic consumption, heavily reliant on tourism, an industry highly impacted by plastic pollution.



	<p>commitment to the Cartagena Convention and the collective adoption of regional interventions and planning, the progress made to eradicate plastic pollution nuisance is limited. The focus of some of these initiatives has encompassed reduction strategies, market-based instruments, and penalties for non-compliance. For example, in 2019, Barbados instituted a national ban on the import of single-use plastic conure, distritainers and cutlery, progressed into a ban on the distribution, and finally in one year later, in 2020, a ban on the import or manufacture of any Petro based bag. In Barbados, under the Control of Disposable Plastic Bill, Note that anyone who imports such items, in violation of the law, is guilty of an offense and liable on summary conviction to a fine of \$100,000.00 or face imprisonment for a term of one year or both.</p> <p>In addition, individuals and businesses who manufacture or offer for sale any such banned material are also guilty of an offense and liable, on summary conviction, to a fine of \$100,000 or jail for one year or both.</p> <p>There is further caution against products labelled biodegradable, environmentally friendly, or other similar wording, while some items may have such labels, they may still contain petroleum elements. Items listed in the Act, (straws, bags, cups and plates, etc.) clearly stating “HDPE” i.e. – LDPE; PP, and PS or Polystyrene admit to being petroleum-based plastics and should not be used. The Government has received financial and technical support through projects such as the Integrating Watershed and Coastal Areas Management in Caribbean Small</p>	<p>Health and the Trade Act, which regulates the scrap metal industry (recycling initiatives).</p> <p>The National Solid Waste Authority is responsible for collection, transport and disposal of waste island-wide and simultaneously acts as regulator of the sector. Plastic is considered an environmental matter and falls under the purview of the National Environment and Planning Agency.</p> <p>The Government of Jamaica took the initiative to implement two Orders which are intended to ban the importation, distribution, manufacture and commercial use of certain types of single use plastics beginning January 1st 2019. First, The Trade (Plastic Packaging Materials Prohibition) Order, 2018, and second, The Natural Resources Conservation Authority (Plastic Packaging Materials Prohibition) Order, 2018. The ban was implemented in phases starting January 1, 2019 to include:</p> <ol style="list-style-type: none"> a. Phase 1 <ul style="list-style-type: none"> o single use plastic bags made wholly or in part of polyethylene or polypropylene of dimensions 610mm X 610mm (24" x 24") and 0.03mm (1.2 mils) in thickness or less; o drinking straws, made wholly or in part of polyethylene or polypropylene, manufactured for single use. b. Phase 2 (Implemented January 1, 2020)- Packaging made wholly or in part of expanded polystyrene foam used for food and beverage containers; c. Phase 3 (implemented January 1, 2021)- Single use drinking straws made wholly or in part of polyethylene or polypropylene used for juice boxes or drink pouches and plastics bags with dimensions of 610 mm x 610 mm (24" x 24") and 0.06 mm (2.5 mils) thickness. <p>Certain types of plastics are excluded from the ban including plastic packaging for certain foods, the medical field and straws for persons with disabilities. Recognising that the ban does not cover all types of plastics and more comprehensive measures are required to adequately manage and regulate plastic</p>	<p>Waste management emerged as the most important policy driver and over 55% of the Southern African Development Community (SADC) members (including South Africa) adopted a top-down approach in developing these policies to address these environmental challenges.</p> <p>South Africa passed a law to ban single-use plastic bags in May 2002 (Hasson et al., 2007) to be implemented one year later. The initial regulation banned plastic bags <80 µm and implemented a levy (Republic of South Africa, 2002), but the thickness of banned bags was lowered to <24 µm due to industry pressure (Dikgang et al., 2012). Due to complaints, the levy amount was lowered and retailers paid for almost 50% of it (Brien and Thondhlana, 2019). No alternatives to plastic bags were discussed in South Africa.</p> <p>A number of years have passed by, yet plastics remain one of the popular waste streams found in illegal dumping sites, landfill sites and oceans. For example, the latest National State of Waste Report indicates that over 50% of plastics in South Africa still end up in landfill sites. The current policy instruments have proven to be ineffective in delivering the expected results. There are persistent challenges with respect to compliance and enforcement.</p> <p>South Africa also witnessed the increase in plastic bag use over time, since the promulgation of the above policy instruments.</p>
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	<p>Island Developing States (IWCAM), the Caribbean Regional Fund for Wastewater Management (CReW), and more recently, the Integrating Water, Land and Ecosystems Management (IWEco), all funded by the Global Environment Facility (GEF) and implemented by the United Nations Environment Programme (UNEP).</p>	<p>pollution, the Government of Jamaica continues to explore additional feasible policy options. Immediate future measures under consideration include the introduction of new solid waste management regulations inclusive of requirements for sorting at source and a voluntary Deposit Refund Scheme for PET plastic bottles.</p>	
<p>Implications for local climate change challenges</p>	<p>The impact plastic has on the environment, and its contributions to climate change are beyond the apparent use of fossil fuels as plastic is increasingly affecting the function of the ocean, the planet's largest carbon sink. But the sea is in great danger, and with it, the Caribbean's biodiversity and high endemism, its coral reefs, mangroves and seagrass, which provide important feeding and breeding grounds for more than 1,300 species of fish, marine mammals and sea turtles. Overexploitation, climate change, habitat destruction from infilling mangroves, coral bleaching and, above all, plastic pollution, are dangerous attacks on the health of the seas. The plastic pollution problem can serve as an amplifying factor to climate change. The blue economy has been identified as the pathway for sustainable development which Barbados needs, to diversify their economies and build climate resilience.</p>	<p>Plastic is a threat both as waste and during production. As macroplastics and microplastics, plastic affects the health of the ocean and Jamaica depends heavily on the ocean (tourism) and on its land (agriculture). Anthropogenic climate change, driven by the exponential increase in emissions of greenhouse gasses (GHGs) will continue to impact the island through a variety of channels. The severity of effects will depend greatly on the extent of warming reached through GHG emissions. The resulting changes to ocean processes and functioning have broad implications for our local economy that must be taken into account, both to inform adaptation efforts and motivate urgent mitigation strategies.</p> <p>Health - Climate change will add a substantial burden to Jamaica's health systems and will also compound the country's vulnerability to other anticipated climate change impacts. ECLAC (2011) anticipates an increase in mosquito borne diseases such as dengue.</p> <p>Tourism - the sector is likely to incur losses due to climate change. Climatic features, such as increased temperatures and precipitation, will affect the demand for tourism in Jamaica. It is anticipated that by 2050, Jamaica's tourism industry will lose between US\$ 132.2 million and US\$106.1 million. This is expected to increase as the current pandemic has already crippled the industry. Additionally, climate change is anticipated to have supply-side effects from extreme events and acidification of the ocean. This is also being reflected throughout this pandemic. The expected loss from extreme events is projected to be between US\$ 5.48 billion and US\$ US\$4.71 billion,</p>	<p>In 2015, the primary production of plastic emitted the equivalent of more than a billion metric tons of carbon dioxide (CO₂), equal to over 3% of global fossil fuel emissions (Geyer, 2020). In comparison, agriculture contributes 10–15% of GHG emissions (Houser and Stuart, 2020). Plastic refining is also one the most GHG expensive industries in the manufacturing sector and produced 184.3–213.0 million Mt CO₂e globally in 2015 (Hamilton et al., 2019). This is owing to the energy intensive process of cracking, a petrochemical process in which saturated hydrocarbons are broken down into smaller, often unsaturated, hydrocarbons known as olefins, that are then made into plastic resins (Hamilton et al., 2019; Ren et al., 2006).</p> <p>Given that so much of South Africa varies from 'semi-arid to hyper-arid with only a few relatively humid parts where rainfall greatly exceeds 500 mm annually', these changes could have a profound impact on the way the country looks in the future.</p> <p>Increases in climate variability and climatic extremes are impacting both water quality and availability through changes in rainfall patterns, with more-intense storms, floods and droughts;</p>



		<p>figures that will need to be revised given the current pandemic. Furthermore, ocean acidification will negatively impact the tourism sector – In 2011, ECLAC estimated this to be between US\$7.95 billion and US\$7.04 billion by 2050 (ECLAC, 2011).</p> <p>Mangroves – Jamaica’s coastlines have many low - lying and highly erodible areas which makes it particularly susceptible to sea level rise, storm surge, and coastal erosion. Mangroves help to protect these very delicate areas and they will be one of the islands hardest hit natural asset ((Simpson, Scott, & Trotz, 2011)</p> <p>Floods- Floods cause more than US\$40 billion in damages globally (Nunez, 2019; OECD, 2016) and accounted for approximately 24,000 deaths annually between 1970 and 2012 (World Meteorological Organization, 2021). The Caribbean is among the second most disaster-prone region in the world, with flooding being one of the most commonly occurring hazard (OCHA, 2020).</p> <p>The climate change projections for the Caribbean region include more intense hurricanes, specifically more category 4 and 5 hurricanes by the end of the century (Climate Studies Group Mona, 2020). Intense hurricanes/ storms translate to an increase in the amount of rainfall as well as wind strength. Consequently, with stronger storms comes more intense floods, flooding and flood impact-on communities across the Caribbean region.</p>	<p>changes in soil moisture and runoff; and the effects of increasing evaporation and changing temperatures on aquatic systems. South Africa has been experiencing a serious drought since 2015, with associated crop losses, water restrictions, and impacts on food and water security.</p>
FIELDWORK			
Methodology applied	Observational and data collection style/approach -Survey and interviews	<p>The study represents a pilot aimed at highlighting how the plastic life cycle contributes to climate change, both directly and indirectly. As Jamaica is more engaged at the packaging stage and use phases, local initiatives have focused on waste.</p> <p>A ridge-to-reef approach was used for our conceptual framework and methodology in this research to action project. This ridge to reef approach can be compared to that of the lifecycle of plastics: which documents</p>	<p>Questionnaires were designed comprising a maximum of 20 questions which were used to interview local consumers on their daily consumption of plastics and knowledge of the life-cycle of plastics.</p> <p>Face to face/virtual interviews were conducted with plastics manufacturing and production companies.</p>



		<p>the linear journey of plastics from production to consumption and disposal.</p> <p>Inland and coastal observational and data collection style/approach -Survey and interviews Surveys and interviews were collected from inland and coastal communities to access first-hand knowledge of the impact plastic has the local and coastal communities which had a socio-economic relationship with the ocean. Fishermen were also asked to describe their experience with plastic both on the coast and in the ocean.</p>	<p>A cleanup in Durban Harbour was conducted to assess the distribution and quantity of plastics near shore environments (Annex 8.3).</p>
<p>Justification of methodology</p>	<p>Observational and data collection style/approach allowed the opportunity to assess the current policy and enabling environment and how it impacts disposal and management practices, review the implementation success of previous Adaptation and Mitigation action related to addressing plastic pollution, identifying strengths and weaknesses. Identify recommendations to support sustainable ocean and climate action acceleration, including new measures and adapting previous measures to suit the localised context. In addition, provide practical and relevant mitigation measures for long-term solutions.</p>	<p>The ridge-to-reef approach allowed for focused attention on the complete cycle beginning with the activities that take place on land how it can impact the coastal environment.</p> <p>Having recognised some commonalities among our countries, 3 of which are small island developing states and 4 of which are not involved in fossil fuel production), we focused on the process from packaging to waste. Through observation, interviews and surveys we were able to get first-hand information to triangulate with the literature.</p> <p>The local investigation looked at how the use and disposal of plastic (primary data) affected the ocean (literature and interviews). This pilot highlighted the lack of climate change awareness among participants but recognised that residents were mindful that things were changing. By engaging with the coastal communities, we were able to determine visible impact to communities that had a close economic relationship with the ocean.</p>	<p>We sought to conduct a holistic approach in order to understand not only the implications of quantity and composition of different types of plastics on climate change, but also to understand relation between consumers and producers on plastic pollution. A combination of quantitative and qualitative investigation was conducted. The cleanup helped with quantitating the data and the surveys and interviews helped us better understand the debris composition and distribution.</p> <p>This approach enabled a collaborative effort between researchers, producers and communities. This will help develop meaningful mitigation measures that can positively impact policy making.</p> <p>A combination of natural science through sampling and social science (through interviews and questionnaires) could be enabled by the opportunity the ACU provided with diverse members of the group contributing their skills.</p> <p>A number of interesting suggestions/mitigation measures suggested include; regular workshops with consumers, innovation centers for</p>



			<p>alternative manufacturing and construction businesses for some members of the community. Lobbying for clearly labeled bins has also begun.</p> <p>This approach also eliminated the normal top-down information transfer from researchers to communities. This will also encourage long term success for the project.</p> <p>The next phase is to engage policy makers to ensure that the results of the project have a more permanent impact.</p>
RESULTS			
Manufacturing			<p>According to the latest Industrial Policy Action Plan (IPAP) the South African plastics sector had a turnover of R75bn in 2015, contributed about 1.9% to GDP and accounted for around 16.5% of the manufacturing sector's GDP. The latest available statistics show that the domestic plastics industry converted 1.5 million tons of virgin primary plastics and 309,520t of recycle during 2016. The sector, which is divided into the capital-intensive manufacture of primary plastics and the downstream manufacture of plastic products, employs almost 58,000 people.</p>
Production	<p>Reducing pollution and waste, it is also hoped that the ban on single-use plastics will help Barbados achieve its marine conservation goals.</p>	<p>The ban has significantly affected the number of businesses that have remained in plastic production. The primary producer and employer, WISYNCO was forced to close that department and terminate over 100 staff members. As the ban did not include SUP bottles, many other companies have seen an increase in demand for bottles. Other companies have seen an increase in demand for plastic bottles.</p>	
Waste treatment	<p>It was highlighted that the aspects taken into consideration in the development of solutions and interventions included: Financing, Public Awareness</p>	<p>It was observed that places open to the general public had open garbage piles on the ground particularly at commercial establishments such as restaurants. Open piles of garbage were also observed at fishermen spots as well as beside some main rivers. In those piles, there was: dried leaves, coconuts, stones and</p>	<p>There has been a drastic increase in the masses of plastic that are recycled in South Africa and that there are many companies that recycle mixed plastics.</p>



	<p>Research requirement and data collection Community involvement and ownership Physical scope of the intervention and the extent of the benefits. When enquired, it was clear that members of the civil society are knowledgeable and capable of being the impact of plastics pollution to exacerbating the effects of climate change from a mitigation perspective. Still, there is a disconnect as it relates to adaptation measures. Climate change and environmental initiatives related to environmental plastic pollution appear to operate within silos from the physical implementation of activities and financial and human resource issues. If synergies are not established, these issues will continue to be treated as competing issues with the policy framework. The steps to move forward sustainably on both issues will continue in business as usual. Returning items for reuse or recycling is not a new practice for Barbadians. The Returnable Containers Act (1986) an Act to provide for the control of the sale of beverages in beverage containers, the payment of a deposit on beverage containers, a refund for the return of those containers and the final disposal of unused or usable containers, has worked well to reduce the amounts of some glass and plastic beverage containers entering the landfill. The Act however does not adequately address other containers or other waste. For this reason, the Act is being revised to ensure that it is more relevant to today's situation as the number and types of items that can be recycled have increased. That being said there are still several types of wastes currently being</p>	<p>paper as well as tin food containers, tin drinks and glass bottles (alcoholic beverages). The non-biodegradable items were mostly plastics that comprised of:</p> <ul style="list-style-type: none"> • PET Plastic bottles (soda and water bottles) • Bottle covers (soda and water bottles) • Lada bags (black plastic bags) • Transparent plastic bags • Styrofoam (lunch) boxes • Plastic forks and spoons • Soup cups (Styrofoam) • Straws • PPE's specifically masks • Snack/biscuit packaging • Kiddies juice boxes • Box juice boxes • Cardboard boxes • Bag juice bags <p>Plastics was observed as representing at least 70% of waste materials found in those garbage piles. At the household level, some residents placed their garbage in black plastic bags (known as 'lada' bags in Westmoreland) and hung them on their gate columns or trees towards the front of the houses for garbage collection. From investigations, it was determined that this practice of hanging plastics bags on gate columns / trees was to prevent garbage from being intercepted by stray animals or mentally ill persons.</p> <p>One trip was made to the parish of St. James, specifically the Freeport Community, which is found in the capital city of Montego Bay. Residents waste was placed in garbage receptacles at the household level. A build-up of non-biodegradable and biodegradable waste on the shoreline around the Freeport harbour was also observed, while boats were docked not far from the shore. The non-biodegradable materials comprised:</p> <ul style="list-style-type: none"> • Plastic bottles (soda and water) • Plastic bottle caps (soda and water) • Lunch box containers • Soup cups 	<p>The majority of marine plastic will consist of mixed types. It was found that the majority of plastic that is recycled in South Africa originates from the Western Cape, but there was no information as to what the cause for this anomaly was.</p> <p>There are notable knowledge gaps in the waste treatment sector in South Africa, these included uncertainties in quantities, composition, and the relationship between recycling rates and marine debris generation. Furthermore, a better understanding of technologies for the management of mixed plastics and how these can be applied to marine debris must be explored in conjunction with an improved understanding surrounding the environmental impact of these waste management options.</p>
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	<p>recycled in Barbados. These include paper, plastics, glass, ferrous (containing iron) and non-ferrous metals, used cooking oil, used automotive oil, newsprint, cardboard and batteries. Information on recycling these types of items is expanded in this brochure. All recyclables entering the Facility are diverted towards recycling as far as possible and only those residual items which cannot be reused or recycled are taken for disposal to the sanitary landfill. These efforts, along with those of the local recyclers as well as other diversion efforts, have ensured that minimal waste enters the Mangrove Sanitary landfill and the SBRC boasts a 70% diversion rate thereby conserving our valuable land resource.</p>	<ul style="list-style-type: none"> • Tin cans • Life vests • Broom sticks • Juice boxes • Deodorants • Rubbing alcohol bottles <p>For the most part plastics comprised at least 65% of waste materials found around the harbour. Respondents were asked about their garbage disposal practices at home and confirmed that residential waste was primarily collected by the municipal authorities but it can be supplemented with private contractors where necessary. Despite this, respondents were keen to mention that they sometimes buried some of their natural garbage for composting purposes.</p>	
<p>Land-based related consequences</p>	<p>While this was not addressed in the fieldwork across Barbados, the small island suffers land-based consequences similar to other Caribbean Islands, such as Jamaica.</p>	<p>Plastics were found scattered across the landscape at the locations visited in Westmoreland. It was almost as if they had become part of the aesthetic make-up of the environment.</p> <p>Plastics were also observed / spotted in drains, culverts, on roadways, bridges and in water bodies at some of the locations visited in Westmoreland. In the capital city of Savanna-la-mar specifically, plastics were observed in drains and culverts. Some of those drains and culverts were also overgrown with vegetation and in need of drain cleaning and maintenance. Dalling Street in Savanna la mar is one such example and is known to flood once there is heavy rainfall. Skips or garbage bins were also observed in the area, but some garbage items were placed on the outside of the skip (because of padlocks). This could also explain how some waste materials ended up in drains and gullies, after a heavy downpour of rainfall on Dalling Street. At the Bluefields River, there were not many garbage items observed in the river; a lunch box was observed stuck between the rocks and water. There were however</p>	<p>Macroplastics and microplastics have been found in the size of a plastic item influences its environmental transport after release. Small microplastics (<200 µm), even heavier-than-water polymers like PET, tend to be retained in the water column, while larger particles precipitate faster.⁴⁸ Larger, less buoyant items like bottles with air trapped inside, foams, and low-density polymer items, are found in surface water and riparian zones.</p> <p>Some microplastics float in the air and become airborne and can contribute to airborne diseases.</p> <p>Recent literature reports increase in disposable nappies on beaches close to informal settlements. Interaction with biota on land is also less reported on, but examples include reports of cattle eating plastic in grazing areas.</p>



		<p>several vendors with stalls near to, and around the river. A skip/garbage bin filled with garbage was near to the vendors as well, which indicates that waste is being collected and disposed of. It is surmised that once there are commercial activities taking place around water bodies, there will be an increase in garbage in these areas. Importantly, it will be very easy for garbage generated around the river to enter and pollute the river.</p> <p>The exception to the above was the Dunbar River and its supporting gully that had a lot of waste materials in it, as opposed to around it. A lot of plastic material was observed inside the Dunbar River, which passes through the capital city, Savanna-la-mar in Westmoreland</p>	
Ocean-based related consequences	<p>The sea is in great danger, and with it, the Caribbean's biodiversity and high endemism, its coral reefs, mangroves and seagrass, which provide important feeding and breeding grounds for more than 1,300 species of fish, marine mammals and sea turtles. Overexploitation, climate change, habitat destruction from infilling mangroves, coral bleaching and, above all, plastic pollution, are dangerous attacks on the health of the seas.</p>	<p>In the coastal community of Freeport, Montego Bay, there was a build-up of non-biodegradable and biodegradable waste on the shoreline, while boats were docked not far from the shore. From investigations it was determined that plastics were washed from upstream communities in Montego Bay, as well from the town centre in the low lands, onto the roadways, then into the Freeport Harbour due to heavy rainfall and strong winds. The sea however pushed back some of those same plastics back unto land where they settled on the coastline and formed part of its aesthetic makeup.</p> <p>Fisher folks highlighted the damage to their lives and livelihoods as plastic is now filling their nets and where fish are caught, plastic is sometimes found in their stomachs.</p> <p>There is also the issue of trans-boundary plastics; plastics from another jurisdiction, ocean or land that enters in the space of another nation. Therefore, some of plastics found locally, may not have come from Jamaica. This has implications for regional collaboration to solving the problem.</p>	<p>One of the ocean-based related consequences of this plastic stream is that young hatchlings are fed toxic plastic by their mothers which they mistake for food.</p>
Implications for local climate change challenges	<p>The plastic pollution problem can serve as an amplifying factor to climate change. The International Coastal Clean-up in Barbados in 2019 reported</p>	<p>The storms impacting the Caribbean are becoming increasingly more powerful, producing increased rainfall and higher storm surge due to climate change. This means that there is less time for recovery</p>	



	<p>a collection of 34,105 pieces of plastic. Studies have found as many as 200,000 pieces of plastic per square kilometer in the Caribbean Sea – estimated at 3 times the global average. Habits define humans. Dropping plastic addiction is a huge step towards protecting wildlife. The oceans and the species within them are inseparable from the region's economic development through the sustainable use of its resources. Plastics are not the only threat to wildlife and their ecosystems.</p>	<p>between events. Precipitation over the ocean is also predicted to increase in intensity and frequency through the first half of this century due to ocean circulation changes. The implications for climate change are the same as explained above.</p>	
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