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Cross-border Plastic Pollution and it's Impact on the *Bay of Bengal*

Prepared By: Change Initiative Research Team

Background

Plastic pollution in the Bay of Bengal (BoB) is a rapidly intensifying crisis for Bangladesh. Studies show that the Ganges–Brahmaputra–Meghna (GBM) river system — fed by upstream India, China (Tibet), Nepal, Bhutan and Myanmar — is among the world's most plastic-polluted watersheds (repository.unescap.org). Together, these rivers carry millions of tonnes of plastic waste each year into the Bay. For example, the combined flows of the Ganges, Brahmaputra and Meghna may discharge up to 3 billion microplastic particles per day into the BoB, and Bangladesh-and-India rivers jointly leak an estimated 4 million tonnes of plastic annually into the BoB (frontiersin.org). One analysis finds that the Ganges, Meghna, Brahmaputra and Indus rivers alone contribute about 19% of global ocean plastic pollution (repository.unescap.org). Importantly for Bangladesh, a recent study estimated that some 15,345 tonnes of single-use plastic flow daily into Bangladesh from 18 transboundary rivers (esdo.org) , amounting to hundreds of thousands of tonnes per year reaching Bangladesh's coast. In short, cross-border plastics are overwhelming Bangladesh's coasts.

The impacts on Bangladesh's environment, economy and people are severe. Its coast and the Sundarbans mangrove (the world's largest) are becoming "plastic cesspits". Marine species ingest plastics and toxic additives (BPA, phthalates, heavy metals) (nature.com), threatening fisheries that supply over 20% of Bangladesh's animal protein. Coastal livelihoods (fishing, tourism) are disrupted by polluted beaches and clogged waterways, with one estimate valuing lost marine ecosystem services at ~$11.4 billion for Bangladesh and neighbors.

Public health risks are rising: microplastics contaminate fish and salt, and plastic litter fosters mosquito-borne disease (flood-blocked drains) (repository.unescap.org). Despite these hazards, regional cooperation lags. Existing frameworks – SAARC (via the South Asia Co-operative Environment Programme), BIMSTEC and the Bay of Bengal Large Marine Ecosystem (BOBLME) project – have no binding plastic-waste protocols. Bangladesh itself notes a data gap: under SACEP initiatives it has only catalogued plastic litter categories along its coast, without quantifying loads. National laws ban some plastics (e.g. plastic bags since 2002) but lack a specific marine-litter statute (apps1.unep.org).

This paper calls for urgent policy action. Bangladesh must strengthen its laws (e.g. enforce plastic bans, impose Extended Producer Responsibility), invest in waste-management innovation (as in Barbados (greenclimate.fund) and Adaptation Fund programs (e.g. Bangladesh's mangrove restoration project (unfccc.int) can be designed to include plastic cleanup and sustainable waste management as a nature-based adaptation strategy. Ultimately, only a coordinated regional strategy can safeguard Bangladesh's coastal ecosystems and communities from this "toxic pool of waste" (waste collection, recycling, river barriers, bioplastic alternatives) and build data infrastructure (monitoring of riverine and marine plastics). Public awareness and enforcement must be scaled up. Crucially, Bangladesh should drive regional collaboration – leveraging bodies like BIMSTEC and the emerging global Plastics Treaty – to stem transboundary waste flows. Climate finance offers an entry point: for example, Green Climate Fund projects

River plastic emissions to the *world's oceans*

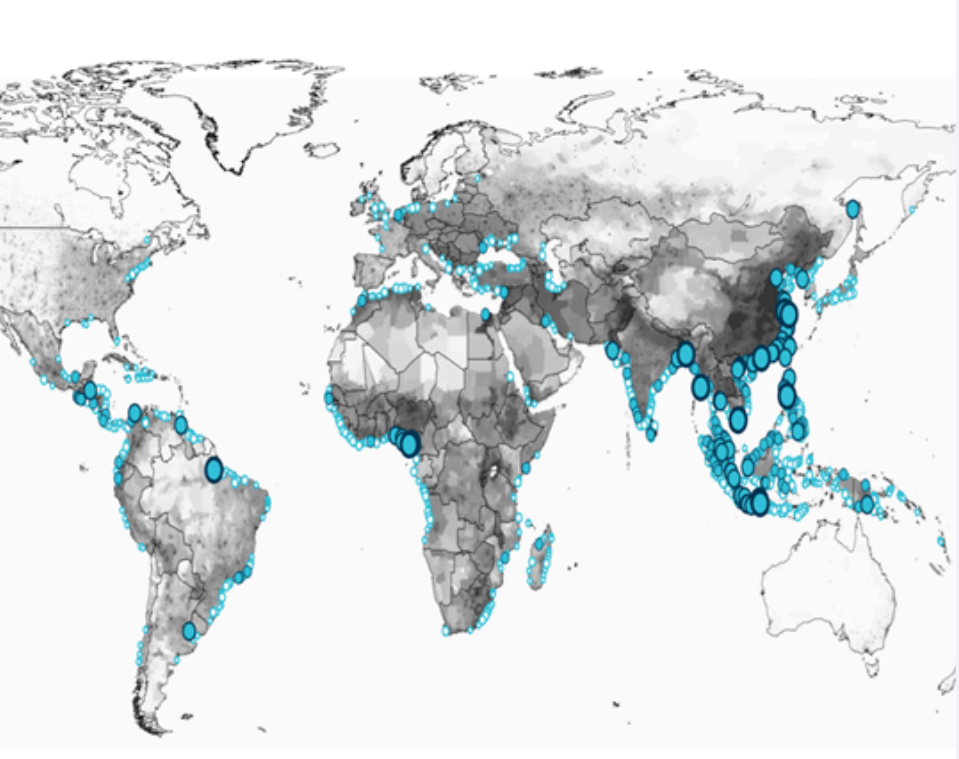


Figure 2: Mass of river plastic flowing into oceans in tonnes per year

Plastic pollution in oceans is strongly influenced by riverine inputs, yet global estimates of these flows remain limited.
This report quantifies annual plastic emissions from rivers,

Figure 2 maps the estimated mass of plastic emitted annually from rivers into oceans, in tonnes per year. The model shows that emissions are highly concentrated in certain regions, particularly Asia, where population density and MPW rates are high and rainfall-driven runoff is intense. Many rivers in Asia discharge more than 20,000 tonnes per year, while most rivers elsewhere contribute far less.

Table 1: Top 20 polluting rivers as predicted by the global river plastic inputs model.

(Placeholder2)	**Yearly average discharge ($m^3\ s^{-1}$)**
Yangtze, China	15800
Ganges, India, Bangladesh	20800
Xi, China	5530
Huangpu, China	404
Cross, Nigeria, Cameroon	240
Brantas, Indonesia	818
Amazon, Brazil, Peru, Columbia, Ecuador	140000
Pasig, Philippines	207
Irrawaddy, Myanmar	5490
Solo, Indonesia	746
Mekong, Thailand, Cambodia, Laos, China, Myan	6010
Imo, Nigeria	279
Dong, China	854
Serayu, Indonesia	370
Magdalena, Colombia	5930
Tamsui, Taiwan	108
Zhujiang, China	133
Hanjiang, China	735
Progo, Indonesia	279
Kwa Ibo, Nigeria	192

Table 1 lists the top 20 polluting rivers. It highlights that the Yangtze River in China is the largest contributor, emitting an estimated 333,000 tonnes per year (midpoint), followed by the Ganges (India, Bangladesh), and several rivers in China and Indonesia. Together, these top 20 rivers contribute about 67% of global river-based plastic input, despite draining only 2.2% of land area.

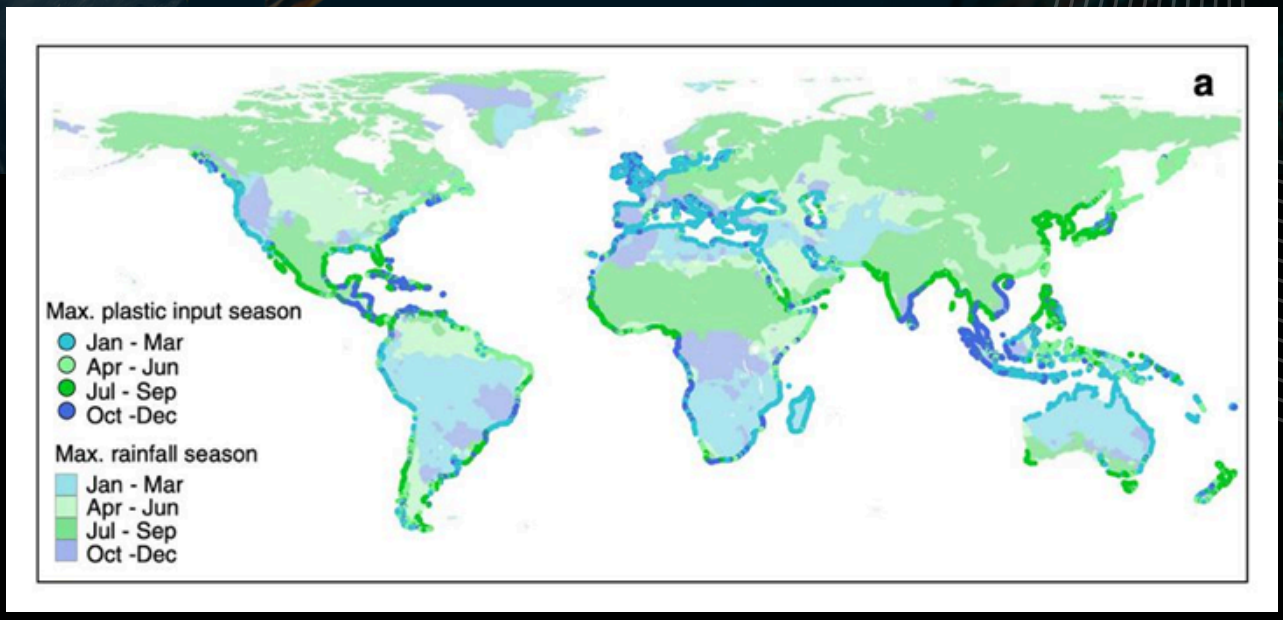


Figure 3: Seasonality of regional inputs of river plastic to oceans.

Figure 3 illustrates seasonal variation in plastic inputs. It shows that globally, ~74.5% of river plastic emissions occur between May and October, driven by monsoon seasons. In Asia, northern rivers like the Yangtze and Ganges peak in summer, while Southeast Asian rivers (e.g. in Indonesia) peak during their rainy season earlier in the year. Other continents show different seasonal patterns: African and North/Central American rivers peak mid-year, whereas European, South American, and Pacific rivers peak between November and May.

Transboundary Pollution *Pathways*

The Bay of Bengal receives a massive inflow of plastic from rivers that cross national borders. The Ganges–Brahmaputra–Meghna (GBM) system alone drains much of the Bay's watershed. These rivers originate in India, Nepal, Bhutan, China (Tibet) and Myanmar before converging in Bangladesh. Major tributaries such as the Padma and Jamuna (Brahmaputra) carry enormous waste loads. One review notes that eight of the world's ten most plastic-polluted rivers are in Asia, including the Ganges (ranked 6th globally) and Indus (3rd). Together, the Indus, Meghna, Brahmaputra and Ganges account for roughly 22% of the plastic in the top-ten polluted rivers – about 19% of all ocean plastics (repository.unescap.org).

Specifically for Bangladesh, field studies confirm torrential plastic flows. A recent assessment found that 18 transboundary rivers entering Bangladesh carry about 15,345 tonnes of single-use plastic waste every day. (Reportedly ~2,500 t/day come from Indian tributaries and ~300 t from Myanmar. In aggregate this amounts to on the order of 10^5–10^6 tonnes per year entering Bangladesh's coastal waters. Much of this plastic originates upstream as urban and industrial waste from neighboring countries. Inadequate waste treatment in India, Nepal and Myanmar means that mismanaged plastics wash into rivers and flow downstream. The riverine route vastly outpaces any contributions from maritime shipping or domestic beaches.

In addition to riverine inputs, coastal Bangladesh receives direct litter from nearby countries. For example, plastic debris floating from Myanmar's Rakhine State is carried by currents into the Naf River and Cox's Bazar beaches. Similarly, plastic-smuggling and informal trade can introduce foreign plastic products. Since "most of the rivers in Bangladesh are transboundary... a significant amount of the plastic waste near coastal areas is not locally produced but... coming from neighbouring countries". India's recent ban on single-use plastics, for instance, raises concern that Bangladesh may absorb the overflow of waste. Analysts have warned that upstream dumping is putting Bangladesh in the role of a "plastic hotspot" (theigc.org). In short, Bangladesh's coast is downstream from nearly all the region's wasteful production and disposal.

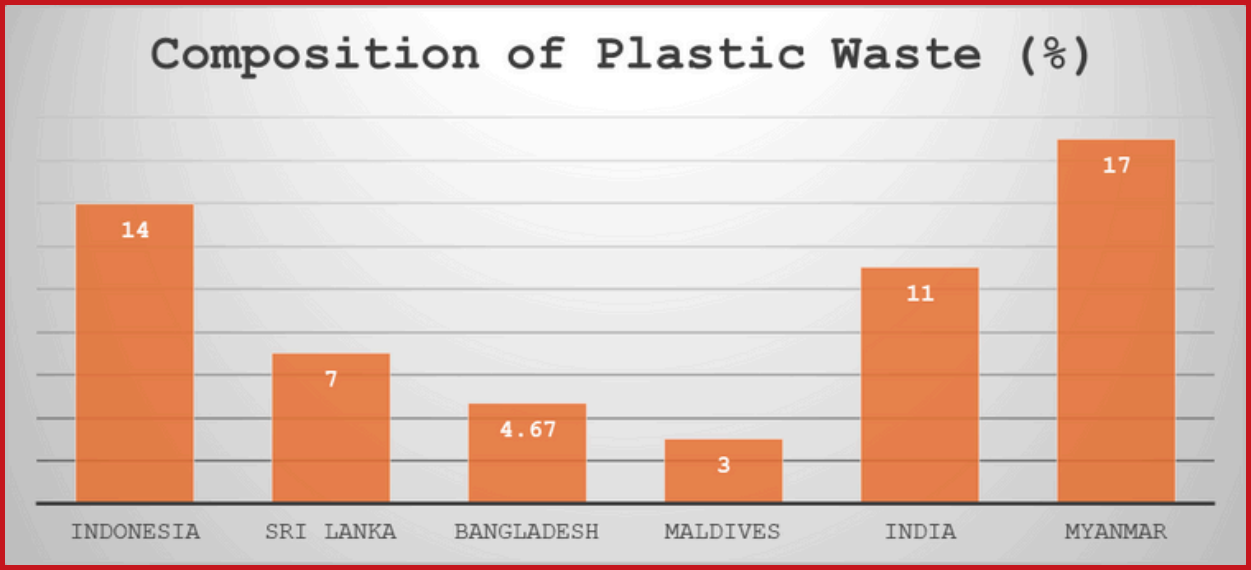


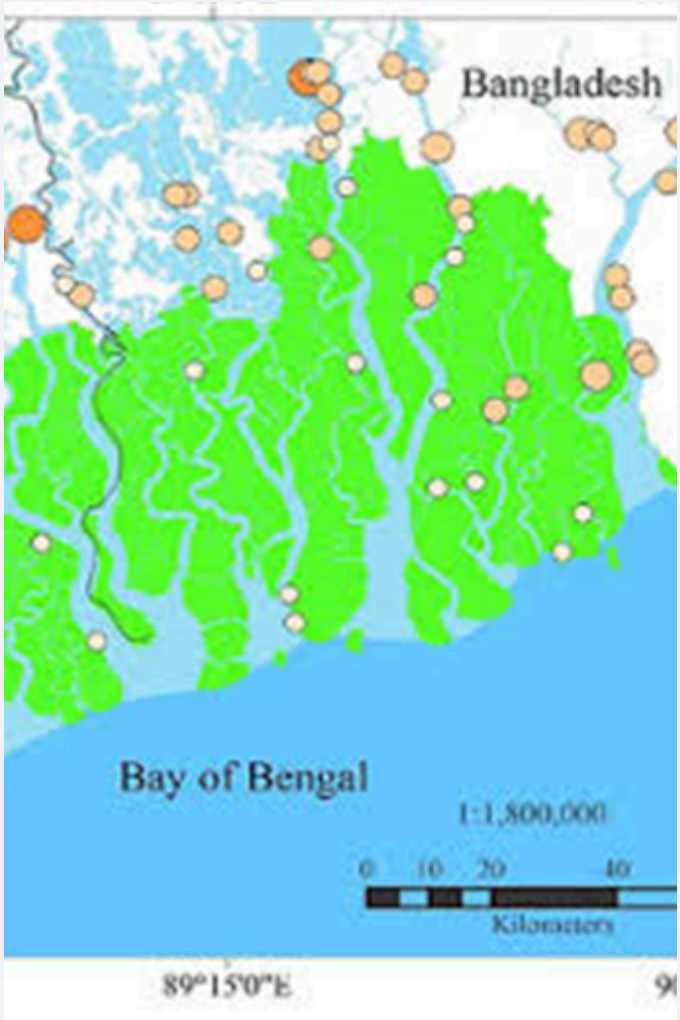
Figure 4: Composition of Plastic waste in Bay of Bengal Shore Countries

Impacts on Bangladesh's *Environment, Economy, and Health*

Cross-border plastics are degrading Bangladesh's coastal ecosystems and inflicting social and economic harm. Key impacts include:

- **Environmental degradation: Plastics are ubiquitous in the Sundarbans mangrove and other coastal habitats. The Sundarbans – a UNESCO World Heritage Site and critical nursery for fisheries – is becoming a "cesspit for plastic waste". Rivers bring 72,000+ tonnes of plastic per year at the Bay's head (Ganga/Brahmaputra/Meghna). Floating debris smothers mangrove seedlings and coral reefs; entangles turtles, dolphins and birds; and fragments into microplastics. A recent study found that 443 microplastic particles were present in the intestines of sampled marine fish in the Bay (bcolp.org), evidence of pervasive contamination. Microplastics can also bind toxic chemicals and pathogens, further stressing aquatic food webs.**

- **Economic losses: Coastal communities in Bangladesh depend on the Bay's fisheries and tourism. Overfishing aside, plastic pollution threatens these economic lifelines. Marine ecosystems provide ~20% of animal protein in Bangladesh's diet, so declines in fish stocks (from habitat loss or ingestion of plastic) endanger food security and export earnings. Coastal tourism (e.g. Cox's Bazar) is hurt by littered beaches; visitors report dirty shores and water. Infrastructure costs also rise: clogged storm drains and river channels (choked by plastic bags and bottles) lead to flooding and property damage during monsoon. In 1988, plastic-blocked drains contributed to a disaster that submerged two-thirds of Bangladesh. Cleaning up mangroves, beaches and reefs imposes heavy burdens on local governments. Globally, each tonne of ocean plastic is estimated to inflict $3,300–33,000 in natural-capital losses. In 2010, Bangladesh along with India, Pakistan and Sri Lanka dumped 3.46 million tonnes of plastic into the ocean – a loss of about $11.4 billion in marine ecosystem services that year. Bangladesh's share of that damage is substantial given its long, densely populated coastline.**



- **Public health risks: Plastic pollution poses direct and indirect health threats. Microplastics and associated chemicals are entering Bangladesh's food chain through seafood and salt. Bisphenol A (BPA) and phthalates – common in plastics – are known endocrine disruptors linked to cancer and reproductive disorders. Evidence of BPA in 94% of South-East Asian urine samples suggests widespread exposure. Moreover, plastics (especially microplastics) can serve as vectors for toxic pollutants and pathogens, increasing disease risk. Plastic litter also creates local health hazards: stagnant pools in dumped debris are breeding grounds for mosquitoes (dengue, malaria), and open burns of plastic trash release dioxins. Pandemic-era dynamics compounded the problem: reliance on single-use PPE and masks has added new plastic waste with infection risk. In sum, Bangladesh's coastal residents face mounting threats from plastic (polluted water, tainted food, and heightened disaster vulnerability) that demand urgent prevention and cleanup.**

Figure 5: Microplastics pollution load in Sundarban delta of Bay of Bengal

Gaps in Regional Governance and Cooperation

Despite the transboundary nature of the problem, regional coordination on marine plastics is weak. No Bay-of-Bengal country has fully addressed the problem of upstream plastic flows. Bangladesh is party to UNCLOS and MARPOL Annex V (ship garbage) (resolutions.unep.org), and national laws exist for general pollution control. But as Bangladesh notes, "the grave nature of [marine litter] requires more stringent provisions both in national and international arena". Critically, the regional institutions that could convene collective action have been largely inactive on plastic waste:

- **SAARC/SACEP: The South Asian Association for Regional Cooperation (SAARC) created the South Asia Co-operative Environment Programme (SACEP), but political tensions (e.g. India-Pakistan) have impeded its effectiveness. To date, SAARC has no unified policy on marine plastics. Bangladesh's own UNEP statement reports that it is developing a marine litter strategy under SACEP, but data are scant and resources limited. In practice, SAARC meetings seldom translate into enforcement on cross-border waste.**
- **BIMSTEC: The Bay of Bengal Initiative for Multi-Sectoral Technical and Economic Cooperation (BIMSTEC) covers Bangladesh, India, Myanmar, Thailand, Sri Lanka, Nepal and Bhutan. Though it has environment and disaster pillars, BIMSTEC's agenda has focused more on trade, energy and connectivity than on pollution. There is no BIMSTEC agreement specifically on marine litter**

or riverine waste management. Without binding targets, the member states have not stemmed plastic flows, leaving Bangladesh's coasts vulnerable.

- Bay of Bengal LME and other forums: The Bay of Bengal Large Marine Ecosystem (BOBLME) project (UNDP/GEF-led) addresses fisheries, habitat and pollution. Its Strategic Action Programme calls for controlling "coastal and marine pollution"(faolex.fao.org), but plastics were not a discrete focus. Regional action plans emphasize nutrient runoff and sewage over solid waste. Similarly, regional conventions (UNESCO-IOC Bay of Bengal Programme, IORA etc.) discuss coastal habitat but lack mechanisms for plastic mitigation. In short, no regional plastic treaty or enforcement mechanism exists in South Asia.

These gaps mean Bangladesh must largely rely on unilateral or ad hoc measures. Its UNEP position paper even urges "special financial instruments" for developing countries to combat marine litter, highlighting the absence of adequate funding. In the absence of regional standards, plastic pollution simply flows downhill. As one expert lamented, "Our water bodies have become a toxic pool of waste". This calls for urgently strengthening and leveraging existing institutions (BIMSTEC, SACEP) and treaty processes (the global plastics treaty and SDG frameworks) to turn rhetoric into coordinated action.

Strategic Response to Plastic Pollution and Overfishing in the *Bay of Bengal*

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Overfishing, driven by illegal methods and unsustainable harvests of key species, further destabilizes biodiversity and jeopardizes coastal livelihoods, amplifying socioeconomic vulnerabilities in the region.

Bangladesh's current governance framework lacks a dedicated Ministry of Ocean Affairs, limiting effective marine resource management. Strategic adoption of technologies like TrashBoom and Remote Electronic Monitoring can curb pollution and illegal fishing.
Aligned with UNCLOS obligations and inspired by frameworks such as the EU's Common Fisheries Policy, Bangladesh must enact enforceable plastic pollution laws and strengthen fisheries management. This coordinated approach is critical to preserving the Bay as a stable maritime commons vital for regional security and sustainable development.
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Policy Recommendations for *Bangladesh*

Bangladesh must adopt a comprehensive national strategy that addresses plastic waste at its source and intercepts it before it reaches the sea. Key policy measures include:

- **Strengthen legal and regulatory frameworks. Bangladesh should upgrade its laws to cover marine plastics explicitly. This could include enacting a Marine Litter Prevention Act and enhancing enforcement of existing bans. For example, plastic bag bans (in place since 2002) must be rigorously enforced, and the thickness limit should be tightened. Extended Producer Responsibility (EPR) laws should mandate that plastic manufacturers (e.g. packaging, fast-moving consumer goods) finance collection and recycling of their products. Regulations should require waste collection services and ban open burning. Penalties for illegal dumping should be meaningful, and local authorities given resources to enforce them. As Bangladesh's UNEP submission notes, current legislation and the 3R policy lack specifics for plastic, and "stringent provisions both in national and international arena" are needed.**

- **Innovate waste management systems. Bangladesh must leapfrog from basic collection to modern waste handling. Municipalities and rural communities should receive funding to build adequate waste collection, sorting and recycling facilities. Pilot projects could deploy riverine interceptors – barriers or skimmers in major rivers – to capture plastic before it flows downstream. Investment in waste-to-energy or advanced recycling (e.g. chemical recycling) can reduce landfill loads, provided emissions are controlled. Incentives or subsidies for biodegradable alternatives (such as jute- or cellulose-based shopping bags should be expanded. The informal recycling sector should be formalized: programs can support waste-picker cooperatives or "plastic banks" that collect and recycle waste, turning trash into livelihoods. Finally, coastal cleanup and habitat restoration must include plastic removal: for example, mangrove planting projects can integrate debris clearing (drawing on Blue Carbon finance, see next section).**

- **Enhance data and monitoring infrastructure. A major barrier is the lack of reliable data on plastic pollution. Bangladesh should establish a national Plastic Pollution Monitoring Network. This would involve regular surveys of riverbanks, coastal beaches and estuaries to quantify plastic loads. Low-cost technologies (e.g. drone or satellite imaging to spot debris accumulations) and citizen science (train fishermen and communities to report plastic in rivers) should be employed. Data should be compiled in a centralized, open-access database, shared with regional partners. Academic institutions (BUET, IUB, universities) should receive grants to research microplastics in fish and water. In short, Bangladesh must move from the current "limited understanding" of marine litter to a robust evidence base that can guide policy and measure progress.**

- **Public awareness and community engagement. Education campaigns are vital. The government, NGOs and media should emphasize the health and economic dangers of plastic, as well as practical solutions (reuse, recycling). Schools and religious centers can integrate anti-litter messages. Community cleanup events should be organized regularly, with local elites and youth taking leadership. Consumer awareness is also needed about sorting waste and using alternatives. Without behavioral change, even the best laws will fail: Bangladesh's own experts note "lack of consumer information, awareness and public participation" as barriers.**

- **Regional and diplomatic action. Bangladesh should actively seek international collaboration. At the BIMSTEC level, it can propose a task force on marine plastics, building on existing meetings. Under SAARC/SACEP, Bangladesh should push for a South Asian Plastic Pact, akin to ASEAN's efforts, that commits neighbors to reduce riverine waste. Participation in the new global Plastics Treaty negotiations is crucial: Bangladesh should articulate its river-plastic crisis and seek support for river-waste infrastructure via the treaty's financing mechanisms. Bilaterally, Bangladesh could negotiate waste-management aid with upstream countries and request technical help (e.g. from India's river cleanup initiatives). On data, Bangladesh could invite joint monitoring projects with India and Myanmar (e.g. synchronized river surveys) to build trust and transparency.**
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- **Integration with climate and development planning. Plastic mitigation should be mainstreamed into climate adaptation and SDG strategies. Coastal management plans (for cyclones, sea-level rise) must account for debris removal to prevent flood risk. Coastal afforestation and mangrove restoration programs (see below) should include plastic cleanup as a component. Waste management improvements can be framed as climate-resilient infrastructure: this opens doors to climate finance (see next section). Finally, Bangladesh should set ambitious national targets (e.g. percentage reduction in mismanaged plastic by 2030) and include plastic indicators in its Voluntary National Review on the SDGs.**
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By combining these measures—laws, innovation, data and diplomacy—Bangladesh can begin to close the leak in its "bucket". Given the magnitude of transboundary flows, the country cannot succeed alone: these national policies should be paired with strong calls for shared responsibility among Bay of Bengal neighbors.

Mobilizing Climate Finance for *Marine Plastic Mitigation*

Innovative financing can help Bangladesh tackle plastic pollution as part of its climate resilience agenda. Although plastic is not traditionally a "climate" issue, there are powerful synergies with coastal adaptation and Blue Economy projects. Two key mechanisms are:

- **Green Climate Fund (GCF): The GCF funds large-scale projects that improve climate resilience and low-carbon development. Bangladesh should design GCF proposals that integrate plastic management into coastal resilience. For example, a mangrove restoration project (to adapt to cyclones and sequester carbon) could include a waste-collection component: cleaning plastic debris from planting sites and installing bins for local communities. GCF's existing projects illustrate the concept: the 2025 Barbados Climate-Resilient Water Reclamation project (USD 110M) will upgrade sewage systems "to reduce marine and groundwater pollution" and "protect the quality of marine ecosystems". Similarly, Bangladesh could use GCF funds to bolster waste infrastructure (e.g. climate-proof landfills, energy-from-waste plants) under the rationale of protecting coastal water quality. Another avenue is to leverage GCF's interest in sustainable urban development: e.g. funding waste-to-energy facilities in Dhaka or Chittagong that reduce landfill use and greenhouse gas emissions, while preventing plastic from leaching into rivers.**

- **Adaptation Fund and Adaptation Projects: The Adaptation Fund finances projects for vulnerable communities facing climate threats. Bangladesh has successfully used Adaptation Fund grants for coastal afforestation. The Community-Based Adaptation through Coastal Afforestation project (CBACC) established 9,650 ha of mangroves, absorbing 965,000 tonnes of CO_2 annually (unfccc.int). To leverage this, Bangladesh should propose expanding such initiatives to explicitly include plastic cleanup. For instance, in restoring mangrove belts, project funds could also deploy nets to trap floating debris, and train villagers to remove plastics before planting. Plastic removal would improve mangrove survival (plastics can hinder seedling growth) and enhance livelihoods (collecting and recycling plastics as a co-benefit). Likewise, Adaptation Fund projects on cyclone shelter upgrades or watershed management could allocate resources to waste interception structures. Framing these actions as disaster-risk reduction (flood prevention) makes them eligible adaptation measures.**

- **Other climate and environmental funds: Bangladesh can also appeal to the Global Environment Facility (GEF) or multilateral development banks for integrated projects that address both pollution and climate. For example, the GEF-7 program for Coastal Resilience could fund pilot "Blue Carbon" initiatives combining mangrove planting with river-waste collection. Bilateral climate grants (from Japan, EU, etc.) could support urban waste management as part of "NDC implementation" on waste (Bangladesh's NDC mentions waste treatment).**

In summary, Bangladesh should link plastic pollution to climate objectives. By packaging marine plastic mitigation as ecosystem-based adaptation and pollution reduction, the country can tap into the financing streams of GCF, the Adaptation Fund and related sources. This approach also aligns with SDGs (12.5 on waste, 13 on climate, 14 on life below water). If successful, climate-funded models in Bangladesh could become regional exemplars: a GCF project on the Meghna Delta, for instance, could inspire similar funding for the Ganges plain in India and Nepal. Coordinated climate-financed action would thus tackle plastics while enhancing coastal resilience – a "two birds with one stone" solution urgently needed in the Bay of Bengal.

Conclusion

- **Cross-border plastic pollution is a clear and present danger to the Bay of Bengal and to Bangladesh's future. The mountains-to-sea river highways of South Asia are spewing millions of tonnes of plastic into Bangladesh's coastal waters. This crisis is already undermining the health of marine ecosystems, threatening food security, damaging the economy, and endangering human health in Bangladesh. It will only worsen unless immediate action is taken.**

- **This position paper has highlighted that no country alone can solve this problem. The plastics flowing through the Ganges-Brahmaputra-Meghna network require a regional solution. We urge the Government of Bangladesh to champion urgent regional collaboration: to use forums like BIMSTEC and SAARC/SACEP to negotiate plastic-waste agreements; to engage neighbors in joint monitoring and data-sharing; and to leverage international processes (e.g. the UN Plastics Treaty) to hold upstream countries accountable. Bangladesh should also align its domestic policies (legal reforms, waste system upgrades, scientific monitoring) with these international efforts.**

- **Time is of the essence. The Bay of Bengal's waters are not inexhaustible; every year of inaction means more tonnes of plastic accumulating in Bangladesh's heritage mangroves and on its shores. We call on policymakers, citizens and the international community to recognize this threat as urgent and transboundary. Only by working together, across borders and sectors, can Bangladesh and its neighbors turn the tide on plastic pollution and protect the Bay of Bengal for future generations.**

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CHANGE INITIATIVE

House: B157, Road: 22, New DOHS, Mohakhali, Dhaka 1206, Bangladesh

Phone: +88-0130-284-3523 | Email: communication@changei.org