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A Government-Focused Approach to Addressing Salinity Intrusion in Bangladesh

1. Introduction

The United Nations Framework Convention on Climate Change (UNFCCC) predicts that Bangladesh will be one of the most impacted countries by climate change, due to its vulnerability to natural disasters such as floods and cyclones, high population density, and high poverty levels.[[1]](#footnote-1) These factors threaten Bangladesh’s future and specifically have impacted the salinity levels in Bangladesh’s soil and water. Over the past 35 years, it is estimated that salt-water intrusion, a major causal factor of increasing salinity, has grew by 26 percent.[[2]](#footnote-2) Increasing salinity presents a distinctive challenge for the government of Bangladesh to address because its effects are widespread, threatening its citizens’ drinking water and food security, agricultural output, and natural resources such as the mangroves. These challenges have already caused widespread changes for Bangladesh’s people and economy, including the relocation of thousands of citizens living in coastal areas and rise of aquaculture practices such as shrimp farming,[[3]](#footnote-3) which compound existing salinity problems. The causes of increasing salinity levels are also complex; international climate trends, international policies, and domestic practices all influence salinity in Bangladesh. This paper will explore the main impacts and causal factors of increasing salinization. It will then recommend key actions the government of Bangladesh can take to improve their approach to addressing increasing salinity and approaches that citizens and government employees can take to induce the government to undertake these actions. This paper will recommend that the government of Bangladesh focuses on creating more comprehensive solutions to addressing increasing salinization by improving local government capacity and coordinating with NGO’s. The government of Bangladesh should further support ongoing initiatives by creating clearer policies and improving enforcement of existing regulations. Finally, the government of Bangladesh can design a better approach to increasing salinity levels by investing in infrastructure and creating incentivizes for its farmers and citizens to engage in sustainable practices.

1. The Impacts of Increasing Salinity on Bangladesh

Increasing salinity in Bangladesh has and will continue to significantly impact its economy and environment. These effects can be separated into its (1) impacts on local residents’ health and livelihood (2) its impact on food security and (3) its impacts on important natural resource areas, such as the Sundarbans.

Rising water and soil salinity levels directly impact the 35 million people who live in coastal Bangladesh and depend on these resources for their livelihood. The World Bank has observed a high incidence of poverty near the coast and identified these districts as some of the poorest in Bangladesh.[[4]](#footnote-4) Recent studies on residents in coastal Bangladesh have found that the increased salinity is associated with higher blood pressure in the coastal population, leading to higher instances of hypertension and cardiovascular diseases.[[5]](#footnote-5) A report by Environment Health Perspectives titled, “Drinking Water Salinity and Maternal Health in Coastal Bangladesh: Implications of Climate Change,” found that in coastal Bangladesh, “the mean sodium intake in pregnant women is well above WHO/FAO–recommended levels and above those of many other countries.”[[6]](#footnote-6) Salinity thus also significantly impacts future generations in Bangladesh because it causes hypertension that impacts maternal and fetal health during pregnancy.[[7]](#footnote-7)

The effects of increased salinity not only impact the individual health of coastal Bangladesh residents, but also threaten their livelihoods and food security. Crop production in coastal Bangladesh has significantly declined due to increasing salinity. Though crops such as rice can initially benefit from some increased levels of salinity, a study completed in 2016 by the International Centre for Climate Change and Development (ICCCAD) reported that salinity is “one of the main reasons for decreasing crop yield and directly affects the yield of the most preferred crops” in coastal Bangladesh.[[8]](#footnote-8) In response, many farmers have started using additional fertilizers which have compounded salinity effects and also placed a larger burden on the poor by making farming more costly.[[9]](#footnote-9) In the context of the broader national economy, about 16% of the total rice production for Bangladesh comes from these regions.[[10]](#footnote-10) Reduction of production from salinity thus poses a large risk not only to local residents and their livelihoods, but also the national economy.

Rising salinity levels also threaten the nation’s well-being by degrading important natural resource areas, such as the Sundarbans. The Sundarbans are a wetland forest delta in the Bay of Bengal that is internationally recognized as a UNESCO World Heritage site.[[11]](#footnote-11) It provides many ecological and economic services to Bangladesh such as cyclone protection of millions of humans lives, a breeding ground for fish, a large supply of wood and building materials, and oxygen production and carbon sequestration.[[12]](#footnote-12) A report by the World Bank titled, “The Impact of Climate Change and Aquatic Salinization on Mangrove Species and Poor Communities in the Bangladesh Sundarbans,” predicts that increasing salinity will significantly reduce this area, thus harming some of the poorest regions in Bangladesh. These geographic changes are predicted to cause increased conflict between groups of people and between people and wildlife as tidal inundations cause wildlife such as crocodiles, sharks, and venomous snakes to come in contact with humans more often.[[13]](#footnote-13)

 Large-scale migration and displacement are predicted to occur in Bangladesh if salinity and water levels continue to rise. The World Bank predicts that migration will first occur within Bangladesh to urban areas and later across national borders, which will increase tensions with neighboring countries with similar natural resource dilemmas.[[14]](#footnote-14) This trend is already being observed within Bangladesh from studies that have noted that a majority of the 2,000 people who settle in the nation's capital every day are leaving coastal areas because they are experiencing rising sea levels, salinity, and extreme weather conditions. The International Organisation for Migration (IOM) specifically has estimated that “70% of Dhaka’s slum-dwellers moved there fleeing some sort of environmental shock.”[[15]](#footnote-15) Increasing salinity thus impacts Bangladesh at an individual, regional, and national level.

1. Causes of Increasing Salinity

To understand how Bangladesh’s government can address increasing salinization, it is necessary to understand the causal factors and magnitude of the salinization problem in Bangladesh. As Zhir Uddin Ahmed Mahmuduzzaman demonstrates in “Causes of Salinity Intrusion in Coastal Belt of Bangladesh,” it is helpful to categorize the causal factors of increasing salinity in Bangladesh into three main areas: (1) natural systems, (2) socioeconomic systems, and (3) policymaking.

* 1. Natural Systems

Climate change is a major cause of increasing salinization in Bangladesh because it raises sea levels, increases the frequency of cyclones and storms, and reduces dry season precipitation levels.[[16]](#footnote-16) As sea levels rise in response to climate change, both freshwater and soil salinity increase as a result of saltwater intrusion. Rising sea levels also lead to back-water effects, which occur when there is insufficient fresh water to counter the movements of tidewater toward rivers. Backwater effects cause floodwater to remain in the country for extended periods of time.[[17]](#footnote-17) Cyclones also cause tidal flooding with similar effects on water and soil as rising sea levels. Lower levels of precipitation reduce the amount of fresh water in Bangladesh’s soil and rivers which reduces its ability to decrease salinization. The World Bank predicts that the impacts of climate change on rising sea levels will continue with “virtual certainty throughout the century and beyond 2100 even if greenhouse gas emissions are stabilized in the near future.”[[18]](#footnote-18) Consequently, the government in Bangladesh should not focus the majority of its efforts on reducing global climate change to reduce salinization. It should, however, focus on the unique aspects of Bangladesh’s environment and natural resources that make it especially susceptible to the impacts of rising sea levels. By focusing on these geographic characteristics, the government of Bangladesh can tailor their solutions to their specific conditions.

Bangladesh’s soil and water are particularly susceptible to rising salinization due to its geographic location. Bangladesh is situated between the Himalayas to the north, the Bay of Bengal to the south, and the Bay of Bengal to the east.[[19]](#footnote-19) The Bay of Bengal receives water from three major rivers, the Brahmaputra, Meghna, and Ganga through estuaries. As a result of its geographic location, Bangladesh’s resilience to increasing salinity is very dependent on ice melt from the Himalayas and river discharge.[[20]](#footnote-20) Bangladesh is also located at the “juncture of many active tectonic boundaries,” making it prone to earthquakes and tsunamis as well as cyclones, flooding, and drought during the dry season and monsoon season.[[21]](#footnote-21) Due to this vulnerability to natural disasters, the government of Bangladesh must maintain a distinctive focus on “large-scale, disaster risk mitigation infrastructure” that other countries with salinization issues do not necessarily face.

* 1. Socioeconomic Systems

Socioeconomic systems can be understood as anthropogenic activities that cause increased salinity themselves or exacerbate the salinity changes occurring from natural systems. The main anthropogenic activities that impact Bangladesh include damming of rivers, mismanagement of coastal polders, and an increased dependency on aquaculture practices such as shrimp cultivation. River damming and barrages prevent necessary sediment and water circulation and also reduces upstream pressure so tidal flood water remains within Bangladesh for prolonged periods of time.[[22]](#footnote-22) The Farrakha barrage, for example, was constructed by India in 1975 and led to large reductions in the available freshwater in the Ganges River and the Meghna estuary, which are major sources of freshwater in Bangladesh. In 1996, Bangladesh and India signed the Ganges Water Treaty to maintain water flow during the dry season but this treaty was unable to restore freshwater levels in Bangladesh.[[23]](#footnote-23) Potential dams from hydroelectric projects in both China and India, such as the Zangmu Hydropower Station[[24]](#footnote-24) on the Brahmaputra River or the Tipaimukhi Dam in India, threaten to further reduce freshwater flow and salinity resilience in Bangladesh.

In the 1960s, the government of Bangladesh created polders in its coastal zones to protect its coastal areas from natural disasters and to help improve agricultural productivity. This project was taken on with the aid of the Netherlands, who have been very successful in using polders to combat rising sea levels and flooding in their coastal areas. In Bangladesh, however, this project has failed because the government was unable to properly maintain these polders, and in many cases, the polders were breached to promote shrimp culture. As a result, the damaged polders are now contributing to rising salinity by allowing salinity intrusion into agricultural areas.[[25]](#footnote-25) The unmaintained polders have also permanently damaged the land because the polders cause water logging when they are not maintained because their exit points become blocked with silt deposition.[[26]](#footnote-26) The failure of this project demonstrates the risks of using solutions to flooding and rising sea levels adopted from dissimilar nations. The inability of the government of Bangladesh to provide the kind of maintenance or regulation of these polders necessary to ensure that they benefit Bangladesh’s coastal areas provides a valuable lesson when approaching implementable solutions to Bangladesh’s salinity problem.

In the past thirty years, global shrimp production increased by 34 percent, and Bangladesh’s aquaculture practices have correspondingly increased by over two-fold.[[27]](#footnote-27) These practices have numerous effects that both directly and indirectly lead to increased salinization. Shrimp culture *directly* increases saltwater intrusion because shrimp ponds allow for percolation in surrounding soil, consequently increasing soil salinity. Practices of diverting salt-water and freshwater to shrimp farms also increase salinity along coastal areas and reduce crucial freshwater supplies. Groundwater is often withdrawn for shrimp farming practices which leads to water contamination.[[28]](#footnote-28) Increased aquaculture practices in Bangladesh have also *indirectly* contributed to rising salinity by increasing sedimentation which can create blockages in waterways and land degradation and destruction. Specifically, crucial mangrove and agricultural land have been damaged and converted into land for shrimp farming which consequently damages some of Bangladesh's natural barriers against saltwater intrusion and rising salinity. This process of land degradation creates a dangerous cycle for Bangladesh; as crucial land is damaged or converted for shrimp farming, farmers become unable to continue producing other crops and consequently turn to shrimp farming, thus incentivizing the expansion of the shrimp aquaculture practices. Since Bangladesh is one of the top global exporters of shrimp, this issue of constantly increasing aquaculture practices is especially challenging for the government of Bangladesh because these practices have become a crucial source of international revenue.

* 1. Policy Making

Many of the previously identified causal factors, such as unmaintained polders and destructive shrimp farming practices, have been permitted because Bangladesh’s local governments lack sufficient power and resources. In “Problems of Strengthening Local Government in Bangladesh: Towards a Comprehensive Solution,” Zayeda Sharmin, Amdadual Haque, and Fakhrul Islam detail the history of local governments in Bangladesh, noting:

The local government bodies had never been, in independent Bangladesh, ‘self-governing’ bodies in the true sense of the term. They could simply be labeled as an extension of the central government with guided and limited local participation. Consequently, local governments have always been institutionally and financially weak, poorly managed and lacked social and political credibility.[[29]](#footnote-29)

The inability for local government to gain power or sufficient resources prevents governmental bodies from fulfilling their responsibilities. As a result, the government of Bangladesh has a very limited ability to enforce environmental regulations. Many areas in Bangladesh, for example, allow for illegal shrimp farming practices that harm groundwater and freshwater resources. The lack of capacity at the local level also prevents these government bodies from taking on initiatives to build infrastructure to increase resilience to natural disasters and other environmental problems, such as sediment build-up, that contribute to rising salinity levels.

1. Current Efforts to Address Increasing Salinization in Bangladesh

Before making recommendations on how Bangladesh’s government can best address increasing salinization, it is necessary to understand their current efforts. Since Bangladesh’s government power is very centralized, many of these efforts originate at the national level with the assistance of predominantly international NGO’s and institutions such as the World Bank. At the national level, Bangladesh’s Ministry of Environment and Forests (MOEF) is responsible for directing initiatives related to natural resource management, addressing climate change, and advising numerous high-level committees.[[30]](#footnote-30) The main instruments that have been created by MOEF to address issues of natural resources include Bangladesh Climate Change Strategy and Action Plan (BCCSAP), the Climate Change Unit (CCU), National Adaptation Programmes of Action (NAPA), and the Climate Change Trust Fund (CTF) and Bangladesh Climate Change Resilience Fund (BCCRF). NAPA is responsible for coordination with civil society organizations and analyzes populations that are most at risk, BCCSAP is a ten-year action plan to adjust to changing conditions related to climate, and CTF manages the budget specifically allocated to addressing climate change impacts. BCCRF is a fund created with international support from the US, UK, Sweden, Denmark and the European Union and will be managed by the World Bank to implement action plans that stem from BCCSAP.[[31]](#footnote-31) It is important to note that while many actions are carried out at the local and community levels, the administration and direction of these efforts stem from national entities.

1. Policy Recommendations

The government of Bangladesh has been very successful in accessing international resources to help address issues related to climate change, and it has initiated numerous projects across many sectors. However, the government of Bangladesh needs to shift its focus to creating a more coordinated effort to solve issues of increasing salinization. The government of Bangladesh should focus on the following main efforts to achieve these goals: (1) empowering local governments, (2) improving coordination with stakeholders such as NGOs, and international organizations, (3) improving policies and regulation enforcement that will protect the Sundarbans and will improve agricultural practices. If the government of Bangladesh takes these measures, their approach to reducing salinization will achieve much higher levels of coordination between different levels of government, stakeholders, NGOs and international organizations. By increasing the institutional capacities of many of their local branches of government, the government of Bangladesh will empower these governments and use more effective measures to prevent harmful anthropogenic factors such as excessive shrimp farming or illegal destruction of agricultural land. The government of Bangladesh can assist local governments with reducing harmful practices through improving regulation, policy, and changing incentive structures so that farmers are encouraged to use more sustainable practices.

* 1. Empowering Local Governments

In a study on decentralized processes in over 19 selected countries in Asia and Africa, Bangladesh received the lowest rating.[[32]](#footnote-32) Improving the capacity of local governments will allow for more effective enforcement of policies and support of new initiatives related to reducing salinity. It is important to note that increasing the capacities of local governments does not necessarily guarantee that certain national initiatives will be executed more effectively. As Krister P. Andersson, Clark C. Gibson, Fabrice Lehoucq note in “The Politics of Decentralized Natural Resource Governance,” “decentralized natural resource policy depends on more than the hopes of the central government or international organizations; more than the time- and place-specific knowledge of local politicians.”[[33]](#footnote-33) After studying deforestation measures at the local level in Bolivia and Guatemala, Andersson, Gibson, and Lehoucq argued that the political incentives of local politicians are crucial for determining where local governments are most effective. They further argue, “decentralized policies that bestow advantages to incumbent politicians (or significant costs on those who fail to act) are far more likely to be pursued.’[[34]](#footnote-34) The government of Bangladesh must consequently create careful incentives while decentralizing; since efforts to improve poor salinity conditions are crucial for Bangladesh’s economic success and environmental stability in the future, the government should structure incentives so that politicians prioritize these measures. In, “National Environment Policy of Bangladesh: A Critical Review,” Raihan Akhtar evaluated whether Bangladesh’s current environmental approaches comprehensively address all pertinent issue areas and are effective. He found that while Bangladesh focuses on many pertinent issue areas, the government “adopts only command and control mechanisms to implement its guidance. It does not adopt monetary tools, fiscal tools, market-based mechanisms and so on to make the implementation effective and efficient.”[[35]](#footnote-35) This finding is significant because it demonstrates that adopting incentive structures for local governments in Bangladesh may be especially challenging since this practice of creating alternative incentives is not frequently used by the government of Bangladesh.

* 1. Insights on Decentralization from Japan

The government of Bangladesh may gain insight from Japan’s government decentralization efforts. Like Bangladesh, Japan began with a very centralized government. At present, Japan has achieved much higher levels of decentralization through addressing “regulatory, financial, administrative, environmental, and disaster management issues,” which Islam et. al identifies as the most pressing barriers to improving Bangladesh’s local government capacity.[[36]](#footnote-36) In “Towards Good Urban Local Governance in Bangladesh: Lessons learned from Japanese Local Government System to Overcome the Challenges,” Mohammad Nashir Uddin presents insights Bangladesh may draw from Japan’s process of decentralization.[[37]](#footnote-37) It is important to specifically evaluate Uddin’s suggestions for using decentralization to address disaster management, which Bangladesh could use to control for increasing salinization. Uddin notes that Japan faces similar environmental vulnerabilities as Bangladesh, such as risks of typhoons and the negative effects of rising sea levels. After Japan experienced a devastating typhoon in 1959, the central government assisted local government entities by creating disaster management councils to ensure the active creation of disaster management plans at the local level. The central government also created regulations for promoting seismic evaluations and provided local governments with adequate resources so that they local units could provide free evaluations to the local governments. Like Japan, Uddin suggests that the government of Bangladesh needs to “continuously support” local governments with creating contingency plans with “resources, ideas, and guidance…[local governments have] yet to formulate and implement their specific risk management plan; [local governments] are being treated merely as a part, despite the needs of special treatments due to local characters.”[[38]](#footnote-38) Though Uddin is correct that Bangladesh needs localized approaches to disaster response, these suggestions should be broadened to emphasize efforts to address environmental challenges such as rising salinity.

To ensure that local units prioritize proactive environmental management, the government needs to ensure local governments are more integrated into initiatives led by the national government or NGOs and create clearer processes for local government association. In “Problems of Strengthening Local Government in Bangladesh: Towards a Comprehensive Solution,” Zayeda Sharmin, Amdadul Haque, and Fakhrul Islam specifically advise the government of Bangladesh to, (1) “Formulate an Integrated Local Government legislature covering all levels of Local Government to get a complementary relationship between and among the levels of local bodies” and (2) enact a “Local Government Act [to] provide legal authority to supervise and monitor the activities of NGOs and other development factors operating within their territorial jurisdictions.”[[39]](#footnote-39) These recommendations will involve local government in initiatives that are currently directed at the national level and will create locally-specific solutions to issues of increasing salinization.

* 1. Improving Coordination with NGOs

The government of Bangladesh can also create more comprehensive solutions to rising salinity by increasing coordination among NGOs. Although there are many initiatives related to salinity and climate initiatives occurring in Bangladesh with the support of international donors, many of these projects are small-scale and are executed independently or are handled exclusively by NGO's without local participation. The government instead needs to act as a resource to coordinate efforts with NGO’s. As noted in the previous section, the government of Bangladesh need not ensure this coordination exclusively at the national level. Instead, local governments should play a role in creating comprehensive visions that integrate NGO’s in coordination with larger, national goals for addressing issues such as increasing salinization.

 Bangladesh has recently attempted to increase coordination with NGO’s, but in doing so, has delegated too much responsibility to outside organizations. In “An Integrated Approach to Environmental Management in Bangladesh,” Raquib Ahmed and Chandan Roy, note that the government of Bangladesh created a National Environmental Management Action Plan (NEMAP), which led to consultations with NGOs, scientists, grassroots organizers, journalists and other stakeholders. [[40]](#footnote-40) This plan, however, allowed for the responsibility of managing environmental issues to be disproportionately delegated to NGOs.[[41]](#footnote-41)Ahmed and Roy observed that Bangladesh is one of over 40 countries to adopt this model of high NGO participation in national development. Though this participation encourages transparency and plays a role in decentralizing power, Ahmed and Roy argue that this model introduces numerous new problems into countries such as Bangladesh, because it encourages less coordination between various governmental agencies. In Bangladesh, this lack of coordination and dependency on NGO’s is demonstrated by the overlapping duties between Bangladesh’s 11 ministries and 24 agencies that are focused on environmental issues such as land management and environmental issues.

The Asian Development Bank also noted Bangladesh’s lack of governmental coordination in their analysis of Bangladesh and its key constraints in 2004. They stated that the division of responsibilities between these ministries, “hinders smooth operation and execution of sustainable management regime.”[[42]](#footnote-42) The report specifically notes how Bangladesh's Department of Fisheries is responsible for the improvement of the fisheries sector, but the legal owners of water bodies are other government ministries depending on their size, such as the Ministry of Land, Ministry of Youth and Sport, and Ministry of Water Resources.[[43]](#footnote-43) As a result of these divided responsibilities, the report notes that many inter-agency conflicts arise, preventing “the subject of protecting the resources and the ecosystems…to be treated with appropriate urgency and priority, and thus creates inconsistencies.”[[44]](#footnote-44) This analysis supports Ahmed and Roy’s argument that high NGO involvement with national development can be highly problematic for countries such as Bangladesh. This dependency leads these countries to design inefficient models and does not prioritize their improvement since NGO's manage the majority of these efforts. As a result, the government of Bangladesh should continue some practices from NEMAP, such as high coordination with numerous stakeholders and constant evolution of its current national environment program, the Bangladesh Climate Change Strategy and Action Plan. The action plan should not, however, continue with Bangladesh’s current model of high NGO dependency, and should instead work to create more involvement and responsibility for local government entities instead. This approach will ensure that the government of Bangladesh continues to design comprehensive solutions for issues such as increasing salinization while also shifting toward a more efficient model for government-NGO interaction.

* 1. Improve Environmental Policies and Regulation

On a broad level, the government of Bangladesh needs to assist environmental initiatives by improving their environmental policies. Not only are many of their policies outdated, but in many cases, they fail to accurately represent the nature of environmental issues. The Country Analysis report by the Asia Development Bank argues that much of Bangladesh's policies create a false division between policies focused on improving the environment and policies that impact other aspects of the nation, such as economic policies. Consequently, the report recommends that "environmental aspects should be treated as a cross-cutting issue. Environmental programs may not be undertaken as separate programs. For every sector, environment components should be identified so that these are duly addressed, while formulating programs or activities in that sector.”[[45]](#footnote-45) The diverse impacts and causes of salinization provide supportive evidence for this recommendation; the government of Bangladesh needs to shift its future policymaking to incorporating environmental considerations throughout its new policies, instead of creating policies with solely environmental focuses. These actions will not only better address issues such as increasing salinization, but they may also decrease redundancies and conflicts that arise from policy contradictions between different ministries and agencies.

 To address issues specifically related to increasing salinization, the government of Bangladesh should focus on improving regulations regarding shrimp farming and the destruction of the Sundarbans. Although Bangladesh has many environmental regulations regarding shrimp-farming, it rarely enforces them. A study performed by the Asian Institute of Technology interviewed shrimp farmers in coastal Bangladesh and discovered that the majority of shrimp farmers in the area were unaware of any existing regulations and compliance levels were very low.[[46]](#footnote-46) The report also noted that “out of 10,428 shrimp farms under Satkhira District, only 564 farms have registered with the Department of Fisheries (DOF) Bangladesh,” demonstrating the lack of meaningful enforcement of shrimp-farming policy in Bangladesh.[[47]](#footnote-47) Bangladesh also lacks a clear national policy regarding changing farmland to shrimp-farming which significantly limits their ability to contain the expansion of shrimp-farming practices.

Though many potential technological improvements exist for sustainable shrimp-practices, the government of Bangladesh has focused much more on the promotion of shrimp farming practices than enforcing more sustainable practices. This emphasis is likely because shrimp-farming has become such a significant part of Bangladesh’s economy. A study in *Environmental Management* notes that Thailand, the top global exporter of shrimp, has faced very similar problems with shrimp farming: the government has largely failed to enforce sustainable practices because "low-interest loans and import duty exemption for equipment have encouraged investment in the development of intensive shrimp aquaculture.[[48]](#footnote-48)” The report provides two important insights for how the government of Thailand may come to value investment in sustainability. First, the World Bank partnered with MIDAS Agronomics to calculate the large financial losses to Thailand due to their poor solutions to issues of sustainability and technology in shrimp farming practices.[[49]](#footnote-49) If a similar report was produced in Bangladesh, it could provide a financial incentive for the government to invest further in policy enforcement and creation. The report also notes:

Most Western nations that buy shrimp from Thailand are unaware of the environmental degradation and social changes that accompanied the rapid growth of farming. If the unsustainable practices of shrimp farming receive more media coverage in the West, consumers may decide not to buy shrimp products from countries that exploit mangroves, displace traditional livelihoods, and despoil coastal zones by abandoning farms and discharging waste from the ponds.[[50]](#footnote-50)

The same theory can be applied to Bangladesh. International organizations could play a crucial role in pressuring the government of Bangladesh into prioritizing sustainable practices and regulation by increasing awareness of the environmental consequences of Bangladesh’s harmful practices to its largest consumers. If Western nations began to reduce their consumption in response to these practices, the government of Bangladesh would face serious economic pressure to improve their practices.

Since shrimp farming drastically increases salinity in coastal Bangladesh, the government’s failure to regulate this practice also has large impacts on the destruction of the Sundarbans. Although Bangladesh’s shrimp farming policies include clauses related to the Sundarbans, such as Section 5.3.5 of the 2014 National Shrimp Policy, which “prohibits the expansion of the shrimp industry by clearing mangrove forests and prevents any shrimp-related activities that make the forest vulnerable,” these policies are largely unenforced. Additional clauses of these policies also reveal many ambiguities and contradictions that prevent meaningful protection of the Sundarbans. A study by Arizona State University identifies some of these issues in Bangladesh’s National Shrimp Policy: “5.8.2, for instance, aims to bring government/private lands under shrimp culture and apply ‘necessary’ vertical/horizontal methods of expansion, whereas, section 5.3.3 clearly instructs to establish shrimp-culture infrastructures ensuring environmental balance.”[[51]](#footnote-51) These policies leave room for loopholes with vague concepts of “environmental balance” that farmers and stakeholders in the shrimp farming industry can use to continue to expand their practices.

Although the government of Bangladesh needs to invest in clarifying their environmental policies and enforcing them, the Sundarbans present an even more pressing problem: the need to clarify property rights. To effectively protect this crucial area from destructive practices, the government of Bangladesh needs to adjust their approach to rights in the forest. A study by the University of Southern Queensland performed analysis on past forest management policies aimed at improving sustainability in the Sundarbans Mangrove Forest and concluded that “although the conservation of the Sundarbans Mangrove Forest has received high priority from policy-makers in different time periods,…[past and current] policies did not recognize any attachment and belonging by the local people...[instead] treating the forest as a public good under state property rights regime.”[[52]](#footnote-52) The government of Bangladesh needs to clarify property rights in the Sundarbans in a way that recognizes the rights of local people. Though the government may be reluctant to take such actions since it may reduce their power, clarifying these rights will be crucial to ensuring cooperation from local people with efforts to improve sustainability.

1. Enactment Strategy: Government of Bangladesh

The recommendations outlined above are focused mainly on ways that the government of Bangladesh can improve its approach to increasing salinity. It is important to focus on enactment approaches that people within the government or outside of the government might use to pressure the government to take the actions discussed. To increase decentralization to local governments and NGO coordination, government officials may call for a Constitutional Convention or seek to pass a form of legislation that would make a formalized commitment to decentralization. Sharmin et. al., for example, propose that the Government of Bangladesh amend Article 11 of the Constitution because it currently calls for ensuring “participation by the people through their elected representatives in administration at all level,” which creates ambiguity between “functional administration” and “territorial administration.”[[53]](#footnote-53) This section has allowed for the Government of Bangladesh to avoid effective people’s participation at all levels of government, and thus, a constitutional amendment could improve decentralization efforts. Legislation such as a “Local Government Act” that grants local governments more authority would simultaneously increase decentralization and improve coordination with NGO’s.

Incentivizing government officials to engage in decentralization efforts is also challenging because government officials may be reluctant to relinquish power or authority. For those seeking to pressure decentralization efforts, it is necessary to understand incentives for political actors. As the World Bank discusses in its report, “The Political Economy of Decentralization Reforms: Implications for Aid Effectiveness,” those seeking to encourage decentralization should understand where individual politicians are hoping to move in their careers and understand whether promoting decentralization will help their political goals.[[54]](#footnote-54) The report notes that politicians and bureaucrats are often incentivized to support decentralization when there are changes in the political landscape:

The emergence of a multiparty environment or changes in the balance of power among existing parties can lead actors to reposition their stances on decentralization (either pre- or post-election) and trigger a reconfiguration of the institutional landscape. This has clearly been the case in Nicaragua, where the Sandinistas worked in partnership with the Association of Nicaraguan Municipalities to push decentralization legislation when they were in the opposition.[[55]](#footnote-55)

By understanding opportune times to pressure politicians to value decentralization, government and independent actors can be more effective in advocating for measures such as a constitutional amendment or new legislation.

The report also notes that politicians may change their stance on decentralization if it no longer serves their political interests or they may come to fully understand how these efforts will decrease their own power. It is important for those who are seeking decentralization to understand this high propensity to change position and seek out measures to hold politicians and bureaucrats accountable. To do so, government officials or external actors may pressure politicians to create strategic plans, which "provide[s] mandates for leaders but enable[s] them to seek periodic revisions if circumstances change, so the plans are not straight jackets when they become obsolete."[[56]](#footnote-56) However, strategic plans can often fail to hold politicians accountable if the government fails to create systems and efforts to fulfill the plan and stay accountable. In these instances, government or external actors can hold the government accountable to its commitments by "tying [the government's] hands by elevating the status of the policy to make it more difficult to rescind, or signing agreements with higher authorities, for example, the World Bank."[[57]](#footnote-57) Bangladesh’s high involvement with NGO’s and institutions like the World Bank may encourage the government to use these resources more readily.

Government actors that seek to pressure the government to better enforce their regulations can restructure existing incentives to make them more rewarding in the short-term for government officials. For example, in the case of Bangladesh’s unmaintained polders, the government may be more compelled to consistently maintain these systems if they received monetary rewards or greater political support for their actions in the short-term. These incentives can be structured both within and outside of the government: “both governments and non-governmental organizations can co-finance far-sighted initiatives; for instance, by use of tax credits or by matching contributions.”[[58]](#footnote-58) As discussed with Bangladesh’s shrimp farming, the government also needs to be pressured to enforce existing policies. In these instances, external actors may seek to create systems that punish government officials for short-sighted actions that prioritize Bangladesh’s economy in the short term and neglect the long-term environmental implications of the farming practices. Institutions like the World Bank or international investors in shrimp farming can play crucial roles in this punishment, by reducing investment or funding when the government of Bangladesh continues to act in harmful ways.

1. Enactment Strategy: Citizens of Bangladesh

Although the government of Bangladesh needs to prioritize better enforcement of their existing regulations, they may also improve sustainable farming practices by creating incentives for their farmers. There are many potential practices that farmers could adopt to combat rising salinity, such as: adoption of salt-resistant varieties of rice,[[59]](#footnote-59) surface water irrigation systems,[[60]](#footnote-60) deep tillage to reduce leaching the soil,[[61]](#footnote-61) and creating a natural shelter belt to protect coastal areas by planting species that protect the ecosystems.[[62]](#footnote-62) All of these approaches require cooperation with farmers who would need to change practices on their land. To incentivize these farmers, the government of Bangladesh should take a few main approaches, including (1) providing subsidies to farmers who engage in sustainable practices, (2) reducing transaction costs associated with these new practices, (4) involving citizens in the learning process for these practices and (5) assuring rights and compensation for those who may lose their land. The government of Bangladesh is already involved in many programs involving subsidy provision and transaction cost reduction. To convince farmers to adopt sustainable practices, the government can take many approaches to “participatory learning,” which involves farmers in the “discovery process” of new techniques so that they feel confident in their decision to transition their practices.[[63]](#footnote-63) For example, the government of Bangladesh could provide incentives for wealthy farmers to try a new practice on a small area of their land and empower other farmers in the area to monitor and check the success of this new farming method. By allowing these farmers to independently survey and assess a new method, the government builds trust and buy-in with these farmers.[[64]](#footnote-64) It is important to note that this “prototype” method is not restricted to farming. The government of Bangladesh may use this approach with decentralization by granting increased authority to a few local governments and allowing numerous agencies to observe the success of this trial.

1. Land Displacement and Planning for the Future

 It is crucial that the government of Bangladesh improves its approach to assisting those who must be relocated because their land and livelihoods have been destroyed by climate-related causes such as rising salinity. Currently, the government of Bangladesh views relocation as a last resort. Understanding the severe loss of land in coastal areas predicted for Bangladesh, the government needs to transition to a more proactive approach. Specifically, the government needs to view these approaches as rights-based and seek long-term, effective solutions that take into consideration the ability for relocated individuals to secure housing and new jobs.[[65]](#footnote-65) A report produced by the UNFCC provides comprehensive solutions to climate displacement in Bangladesh, including the development of a rights-based national plan, land acquisition and land set aside projects, community land trusts, and accessible emergency response programs.[[66]](#footnote-66) Many of these approaches, such as land set-aside projects and land acquisition, may require high levels of information and capacity from the government to decide the appropriate land to set aside. This expertise can come from both international organizations that can assist with data collection and monitor displaced persons and local governments with higher regional expertise, thus providing additional incentives for the government to engage in decentralization and coordination with NGOs. International funding from sources such as the Green Climate Fund, which was created during the COP16 summit, can provide a further financial incentive for the government of Bangladesh to create these relocation plans. If the government of Bangladesh secures such funding, it is imperative that the funders and external stakeholders such as NGO’s act as “watchdogs,” since many of these funded programs suffer from extreme lacks of transparency and accountability to program goals.[[67]](#footnote-67)

1. Conclusion

 Increasing salinity in Bangladesh is a problem that requires a comprehensive institutional response and accountability. This issue is compounded by other climate-related changes, such as rising sea levels, which threaten the health and livelihoods of some of the poorest populations in Bangladesh. This paper has offered specific actions for the government of Bangladesh to take to address these issues and potential methods that government officials and external stakeholders can use to ensure that the government takes action. Taking action to address increasing salinity in Bangladesh will not only ensure the preservation of rights for many residents, but it will also set an international example for numerous developing countries facing similar climate-related challenges.

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