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ACCELERATION OF URBAN MEASURES FOR CARBON-FREE PROJECT REGION

REPORT
ON
ACCELERATION OF URBAN MEASURES FOR CARBON-FREE PROJECT REGION

By

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Preparation of Payra-Kuakata Comprehensive Plan Focusing on Eco-Tourism Project

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Declaration

I, Dr. Md. Nazrul Islam, declare that all materials included in this report is the end result of my own work and that due acknowledgement have been given in the bibliography and references to ALL sources be they printed, electronic or personal.

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Abstract

The acceleration of urban measures for carbon-free project area, i.e., Galachipa, Kalapara, Rangabali, Barguna Sadar, Patharghata, Amtali, and Taltali upazillas under Patuakhali and Barguna districts is very important for the sustainability of the project. It has also become increasingly important topic in addressing the global issue of climate change. Mangrove plantation is one of the most effective strategies in reducing carbon emissions and increasing carbon sequestration. There are also some other measures to minimize the carbon emissions. This abstract discusses the acceleration of urban measures for a carbon-free project region through the implementation of mangrove plantation in the coastal areas and mainland species plantation in the urban areas along with other measures. The aim is to reduce carbon emissions and increase carbon sequestration through the plantation of mangroves and mainland species in coastal and urban areas, respectively. This initiative will provide numerous benefits such as reducing the urban heat island effect, improving air quality, and increasing biodiversity. The project will require collaboration between various stakeholders, including the government, private sector, and local communities. The success of the project will depend on the effective implementation of policies and the engagement of all stakeholders in the process. Through this initiative, the project region can contribute to the global effort in mitigating climate change and promoting sustainable development.

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1. Introduction

The purpose of this report is to provide a set of guidelines and activities that will enable the seven upazilas of Patuakhali and Barguna district—Galachipa, Kalapara, Rangabali, Barguna Sadar, Patharghata, Amtali, and Taltali - to become a carbon-neutral city. By 2025, when it is fully operational, the Pyra Port is expected to have handled nearly 2 million containers, 2.5 million tons of general cargo, and nearly 43 million tons of other materials (oil products, grain, sand and aggregate, coal, etc.), according to the Payra Port Master Plan prepared in January, 2016. About 13,000 people, including laborers, could find work at the port and its associated facilities (airport, free trade zone, tourist zone etc.). Estimates show that after the Pyra port is fully developed, the new township adjacent to the port could have as many as 43,550 people working there (both directly and indirectly), with a total population of around 1,26,000. It indicates that a substantial amount of carbon will be emitted from the port city and adjacent newly developed sites (living, tourism, and newly developed industrial zones) if no action is taken. It is necessary to develop a carbon-free project area to mitigate the effects of climate change on environment and human health caused by greenhouse gas emissions.

2. Necessity of Making the Payra-Kuakata Comprehensive Plan Focusing on Eco-Tourism Project area as a Carbon Neutral City

Carbon emissions have a substantial impact on human health and the environment. The combustion of fossil fuels such as coal, oil, and gas emit a variety of harmful pollutants into the atmosphere, including particulate matter, nitrogen oxides, and sulfur dioxide, which can cause respiratory problems, cardiovascular disease, and cancer (WHO 2016). Carbon emissions from human activities have caused the Earth's climate to warm at a rate unprecedented in at least the past 2,000 years (Marcott et al. 2013). In addition, human-caused carbon emissions are the primary cause of global warming and are driving changes in the climate system, including increasing temperatures, melting glaciers, rising sea levels and weather pattern changes (IPCC 2021).

Climate change is causing a variety of environmental hazards, including sea-level rise, more frequent and severe natural disasters, and changes in weather patterns, which can lead to droughts and crop failures. These effects can have serious health consequences, such as malnutrition, an increased risk of infectious diseases, and mental health issues related to forced migration and displacement (WHO 2018). The World Health Organization (WHO) estimates that air pollution, primarily caused by the combustion of fossil fuels, causes approximately 7 million premature deaths each year (WHO 2016). According to another estimate, it is responsible for over 150,000 deaths per year and is expected to rise to 250,000 deaths per year by 2030 (WHO 2018). Transitioning to a carbon-neutral society could save up to 4.6 million lives per year by reducing air pollution (Shindell et al. 2018).

According to a study published in the journal Science, human-caused carbon emissions have caused the Earth's climate to warm at a rate unprecedented in at least the last 2,000 years (Marcott et al. 2013). It also contributes to ocean acidification, which has serious consequences for marine ecosystems and fisheries (National Oceanic and Atmospheric Administration, 2021). Unchecked carbon emissions could significantly increase the frequency and severity of extreme weather events like heatwaves, hurricanes, and floods (Union of Concerned Scientists, 2019; Diffenbaugh and Field 2013). According to a report by the United Nations Office for Disaster Risk Reduction, climate change is the "single biggest driver" of economic losses from disasters, and weather-related disasters have increased by 35% between 1990 and 2019 (UNDRR 2020).

According to the Intergovernmental Panel on Climate Change (IPCC), limiting global warming to 1.5°C above pre-industrial levels will necessitate reaching net zero carbon emissions by 2050 (IPCC 2018). According to a study published in the journal Nature Climate Change, transitioning to a low-carbon economy could save up to 175,000 lives per year in Europe alone (Markandya et al. 2016). Reduction measures, such as switching to renewable energy and improving energy efficiency, can help to mitigate the climate impacts of carbon (International Energy Agency 2021).

Last not least, Bangladesh is a low-lying country in the delta of the Ganges, Brahmaputra, and Meghna rivers, making it extremely vulnerable to flooding and sea-level rise. A 32-101 cm sea level rise by the end of the century is predicted by the Intergovernmental Panel on Climate Change for Bangladesh (IPCC 2014). Furthermore, most people in Bangladesh rely heavily on agriculture for their income. The effects of climate change on agricultural output are substantial, and they have the potential to exacerbate poverty and food insecurity (Hossain and Rashid 2016). In addition, the area's proximity to the ocean makes it vulnerable to cyclones; the coast experiences an average of 4-6 cyclones per year, each of which has the potential to wreak havoc on the local economy by destroying buildings, crops, and transportation links, and by triggering storm surges that can inundate low-lying coastal areas (Rashid 2018). The risk of coastal flooding and population displacement has been shown to increase as sea levels rise, according to a study conducted in 2017 (Islam et al. 2017).

3. Actions Required to Make the Project Area as Carbon Free Area

To reach a state of carbon neutrality, it is necessary to find a way to bring the total amount of carbon dioxide and other greenhouse gas emissions, whether they were produced directly or indirectly, into a state of equilibrium over a predetermined time period. This can be done through the implementation of carbon removal or offset programs. The Intergovernmental Panel on Climate Change (IPCC) emphasized the need to reduce and phase out the use of fossil fuels, use more renewable energy, improve energy efficiency, and highlighted the importance of implementing these measures in cities to achieve carbon neutrality (Masson-Delmotte et al. 2018). In addition, carbon removal or sequestration in terrestrial and marine ecosystems needs to be encouraged in order to reach the goal of reaching net-zero carbon emissions and achieving sustainable development (Cheng 2020). The primary objective of the project is to realize carbon neutrality in the geographic region that has been designated as the project area. This indicates that the region will be required to eliminate all of its emissions of greenhouse gases and compensate for any emissions that are still produced using carbon sequestration or some other method. In order to accomplish this mission, the project will center its efforts on the following goals:

3.1. Interrelationships and synergies between adaptation and mitigation strategies

In addition to climate change mitigation strategies, adaptation strategies are also crucial. Fig. 1 illustrates that synergies are more advantageous than separate approaches to adaptation and mitigation. Implementing distributed solar power instead of fossil fuels in buildings as a mitigation strategy reduces carbon emissions in the energy sector. Adaptation and the use of distributed solar power are complementary, as solar power results in a more resilient power supply system than over-the-ground grids, which are susceptible to climate change-induced storms and temperature fluctuations. Planting and maintaining forests in nature is a synergy between mitigation and adaptation strategies. The forests reduce and store carbon, thereby mitigating global warming. In addition, forests adapt to climate change by protecting against droughts, fires, flooding, and heat waves (Moomaw et al., 2019). Wind energy and urban green spaces are additional examples of energy and nature sector strategies that exhibit synergy and benefit both mitigation and adaptation.

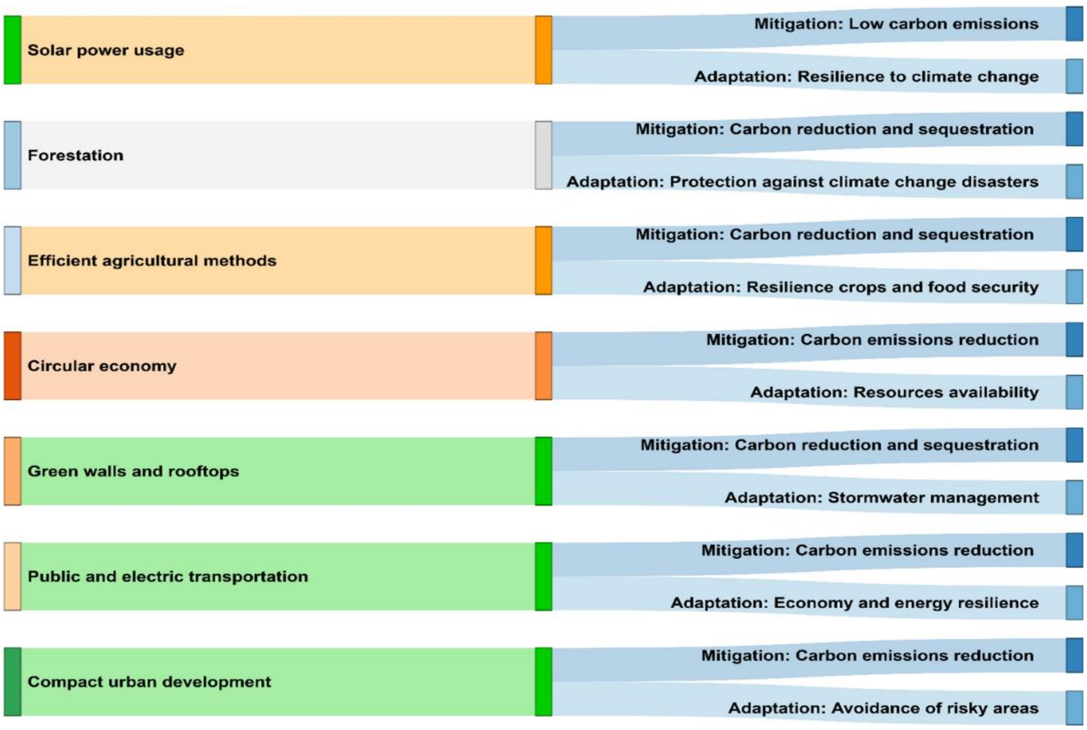

Fig. 1. Summary of how mitigation and adaptation strategies complement each other. Solar power, a renewable energy source, reduces climate change by lowering carbon emissions. Solar power adapts to climate change because it can withstand storms and high temperatures, unlike centralized grid systems. New carbon neutrality policies should emphasize mitigation and adaptation, not just mitigation.

3.2. Reducing greenhouse gas emissions

It is possible that lowering greenhouse gas emissions in a port city will prove to be a challenging endeavor that will require the participation of a variety of stakeholders, including port authorities, shipping companies, the local government, and citizens. In order to lessen the amount of greenhouse gases released into the atmosphere, a port city can take the following measures:

3.2.1. Encourage the use of cleaner fuels

Future carbon neutrality requires a transition away from fossil fuel energy sources and toward renewable energy sources. Promoting the use of cleaner fuels like liquefied natural gas (LNG) or biofuels can significantly reduce greenhouse gas emissions from ships. LNG has the potential to reduce greenhouse gas emissions from ships by 10-20% compared to traditional marine fuels, according to a study by the International Council for Clean Transportation (ICCT) (International Council on Clean Transportation 2017). Ports may offer financial incentives to ships that use cleaner fuels or enact regulations mandating the use of cleaner fuels in their waters.

3.2.2. Enhance energy efficiency

Port authorities can implement measures to enhance the energy efficiency of port operations, including the use of LED lighting, the improvement of insulation, the upgrade to energy-efficient appliances, the implementation of energy management systems, and the reduction of vehicle and ship idling times. Consumption of energy, and therefore the demand for electricity generated from fossil fuels, may be lowered as a result of the implementation of these measures. These measures can help reduce energy consumption and emissions of greenhouse gases. According to a European Commission report, implementing energy efficiency measures can reduce greenhouse gas emissions from ports by up to 30 percent. (European Commission 2013).

LED lighting is an extremely energy-efficient technology that uses much less electricity than conventional lighting. LED lighting upgrades can reduce energy consumption by up to 80% compared to conventional lighting (US Department of Energy, 2021). Increasing building insulation can reduce heating and cooling needs, thereby reducing energy consumption. Upgrading to energy-efficient refrigerators, washing machines, and air conditioners can also significantly reduce energy consumption. According to the International Energy Agency (IEA), energy efficiency improvements can provide nearly 40 percent of the required reduction in energy-related carbon dioxide ($CO2$) emissions by 2040 to meet global climate goals (IEA, 2019). Numerous studies have demonstrated the potential carbon emission reduction benefits of energy efficiency measures. According to one study published in Energy Policy, increasing energy efficiency in the European Union could reduce carbon emissions by up to 25% (Friedrich et al. 2015). Another study published in the journal Applied Energy found that increasing residential energy efficiency could substantially reduce carbon emissions (Lin et al., 2021). The implementation of these energy-efficient measures in the project area will be encouraged.

3.2.3. Reducing single use of plastic

Plastic use has been found to have a significant impact on greenhouse gas emissions, with the production and incineration of plastic contributing to global carbon emissions. According to various sources, plastics are estimated to emit around 3.4-10% of global greenhouse gas emissions (OECD), with some projections indicating that greenhouse gas emissions from plastics could reach over 56 gigatons by 2050 (Shen et al. 2020). Additionally, the extraction and transportation of fossil fuels used to produce plastics also contributes to carbon emissions (Ford et al. 2022).

3.2.4. Use of Bio- / recyclable plastic

Replacing conventional plastics with bio-based plastics (made from renewable feedstocks) is frequently proposed as a way to lower carbon emissions and help mitigate the impacts of climate change (Posen et al. 2017). By reducing the amount of plastic waste generated, and by using alternative materials or reusable products, individuals and organizations can contribute to the reduction of emissions associated with plastic production and disposal. However, it is important to note that plastic use is just one part of the broader challenge of reducing greenhouse gas emissions, and meaningful action will require a holistic and interconnected approach.

3.2.5. Implement shore power

Providing ships with shore power while docked can significantly reduce ship emissions. Shore power enables ships to turn off their engines and connect to an electrical grid on the shore, which provides power to run ship systems and maintain emission-free operation of onboard facilities. Port of Los Angeles research indicates that providing shore power to ships can reduce greenhouse gas emissions by up to 95% (Port of Los Angeles 2017).

3.2.6. Develop sustainable transportation systems

According to a report by the International Transport Forum, promoting sustainable urban transport can cut greenhouse gas emissions by as much as 25% (International Transport Forum 2016). To mitigate and adapt to climate change in the transportation sector, promoting public transportation, increasing vehicle efficiency, use of bicycles, electrifying transportation, and encouraging car-sharing services are all strategies (Sharifi, 2021). All of these measures will reduce carbon emissions, thereby mitigating climate change; at the same time, they will result in cost and energy savings, thereby enhancing economic and energy resilience and enabling adaptation to climate change. Compact urban development with the proper density, land use mix, and accessibility contributes to climate change mitigation and adaptation in urban planning. Compact urban development reduces per capita travel demand, heating and cooling energy demand, and provides more efficient energy systems, thereby reducing carbon emissions and mitigating climate change. In addition, compact urban development reduces land demand, avoids risky locations, and is less susceptible to intense heat events than urban sprawl, enabling adaptation to climate change. Congestion pricing and water-sensitive urban design are two additional examples of synergistic transportation and urban design strategies that enhance both mitigation and adaptation. Port authorities and local governments can work together to improve public transportation systems and encourage the use of sustainable modes of transportation.

3.2.7. Ensure sustainable waste management practices

Sustainable waste management is essential for lowering carbon emissions. Improper disposal of waste, including plastic, food, and other materials, is a significant contributor to greenhouse gas emissions. For example, composting can aid in reducing the amount of organic waste sent to landfills, thereby reducing methane emissions. Recycling and reuse can reduce the emissions produced by waste incineration, which can include carbon dioxide and other air pollutants.

3.2.8. Improve building efficiency

Buildings are a significant contributor to carbon emissions; therefore, making buildings more energy-efficient can play a significant role in reducing the overall carbon footprint of a city. This can involve retrofitting already-existing buildings with insulation, energy-efficient lighting, and intelligent heating and cooling systems, in addition to the construction of new buildings according to high energy-efficiency standards.

3.2.9. Transitioning to renewable energy sources

Carbon emissions can be drastically cut by switching to renewable energy sources like solar, wind, water, and geothermal. Renewable energy sources have been shown to have the potential to lower carbon emissions in a number of studies. An article in the journal Energy found that switching to renewable energy sources like solar, wind, and hydro in the United States could cut carbon emissions by as much as 80% by the year 2050 (Jenkins et al. 2018). Another study found that the European Union's electricity needs could be met by a mix of geothermal, wind, and solar energy with minimal impact on the environment (Panzer et al. 2021). Traditional fossil fuels, a major contributor to climate change, can be replaced by these energy sources because they produce fewer or no greenhouse gases (GHGs) during operation. The proportion of electricity generated from renewable sources is expected to rise from 29% in 2020 to 74% in 2050, as reported by the International Energy Agency (IEA). In order to reduce carbon emissions and counteract climate change, the IEA has called for a greater reliance on renewable energy. This means that in the project area, the use of renewable energy sources will be emphasized further.

3.2.10. Implementing new carbon-reduction technologies

Carbon capture, utilization, and storage (CCUS) has also been suggested as a way to reduce emissions in the power and industrial sectors. CO2 from fossil fuel processes is separated and captured. CO_2 is transported to geological reserves for long-term storage. CO_2 can also be used to make chemicals, algae, concrete, and enhanced oil recovery. Reducing emissions while using fossil fuels is the goal. The literature discusses pre-, post-, and oxyfuel combustion capture technologies. Each method captures CO_2 differently. Post-combustion capture systems are ideal for retrofit projects and have many uses (Fawzy et al. 2020; Osman 2020).

Capture technology must also improve to reduce system costs. Lei et al. reviewed carbon membrane systems for hydrogen purification, CO_2 capture during combustion, and natural gas sweetening. Carbon membranes capture CO_2 with less energy and footprint than amine absorption. Even at 90% humidity, the carbon molecular sieve membrane has a 2140 Barrer permeability of CO_2, separating CO_2/NO_2. Carbon molecular sieve membranes for flue gas separation have drawbacks, such as the large area needed to capture a given amount of CO_2 and deteriorating performance due to carbon matrix species sorption. Ultra-thin, hydrophobic carbon molecular sieve membranes were suggested (Lei et al. 2020). In conclusion, carbon capture, utilization, and storage can reduce carbon emissions by storing or using carbon to make chemicals, algae, and concrete. It shouldn't promote fossil fuels, though.

3.3. Enhancing carbon sequestration

Increasing carbon sequestration in coastal areas can be an effective means of combating global warming. Here are some steps that can be taken to increase carbon sequestration in coastal areas, along with citations and references that are pertinent to this topic:

3.3.1. Coastal Afforestation/reforestation

Coastal wetlands such as mangroves, salt marshes, and seagrass meadows are known to be highly effective at sequestering carbon (Fourqurean et al. 2012). United Nations Food and Agriculture Organization research indicates that mangroves can store up to four times more carbon per hectare than tropical rainforests (Alongi 2014). Therefore, coastal afforestation should be continued with mangroves in newly accreted char lands as it has the capacity to accelerate the coastal sedimentation process and reduce coastal erosion. At the present conditions, there are charlands in all the seven upazillas, i.e., Galachipa, Kalapara, Rangabali, Barguna Sadar, Patharghata, Amtali, and Taltali. This land is suitable for plantation which will stabilize the land and sequester the carbon. There might have different plantation pattern (Fig. 2) however, Fig. 2a is the most common one. The distance between two subsequent propagules is generally 1 m, however, depends on the situation. With time, tinning should be done. Studies have found a significant amount of landmass has been created on various chars' lands and offshore islands. In contrast, mangrove trial plantations serve as seed sources in coastal regions. The initial plantation with pioneer species - (*Sonneratia spp.* /*Avicennia spp*.) will face natural mortality and create produced enormous voids within the forests. In the coastal plantation, around 90% of the planting materials is keora following baen and golpata. There is an immediate need to restore these gaps through reforestation with the same species, establishing a second rotation mangrove plantation by introducing recommended mangrove species with adaptive capabilities for a long-term, sustainable coastal shelterbelt. A successful underplanting with shade tolerant species, i.e., *H. fomes, X. moluccensis* will also produce mixed and multi-story forests. In the river bank, *N. fruticans* can be planted to protect the land against erosion. As a result of the coastal environment's high degree of dynamism, sedimentation is quite high in certain areas of the coastline. Over the past two decades, the Bangladesh Forest Research Institute has selected suitable mangrove species for coastal areas in order to address the stated issues. At the age of 16-21 years, *H. fomes, E. agallocha, X. mekongensis, A. corniculatum, Cynometra ramiflora* (shingra), *Phoenix paludosa* (hantal), and *N. fruticans* were found to be promising for coastal zone plantation and the monoculture should be reduced by introducing some of these at the later phase and thereby increase diversity (Islam et al. 2013).

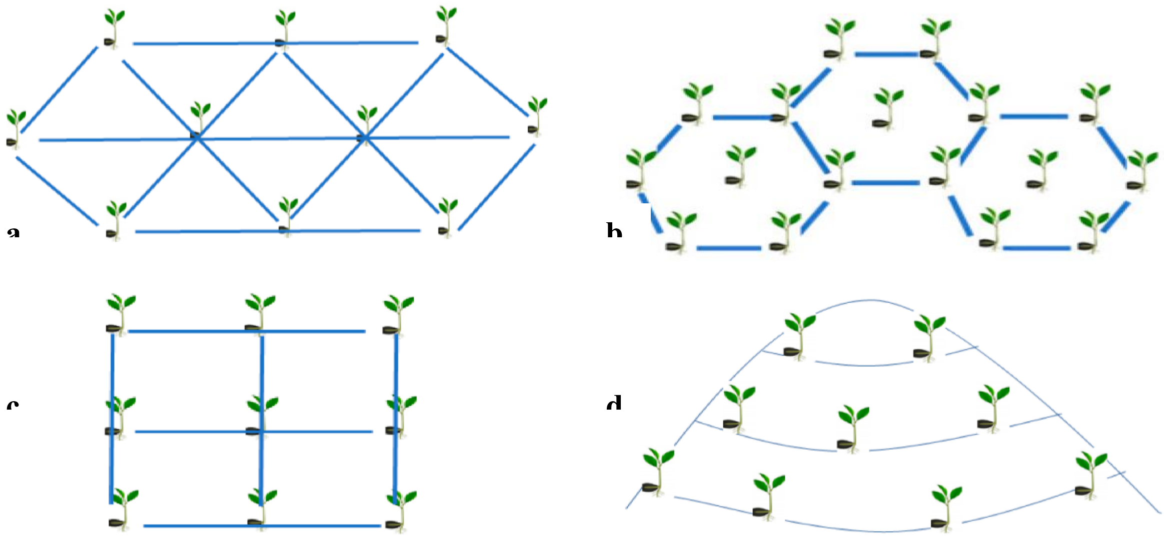

Fig. 2. Plantation design and pattern for mangrove and mainland species.

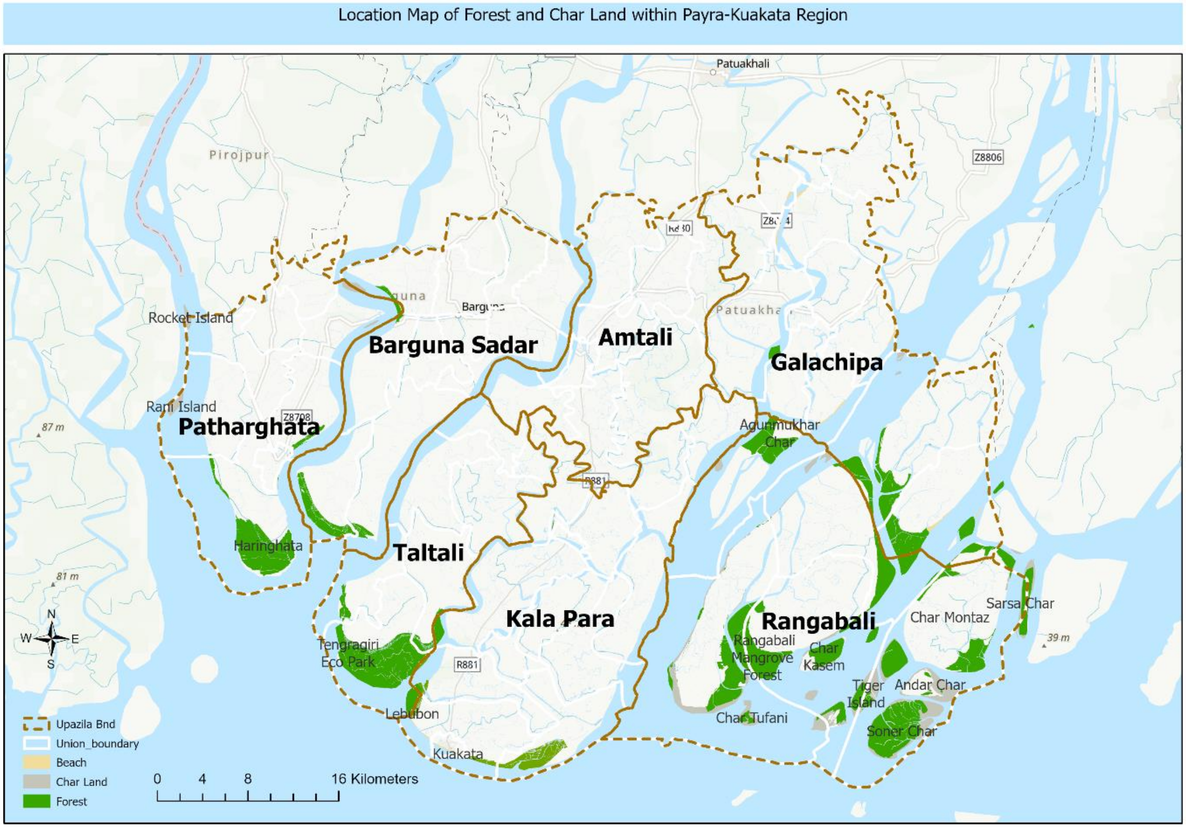

Fig. 3. Forest area and the proposed plantation area with the mangrove planting materials

As the forest floor gradually rises, the land becomes unsuitable for *S. apetala* and *A. officinalis*. Other mangrove species cannot thrive in this environment. Then on the raised coastal lands, foreshore lands, and coastal embankment, a plantation program with other site-appropriate non-mangrove and palm species can be initiated to enhance the coastal ecosystem. For example:

- On the elevated coastal lands, the plant species *S. saman, C. equesetifolia, P. dulce, A. nilotica, Albizia lebbeck*, and *A. procera* were discovered to be suitable for planting (Islam et al. 2014).
- Palm plantations can provide a strong shelterbelt; only the palmyra palm can withstand winds of up to 300 miles per hour and is the best windbreak against cyclonic storms (Islam et al. 2014). Therefore, palm species, such as *Cocos nucifera* (coconut), *Phoenix sylvestris* (date palm), and *Borassus flabellifer* (palmyra palm), can be planted to suitable foreshore coastal regions of Bangladesh (Islam et al. 2014).
- Non-mangrove species that can withstand flooding like *A. mangium, A. auriculiformis, S. saman, Mangifera indica* (mango), *T. arjuna, Lagerstroemia speciosa* (jarul) can be planted into salinity threatened home gardens to increase household income and ensure food security at least during crisis time. Other tree species that can grow well and tolerate

moderate to strong saline conditions can be planted to increase indigenous species diversity include *P. dulce, C. equisetifolia, A. nilotica, A. procera, C. nucifera, P. sylvestris, B. flabellifer,* and *Areca catechu* (betel nut) (Islam et al. 2014).

Mangrove planting materials are not common in the area. Thus, mangrove nursery is necessary to develop in the project coastal area/charlands which would ensure the supply of planting materials on a sustainable basis.

3.3.2. Plantation along road-side/park or any other vacant places

Plantations should even be done along the sides of roads, and they should be done with species that have a high capacity to absorb carbon dioxide. According to Rahman et al. (2015), the most important species in terms of stem density, basal area, and biomass carbon content were *Samanea saman, Dalbergia sissoo, Acacia nilotica,* and *Leucaena leucocephala.* In addition, the vacant areas require to be planted with native species in suitable place to facilitate rapid regeneration and guarantee the protection of biodiversity (e.g., Koroi, Karanja, Gamar, Kadam, Tal, Hijol, Tamal, Nageswar Madar etc.). In areas of water *Barringtonia acutangula, Crataeva magna, Erythrina fusca, Pongamia pinnata,* and *Trewia nudifolra* can be grown along water edges in low-lying areas (Alam et al. 1991) to promote carbon sequestration.

Besides those mangrove and mainland tree species plantation, there are some recommended plant species for planting in the proposed park for beautification like kanchan (*Phanera variegate*), krisnochura (*Phanera variegate*), bokul (*Mimusops elengi*), radhachura (*Caesalpinia pulcherrima*), konokchura (*Peltophorum pterocarpum*), jarul (*Lagerstroemia speciosa*), madhobilata (*Hiptage benghalensis*), hedge bamboo, etc. Using those species, a beautiful design can be made depending on the site condition and requirements.

3.3.3. Reducing coastal erosion

Coastal erosion can release carbon back into the atmosphere, exacerbating global warming. Carbon sequestration can be increased in coastal areas by implementing measures to reduce coastal erosion, such as implementing soft structural/engineering options (beach nourishment/feeding, dune construction, revegetation, and other non-structural management options) to dissipate wave energy by mimicking natural forces and preserving the coastline's natural topography, planting vegetation, restoring dunes, and constructing artificial reefs. National Oceanic and Atmospheric Administration research indicates that restoring dunes can increase carbon sequestration in coastal areas (Pendleton et al. 2012).

- In mudflat environments, it is essential to plant vegetation species at the appropriate elevation. Saltmarsh species are recommended for low and subtidal deltas below the high-water mark. Typically, saltmarshes are zoned according to elevation, with the zones governed by the frequency and duration of tidal flooding. Spartina, as a pioneer species within this zone, is tolerant of more frequent flooding than higher marsh species and, as a result, is frequently planted well below the intertidal zone (French 2001). Other saltmarsh species that can be utilized include helophytes such as *Phragmites australis* (Cav.) Trin. ex Steudel and *Scirpus lacustre* L. Mangroves are also recommended and easy to plant in this region. If the area has a severe erosion problem already, then special seeding techniques are required.
- In sandy beaches, seeing the presence of wider ripple marks, tool marks and mud crack, Ipomea can be planted to reduce erosion. In addition to this, other beach grass *(Acanthus ilicifolius* (Hargoza)*, Acrostichum aureum* (Hudu, Tiger fern) can be combined used with it. Over time, the vegetation species will be replaced, first by pioneer mangrove species, then by seral mangrove species. This process will take place gradually. At long last, salt-resistant varieties of mainland plants will be cultivated.
- To reduce insect damage, a combination of species is recommended; however, the selection must be carefully considered to avoid competition. Several publications offer planting/replanting guidelines, including Hanley (2006). The mangrove forest should have a minimum width of 300 meters, a minimum density of 0.5 meters, and a staggered planting pattern.
- Over time, the vegetation species will be replaced, first by pioneer mangrove species, then by seral mangrove species. This process will take place gradually. At long last, salt-resistant varieties of mainland plants will be cultivated.

3.3.4. Reducing forest conversion

Reducing forest conversion to agricultural land by promoting agroforestry, regenerative agriculture, and polyculture contributes to agricultural climate change mitigation and adaptation (Montanaro et al., 2018). Reduced forest conversion contributes to climate change mitigation by reducing greenhouse gas emissions and enhancing carbon sequestration. In addition, enhancing efficient agricultural practices facilitates adaptation to climate change by enhancing soil carbon and water efficiency, resulting in resilient crops and food security.

- *Conserving Blue carbon*: Blue carbon refers to the carbon stored in coastal and marine ecosystems and is referred to in the context of implementing projects involving blue carbon. Coastal carbon sequestration can be increased by implementing blue carbon projects such as seagrass conservation and restoration. The Nature Conservancy found that seagrass meadows can store up to 83,000 metric tons of carbon per square kilometer (Greiner et al. 2013).
- *Promoting sustainable fishing practices*: Unsustainable fishing practices can result in the destruction of marine ecosystems, which reduces the capacity for carbon sequestration. Increasing carbon sequestration in coastal regions can be facilitated by promoting sustainable fishing practices such as selective fishing, fishery closures, and the reduction of bycatch. According to a World Bank study, sustainable fisheries management can help increase carbon sequestration in coastal regions (World Bank 2012).
- *Establish green infrastructure*: Investing in green infrastructure, such as green roofs, green walls, and urban forests, can help absorb carbon dioxide emissions and reduce the urban heat island effect (Grafakos et al. 2019). In order to implement green infrastructure in the city, port authorities can collaborate with local government and other stakeholders. National Renewable Energy Laboratory research indicates that green roofs can reduce building energy consumption by up to 15% and mitigate the urban heat island effect (National Renewable Energy Laboratory 2012).
- *Engaging local Community*: The project will engage with the community in order to raise awareness about the significance of reducing greenhouse gas emissions and promote participation in efforts to reduce carbon emissions. The encouragement of walking and the use of bicycles as modes of transportation in order to cut down on carbon emissions can help to reduce congestion on roads, which in turn can cut down on emissions from cars that are left running. A further strategy that can significantly cut greenhouse gas emissions is encouraging people to use public transportation options such as buses and trains rather than driving their own cars. One strategy for lowering carbon emissions is increasing the use of electric vehicles while decreasing the number of cars that run on fossil fuels. For instance, a study that was published in the journal Environmental Research Letters found that making the switch from automobiles to bicycles for short trips within urban areas could result in a reduction of carbon emissions of up to 10% (Brand et al., 2018). According to the findings of another study that was recently published in the journal Energy Policy, increasing the use of public

transportation in urban areas could significantly cut greenhouse gas emissions (Glaeser & Kahn 2010).

4. Conclusion

It is absolutely necessary to quicken urban action in the direction of a potential carbon-free project area in order to reduce the negative effects of climate change. The goal of the project is to achieve carbon neutrality in the area that has been identified as the project area by lowering emissions of greenhouse gases, investigating potential opportunities for carbon sequestration, and involving the local community. The project will contribute to a more sustainable and environmentally friendly future for the region if the actions that have been outlined are carried out as planned.

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