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The Ramsar Wetlands Convention: Conservation of Mangrove Ecosystems for a Sustainable Blue Economy

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Abstract

Pakistan is a party to the Ramsar Convention on Wetlands (RCWL), which provides a framework for all the signatory parties to pursue and encourage the policies to conserve the mangrove ecosystem on domestic and regional levels. Therefore, to ensure the preservation of Pakistan's wetlands Pakistan became the party to various international conventions such as The (CBD) Convention on Biological Diversity, which is a globally enforced convention and the purpose of that agreement is to preserve the biodiversity of ecological and mangroves ecosystem by utilizing its constitutes for stability in the form of shared equity and fair benefits, Pakistan became a party to it in 1994 and established the (NBSAP) National Biodiversity Strategy and Action Plan in the light of this national policy framework Pakistan acknowledged the significance of the mangrove ecosystems services and climate change modification and diminishment. Pakistan is a signatory to this treaty and became a party to it in 1994, (NDC) National Determined Contribution to decrease the emission effects on the climate,(NDC) enhances the cultivation of mangroves for the carbon deposit project but Pakistan's Mangrove ecosystems are facing various threats such as climate change, degradation, water scarcity, illegal cutting of mangrove forests, industrialization, urbanization, overexploitation of fish and timber, the flow of fresh water and poisonous fluids into the sea, erosion these human activities are disturbing the ecological and mangrove ecosystem equilibrium which is the obstacle for sustainable growth of the blue economy

Key Words: Ramsar Wetlands Convention, Mangrove Ecosystem, Blue Economy, United Nations, Pakistan.

1. Introduction

Ramsar Wetlands Convention (RWC¹) is an international treaty legally binding for all the member states to preserve the biodiversity of their wetland ecosystems. Article² 2 of the Ramsar Wetlands Convention (RWC) stipulates that all the signatory parties should formulate a conducive framework for the conservation and wise use of Ramsar Wetland Sites. Article 2.4 of the Ramsar Wetlands Convention (RWC)³ administrates preserving the flora and fauna of the designated wetlands sites such as coral reefs, mangroves, fishes, and other marine resources. Article 3 of the Ramsar Wetlands Convention (RWC)⁴ upholds that all signatory members should consult with other state members to organize productive planning for the conservation of marine resources by providing impactful guidelines for the exploration of marine species under the administration of the state governments. Pakistan became a party to the Ramsar Wetland Convention (RWC) in 1976, and this international treaty recognized Pakistan's 19 sites as significant Ramsar Sites. Such as Chashma Barrage (Punjab)⁵, Taunsa Barrage (Punjab), Uchhali (Punjab), Tanda Dam (Khyber Pakhtunkhwa), Thanedar Wala Game Reserve (Khyber Pakhtunkhwa), Astola Island (Balochistan), Jiwani Coastal Wetland (Balochistan), Miani Hor (Balochistan), Ormara Turtle Beaches (Balochistan), Hub Dam (Sindh/Balochistan), Deh Akro-II Desert Wetland Complex (Sindh), Drigh Lake (Sindh), Haleji Lake (Sindh), Indus Delta (Sindh), Indus Dolphin Reserve (Sindh), Jubho Lagoon (Sindh), Kinjhar Lake (Sindh), Nurri Lagoon (Sindh), Runn of Kutch (Sindh). These Ramsar Wetlands Sites (RWS) consist of 1, 343, 807 hectares and to preserve and protect this Ramsar Wetlands ecosystem Pakistan is a party to various international treaties such as the (CMS)⁶ Convention on Migratory Species, this convention aims to protect the ecological diversity by preserving the migratory species, (UNFCCC)⁷ United Nations Framework Convention on Climate Change, this convention deals with the consequence of climate changes on the ecological environment, (CBD)⁸ Convention on Biological Diversity, this convention supports the biological aspects of ecosystems, (CITES)⁹ Convention on International Trade in Endangered species, this convention deals with the illegal trade of unique species, and on a national level. From 2015 to 2020 Pakistan established the (NBSAP)¹⁰

¹Waqas Jan, "The Ramsar Convention and Pakistan," Daily Times (blog), March 6, 2020, accessed on 29, Dec 2023 available at <https://dailytimes.com.pk/571248/the-ramsar-convention-and-pakistan-daily-times/>.

²Michelle L. Pyke, Sandy, "The Convention on Wetlands (Ramsar)," Botanic Gardens Conservation Vol. 3, no. 0.2 (June 1999): 38--39. accessed on 29, Dec 2023 available at <https://www.jstor.org/stable/24753839>

³Elsa Tsoumani, Asterios Tsoumanis, "The Convention on Biological Diversity," Botanic Gardens Conservation News 3, no. 2 (1999): 29--33. accessed on 29, Dec 2023 available at <https://www.jstor.org/stable/24753837>

⁴Muhammad Ramzan Rafique, "Wetlands of Pakistan: Management and Conservation," Agri Hunt - A Hunt for Agricultural Knowledge, January 6, 2011, access on 29, Dec 2023 available at <https://agrihunt.com/articles/pak-agri-outlook/wetlands-of-pakistan-management-and-conservation/>.

⁵"Sitelist.Pdf," accessed 29, Dec, 2023 available at <https://www.ramsar.org/sites/default/files/documents/library/sitelist.pdf>.

⁶"Conference to Conclude a Convention on the Conservation of Migratory Species of Wild Animals," International Legal Materials 19, no. 1 (1980): 11--32. accessed on 11, Dec 2023 available at <https://www.jstor.org/stable/20692122>

⁷Haliy and Max, "The United Nations Framework Convention on Climate Change," Botanic Gardens Conservation News 3, no. 2 (1999): 44--45. accessed on 11, Dec 2023 available at <https://www.jstor.org/stable/24753842>

⁸Elsa Tsoumani, Asterios Tsoumanis, "The Convention on Biological Diversity," Botanic Gardens Conservation News 3, no. 2 (1999): 29--33. accessed on 11, Dec 2023 available at <https://www.jstor.org/stable/24753837>

⁹Barry Walden Walsh, "Convention on International Trade in Endangered Species of Wild Fauna and Flora: A CITES Timeline," Selbyana 26, no. 1/2 (2005): 92--102. accessed on 11, Dec 2023 available at <https://www.jstor.org/stable/41760179>

¹⁰Biosafety Unit, "National Biodiversity Strategies and Action Plans (NBSAPs)" (Secretariat of the Convention on Biological Diversity), accessed on 10, Dec 2023 available at <https://www.cbd.int/nbsap/>.

National Biodiversity Strategy Action Plan, The objectives of this program are to protect biodiversity and connecting all the stakeholders, it comprises various correlative areas such as earth-bound biodiversity preservation, oceanic biodiversity conservation, marine resources awareness, research-based knowledge about marine resources, development of systematic and organized institutions and viable policies furthermore, from 2010 to 2030 Pakistan established (NCZMP)¹¹ National Coastal Zone Management Plan, it addresses interlaced coastal aspects, coastal zone management and seaside land-use planning, territorial zoning, surveillance, enactment, participation of stakeholders, skill developments these are few initiatives Pakistan has taken for the protection of ecological biodiversity of ecosystems of the Ramsar Wetlands sites but in 2001 World Bank reported ¹²Pakistan invested only 0.5% of its GDP in the preservation of marine resources of Ramsar Wetlands Sites which is considerably lower than the global average of 1.4% their low investment in the marine sector restricts the aptitude of the government and other investors, participants, and stakeholders to carry out marine preservation programs and policies for the conservation of Pakistan's Ramsar Wetlands Sites. These international conventions necessitate productive executions on the national level via national regulations and protocols but Pakistan is incapable of enforcing these laws competently because of weak legal frameworks and ignorance of political parties and insufficient adaptation of these strategies leads toward imbalanced changes in Wetlands ecosystems this imbalanced biodiversity poses the threats to the Wetlands mangrove ecosystem of Pakistan. These ramifications have unfavorable outcomes for the biodiversity of the ecosystem conservation of Ramsar Wetlands Sites the well-being of humans and the sustainable growth of the blue economy. Therefore, the questions arise What are the legal responsibilities of Pakistan to conserve its Ramsar Wetlands Sites? Why has Pakistan fallen behind in conserving the mangrove ecosystems of its Ramsar Wetlands Sites and the growth of the blue economy? To answer these questions this research has applied qualitative research methodology and an explanatory approach and to support the argument this research utilized secondary sources.

2. Theoretical Framework: Ecological Economics

This research applies ecological economics theory¹³. Ecological economics theory was put forth by Herman Edward Daly¹⁴, ecological economics posits the interdisciplinary and transdisciplinary fields that pledge attention towards the interdependence of evolution between human economy and natural ecosystems. Ecological Economics evokes the notion of 'sustainable development' argues that the concept of sustainability is deep-textured and complex multifaceted objectives concentrate on the multidimensional relationship with diverse constituents of 'sustainability' such as social costs, degradation of natural resources in ecological

¹¹"CZMA-CZMP-Final.Pdf," Accessed on 10, Dec 2023 Available at <https://www.dakshin.org/wp-content/uploads/2018/05/CZMA-CZMP-final.pdf>.

¹²"Pakistan Restores Mangroves for Economy and Ecosystem Benefits," UNEP vol 2 (May 14, 2021): 12--15. accessed on 10, Dec 2023 available at <https://www.jstor.org/stable/43265919>

¹³Giuseppe Munda, "Environmental Economics, Ecological Economics, and the Concept of Sustainable Development," *Environmental Values* 6, no. 2 (1997): 213--33. accessed on Dec 11, 2023, available at <https://www.jstor.org/stable/30301601>

¹⁴Herman E. Daly, "On Economics as a Life Science," *Journal of Political Economy* 76, no. 3 (1968): 392--406. accessed on Dec 11, 2023, available at <https://www.jstor.org/stable/1829303>

environment, and maximized growth of economy these trends delves into the economic optimization which is engrossed in economist decision making but the efficiency of economic sustainability is not attainable if collective cost and benefits are not taken into account because our conventional economists do not restrain any human activity and decision-making that depletes the natural resources or natural capital, therefore, embed that the natural resources air, water, fiber, minerals, marine resources are fundamentals of our economy produced by natural ecosystems, our growth of economy, social costs and ecological protection are interlaced and extensively interdependent on each other that complexed intermingled structure presents interdisciplinary interdependence which is bounded with our ecosystems and materials of the earth in the form of natural resources therefore, economy is the subsystem of the ecosystem preservation and protection of ecosystems are affirmation to the sustainability of the economy both share commonplace for the promotion of sustainable development and comprehended the essentiality of the balance economic growth with the protection of marine resources and preservation of ecosystems.

3. Legal Obligations and Site-level Analysis

3.1. *Deh Akro-II Wetland Complex*

Therefore, the most significant Ramsar sites in Pakistan are contributing to disrupted ecosystem biodiversity. The Deh Akro-II wetland complex¹⁵ which is situated in the Thar Desert Sindh is an abundant and vibrant biodiverse ecosystem that consists of nomadic birds, and vulnerable species, which includes Indian wild ass and flamingos. Coastal communities rely on these natural assets and higher levels of consumption of these marine resources by the coastal communities pose severe threats to the preservation and protection of these marine treasures. Excessive depletion of marine resources, pollution, and human intrusion are the origins of imbalanced biodiversity of ecosystems due to overexploitation of fishing, discarding the solid and liquid wastes into the wetland areas, salt-water encroachment from water extraction, loss of flora due to droughts. Human activities are depleting natural resources and the Pakistan government has failed to accomplish Article 2 of the Ramsar Wetlands Convention (RWC) which stipulates, that all the signatory parties should formulate a conducive framework for the conservation and wise use of Ramsar Wetland Sites. Our government should prioritize those economic activities that should align with the harmony of Wetlands ecosystems and human activities through law enforcement.

3.2. *Indus Dolphin Reserve*

Indus Dolphin Reserve is also facing serious threats from human activities, it is in the Sindh Indus Delta Wetland and consists of 1.5 square kilometres. It accommodates almost hundreds of Indus dolphins which are under threat because of their meat and oil hunting from the local coastal communities. It offers other marine species the habitats, rays, turtles, fishes, crocodiles, and sharks but due to illegal fishing activities by the coastal fishermen they use dynamite to capture fish at the mouth of the river, these human activities are posing a threat to the equilibrium

¹⁵Global Nature Funds, "Deh Akro-II Wetland Complex," March 2015, accessed on Dec 12 2023 available at <https://www.globalnature.org/en/living-lakes/asia/deh-akro-wetlands>.

of ecosystem biodiversity there are certain key factors which are contributing to this imbalance ecosystem such as sea blindness among the fishermen, delicate law enforcement, weak regulations by the concerning authorities, unsatisfactory management and monitoring frameworks from stakeholders. Pakistan's government is unsuccessful in establishing a productive legal framework to protect Article 2.4 of the Ramsar Wetlands Convention¹⁶ (RWC) which administrates the preservation of the flora and fauna of the designated wetlands sites such as coral reefs, mangroves, fishes, and other marine resources.

3.3. Jiwani Coastal Wetland

Jiwani Coastal Wetland¹⁷ is situated in Balochistan and encompasses 1 square kilometer which corresponds to the Arabian Sea coast it has a multifaceted ecosystem with an abundant diverse life cycle that includes coral reefs, mudflats, marshes, lagoons, seagrass, sandbanks, dunes seagrass beds, tidal creeks, crabs, turtles, dolphins but this breathtaking diverse ecosystem is facing certain threats, due to coastal construction projects, urban development plans, port constructions. these are the major triggers and the absence of coordination, cooperation, and consultation for proper planning. Pakistan's government has overlooked the significance of Article 3 of the Ramsar Wetlands Convention (RWC)¹⁸ which upholds that all signatory members should consult with other state members to organize productive planning for the conservation of marine resources by providing impactful guidelines for the exploration of marine species under the administration of the state governments. Therefore, there is a need to take certain measures that are ignored by policymakers such as environment-friendly construction designs that can cause less disturbance to the Wetland site the vibration of construction sites produce they disturbs the composition of the soil, construction sites should avoid unnecessary depletion of the vegetation for the clearness of the construction site, there should be a mechanism for the drainage of waste, during the construction preservation of grass is essential as these grassy areas are filtered for stones to reach the Wetland sites, unnecessary digging store the healthy rainfall before it reaches to the site. There should be a diversion to the contaminated water there should be small channels for the diversion of the containment water flow but for that, There should be an interaction between policymakers and institutionalists, remodeling the marine policies to align with the modernized marine system, reallocation of resources through the governmental institutions to the coastal communities, providing the incentives and promotion of research-oriented environment to understand the potential of marine resources.

¹⁶Elsa Tsoumani, Asterios Tsoumanis, "The Convention on Biological Diversity," Botanic Gardens Conservation News 3, no. 2 (1999): 29--33. accessed on 29, Dec 2023 available at <https://www.jstor.org/stable/24753837>

¹⁷Ramsar Sites Information Services, "Jiwani Coastal Wetland Ramsar Sites Information Service," 2001, accessed on Dec 12 2023 available at <https://rsis.ramsar.org/rsi/1066>.

¹⁸Muhammad Ramzan Rafique, "Wetlands of Pakistan: Management and Conservation," Agri Hunt - A Hunt for Agricultural Knowledge, January 6, 2011, access on 29, Dec 2023 available at <https://agrihunt.com/articles/pak-agri-outlook/wetlands-of-pakistan-management-and-conservation/>.

3.4. North West Alpine Wetlands Complex

North West Alpine Wetlands Complex¹⁹, is a high-altitudinal mountainous area situated in the northern areas of Pakistan it incorporates 1,500 square kilometers. Which encompasses alpine lakes, ponds, meadows, and marshes, it offers unique biodiversity such as snow leopards, markhors, Himalayan brown bears, plants, and Tibetan antelope but this magnificent biodiverse ecosystem is under threat by melting glaciers which are altering the hydrological aspects of this ecosystem. Pakistan's government has not formed any policy to apply Article 3 of the Ramsar Wetlands Convention (RWC)²⁰ which describes that all signatory members should consult with other state members to organize productive planning for the conservation of marine resources by providing impactful guidelines under the administration of the state governments. There is a huge gap in this policy because policymakers have neglected the fact Pakistan has gigantic glaciers²¹, in the northern region which refers to the third pole region which has 7,200 glaciers. Khyber Pakhtunkhwa and Gilgit Baltistan's glaciers are melting and fabricating more than 3,000 lakes according to (UNDP) the United Nations Development Programme 33 lakes are at the edge of an unexpected eruption that will release millions of cubic meters of water which means 7 million people are in a vulnerable position, then there is another prominent factor swift industrialization and urbanization is increasing carbon emission and due to such human activities Pakistan is 5th country that is at the highest effected by the socio-economics activities furthermore, Pakistan has a complex and the largest canal infrastructure which was built by the British administration in the 1900s²² now due to climate change water availability and accessibility are declining day by day which is less than 5,269 cubic meters compare to 1,017 cubic meter per year and major dams were constructed in 1960s-1970s. In the 1930s Indus River had to release about 148 cubic meters of water currently that is decreased to 24 cubic meters annually even after the monsoon rainfalls because most of the dams were built in the 1970s-1980s and these dams were built to store the water for agriculture cultivation but now weather conditions are changed and these changing patterns are causing intense monsoon rains and floods but these dams are not that deep to store the excessive monsoon water and then that water spillover in canals, local communities, fields and so on that is the reason Pakistan lack behind its neighboring countries in the water storage infrastructure building and 2025 that water scarcity will worsen there is a need to build small dams with the required depth to store the water of monsoon rainfalls because that water is a central piece in the conservation of the wetlands ecosystem.

¹⁹Humaira Khan and Siddique Baig, "High Altitude Wetlands of the HKH Region of Northern Pakistan," *Wetlands* 37, no. 2 (April 1, 2017): 371–80, accessed on Dec 13 2023 available at <https://doi.org/10.1007/s13157-016-0868-y>.

²⁰Muhammad Ramzan Rafique, "Wetlands of Pakistan: Management and Conservation," *Agri Hunt - A Hunt for Agricultural Knowledge*, January 6, 2011, access on 29, Dec 2023 available at <https://agrihunt.com/articles/pak-agri-outlook/wetlands-of-pakistan-management-and-conservation/>.

²¹United Nation Development Programme, "Melting Glaciers, Growing Lakes and the Threat of Outburst Floods in Pakistan," August 26, 2022, accessed on 11, Nov 2023 available at <https://reliefweb.int/report/pakistan/melting-glaciers-growing-lakes-and-threat-outburst-floods>.

²²"Nature and Livelihood at Stake in Pakistan -- DW -- 12/12/2018," *dw.com*, accessed Nov 21, 2023, available at <https://www.dw.com/en/pakistans-dams-threaten-mangroves-and-livelihoods/a-46696480>.

3.5. Makran Coast Wetlands Complex

Makran Coast wetlands complex²³ is situated in Balochistan which corresponds to the Arabian Sea and consists of 1 million hectares. the ecosystem is under severe threat because of human activities such as development projects for tourism, and coastal developments. Balochistan's Ramsar Wetlands Sites are under serious threats due to domestic disorganized political structures because Sindh and Balochistan both have diverse political cultures, in Sindh there are urban and feudal influences and multiple stakeholders participate in the decision-making and shape the diverse political structure on the other hand Balochistan has entirely different political dynamics where tribal masters influence the decision-making and shape its political landscape therefore, in Balochistan Tribal leaders run the factories or they are shareholders in those industrial activities so the reduction in water supply, industrial waste along the excessive harvesting by the coastal communities are significant factors in the loss marine resources in the Ramsar Wetlands Sites.

3.6. Mangrove degradation and restoration in Sindh

Therefore, the Pakistan government is struggling to provide a protected environment for the Ramsar wetlands and has become a signatory to various international conventions to conserve the Wetlands ecosystems, (CBD) such as the Convention of Biodiversity Development²⁴ and (BAP) Biodiversity Action Plan²⁵, since 1994 to 1999, Pakistan has been a party to these conventions and goals of these conventions are to preserve biodiversity and sustainability of ecosystems in all the provinces of Pakistan but regrettably, Pakistan's Ramsar Wetlands sites ecosystems encountering the various obstacles, (IUCN) International Union for Conservation of Nature reported in 2012 that Pakistan has lost 40% marine resources between 1970-2000, another (UNDP) United Nations Development Programme²⁶ predicted Pakistan has lost 10% mangrove forests between 1970-2010. Sindh ecosystems are crucial to protect mangrove forests deposit carbon in their complex roots and protect the coasts from storms and rising waters. These forests provide abundant biodiversity to ecosystems, such as flora and fauna, conserved ecosystems of Ramsar Wetlands Sites are home to almost two hundred Species of fish, accommodate fifty crustacean species, protect twenty mollusk species, and give shelter to five mammal species, storks, pelicans, cranes, and flamingos. They are food security providers to millions of people through tourism, agriculture, and fishing. These Wetlands Sites are nurseries for fish larvae and provide a sanctuary for fish in the course of their migration but human activities have perturbed the preservation of the Wetlands Sites ecosystem, human have transformed area of these

²³Zulfiqar Ali, "Biological Analysis of Makran Coastal Wetlands Complex, Pakistan,," 2003, accessed on Dec 12 2023 available at Biological Analysis of Makran Coastal Wetlands Complex, Pakistan. | Request PDF (researchgate.net) (https://www.researchgate.net/publication/234037355_Biological_analysis_of_Makran_Coastal_Wetlands_Complex_Pakistan)

²⁴Ben Collen et al., "Biodiversity and Ecosystems," in Thinking Beyond Sectors for Sustainable Development, ed. Jeff Waage and Christopher Yap (Ubiquity Press, 2015), 3--10, accessed on Dec 13 2023 available at <https://www.jstor.org/stable/j.ctv3t5rcm.9>.

²⁵National Biodiversity Strategy and Action Plan (NBSAP), "Pakistan's Biodiversity Action Plan," 2023 2017, accessed on Dec 13 2023 available at <https://leap.unep.org/en/countries/pk/national-legislation/national-biodiversity-strategy-and-action-plan-nbsap>.

²⁶Naureen Chowdhury Fink, "United Nations Development Programme (UNDP)," Meeting the Challenge (International Peace Institute, 2012), accessed on Dec 13 2023 available at <https://www.jstor.org/stable/resrep09638.23>.

Wetlands into agricultural lands and urban areas due to the reduction in Wetlands area means there is more carbon in the environment and quality of natural habitats have become substandard which increased the erosion, Timber and fishing overexertion depleted the biomass diversity that has affected the diversity of Wetlands ecosystem functions further to the argument pollutants industrial effluents, geological mining, agriculture water pollution, oil contaminations through oil spills, plastic waste these human conducts altered the quality of water which harm the mangroves health and degradation of mangroves reduce their storage carbon up to 80% imbalanced equilibrium in biodiversity of ecosystems causing the warm weather and it is contributing into the global warming through greenhouses gases. Therefore, there is a need to preserve the Ramsar Wetlands mangrove ecosystems. (UNEP) United Nations Decade on Ecosystem Restoration Plan²⁷ from 2021 to 2030, the program is directed by the (UNFP) United Nations Environment Programme and (FAO) Food Agriculture Organization²⁸, the aim is to cease, prevent, and revert the degradation of Ramsar Wetlands mangrove ecosystems around the world and Pakistan is a party to this international Mangrove ecosystem restoration plan because one hectare of mangrove forests can generate \$ 33,000-\$57,000 and each dollar invested in the restoration of mangroves ecosystem will benefit 4 dollars. Mangroves are cost-effective and they contribute as natural barriers to environmental catastrophes which is five times more cost-effective than conventional infrastructure because grey walls are not supportive of the natural catastrophic events. Therefore, protected and preserved Wetlands mangrove ecosystems are (NBS) Nature-based solutions²⁹ to climate change. If Wetlands mangrove ecosystems are not preserved and protected, then 39% of the population around the world will be affected by climate change and socioeconomic activities. (IUCN) the International Union for Conservation of Nature³⁰ Reported the essentiality of the preservation of Wetlands mangrove ecosystems. Mangroves offer extraordinary carbon storage which is five times more than any tropical forest and they provide livelihood to more the 120 million people in Pakistan alongside of 600,000 hectares square kilometers³¹. In 2011 to 2019, Pakistan initiated the (NGP) National Greening Programme which involves the preservation of Wetlands mangrove forests but that project did not produce the desired outcomes because in 2019 (SFD³²) Sindh Forests Development and (NGP) National Greening Plan just procured 11.82% of 50,000 hectares the causes of these unappealing outcomes were unawareness about the surveying of the site, mapping and planning of the selection of sites then again in 2013 (DENR) Department of Environment and Natural Resources initiated another Wetlands mangroves preservation projects with the cooperation of local coastal communities for mangroves plantation on 2000 hectare but half of the mangroves survived and Sindh Forests Development replaced dead

²⁷United Nations Decade Restoration plan, "UN Decade on Restoration," 2021-2030, accessed on 25, Nov 2023 available at <https://www.decadeonrestoration.org/>.

²⁸United Nations, "Food and Agriculture Organization of the United Nations," 2012, accessed on 27, Nov 2023 available at <https://www.fao.org/home/en>.

²⁹Nadja Kabisch et al., "Nature-Based Solutions to Climate Change Mitigation and Adaptation in Urban Areas: Perspectives on Indicators, Knowledge Gaps, Barriers, and Opportunities for Action," *Ecology and Society* 21, no. 2 (2016), accessed on 24, Nov 2023 available at <https://www.jstor.org/stable/26270403>.

³⁰Flax and Anthony, "IUCN - International Union for Conservation of Nature and Natural Resources," *Spore*, no. 25 (1990): 16--16, accessed on 26, Nov 2023 available at <https://www.jstor.org/stable/24339629>

³¹Zaeem Mehmood, "Untapped Economic Potential of Pakistan's EEZ," November 8, 2023, accessed on 22, Nov 2023 available at <https://tribune.com.pk/story/2445297/untapped-economic-potential-of-pakistans-eez>.

³²Adhikari, Baig, and Iftikhar, "The Use and Management of Mangrove Ecosystems in Pakistan," accessed on 28, Nov 2023 available <https://www.jstor.org/stable/26199369>

mangroves. Pakistan's archaic marine policies were the cause of this failure because the Sindh Forests Development Department did not inspect the soil of the sites that sites were not suitable for the cultivation of the mangrove forests similar event repeated in Khoru Chan, on 22 June 2023 Sindh Forests Development cultivated 847,257 mangroves and Sindh government broke the record when in 2010 Indian government planted 611,000 mangroves per day besides this comparison the mangroves Sindh Forests Development planted they carried out that cultivation process between dawn and dusk time with the cooperation of local coastal communities at the Thatta coast district in Wetlands Delta Indus Complex that mangrove forest cultivation project was assisted by the (ADB) Asian Development Bank, under the five year multi-million dollar project with the mutual collaboration of Sindh coastal development but the ecosystem and ecological specialists demonstrated definite concerns according to their findings newly cultivated mangroves forests may not persist, the timing Sindh coastal development team selected for the mangrove cultivation is a coarse sea season and at that specific time 70% newly cultivated mangroves cannot survive strong tidal waves of that rough sea season. in 2023 Sindh Forst Development launched another colossal project with the support of direct foreign funding that is the (DBC) Delta Blue Carbon project in 2015 (DBC-1) Delta Blue Carbon mangrove preservation programme started and (DBC-2) site is 60 years old mangrove preservation plan these two projects will provide \$ 12 billion in 2075, and Pakistan has sold \$ 40 million carbon credit already, currently that project is spread over the 670,000 hectares these are ongoing projects (DBC-1) is zoning 250,000 hectares and (DBC-2) is focused on 200,000 hectares these are (CERs) certified emission reduction projects but there is a gap in Sindh coastal development policies because in 2023 Pakistan ministry of climate change and environment coordination official document reported the area Sindh coastal development has selected for these overhyped projects is degraded due to water scarcity Pakistan's Government and policymakers should consider the contemporary challenges and methods to the restoration of the wetlands mangrove ecosystem because the same method cannot be applied to every wetlands mangrove species because there are specific parameters for certain groups of mangroves such as Sonneratia, Ceriops tagal, Rhizophora, Apiculata, Mucronata, Corriculatam, Avicennian marina these all mangroves were available in Pakistan so, there are number of parameters that should be taken into the consideration to cultivate the desired outcome form the restoration of the wetlands mangrove ecosystem because most of the challenges associated to the monitoring of the preservation of mangroves are linked with time duration and multiformity of preservation methods, these methods incorporate to comprehend the ecological philosophy and community ecology of Wetlands mangrove ecosystem, which delves into the interactions among various species within distinct mangrove ecosystems and cultivator should have comprehensive knowledge about hydrologic regimes to understand how water flows into the specific Wetlands mangrove ecosystem and how much flow of water is required to restore and grow the mangroves according to the selected groups of mangrove species, evaluate the restraining determinants in the preservation process then inspect the impact of subsistence users along with traditional practices and perspectives or necessities of the local coastal communities there should be availability of substitutes during the process to utilize the full growth of mangroves, selection of Wetlands sites should have accessibility to water and supportive climate

conditions, the most crucial and critical level is to eliminate any of the major hurdles into the hydrology process in that level excessive water consumptions' of industrialization, urbanization and local coastal communities affect the water flow into the wetlands mangrove ecosystem, selection of adequate groups of mangrove species the cultivator should be well informed and well educated to the contemporary methods of mangrove cultivation then cultivation of mangroves and at last assessment of the mangrove health and prioritization of the usage of mangroves considering the biodiversity of the Wetlands ecosystem therefore, Pakistan government should consider the Article 3 of the Ramsar Wetlands Convention (RWC)³³ which stipulates that all signatory members should consult with other state members to organize productive planning for the conservation of marine resources by providing impactful guidelines for the exploration of marine species under the administration of the state governments so, Pakistan should consult with Indonesia government for the productive guideline to conserve the wetlands mangrove ecosystems.

3.7. Comparative lessons from Indonesia

Indonesia has 3.5 million hectares and the country has 20% of healthy mangrove forests worldwide, for climate change, fisheries services, and coastal protection these direct and indirect uses of mangrove forests generate \$ 1,500 annually and an overall sum it is \$ 50,000 per year because Indonesia has an appropriate framework for (BCP) Blue Carbon Projects and the current net value of that carbon project is \$ 532 million and that project will reduce 11 million tons of carbon dioxide annually because 1.82 million hectares mangroves forests have no degradation and degraded mangrove sites have been converted into the aquaculture ponds. Indonesian issued proper mapping of the suitable soil for the cultivation of mangroves. In 2021 Indonesian Forestry and Environmental Ministries issued guidelines for the management and preservation of mangrove forests with the input of local coastal communities whereas Pakistan's (DBC) Delta Blue Carbon project has produced \$ 40 million carbon credit and Pakistan will produce \$ 12 billion by 2075 but according to Ministry of Climate change, these mangroves are degraded by freshwater diversion. Further to the argument, Sindh Forests Development should incorporate ecological economics methods for the management and economic evaluations of mangrove forests and should make productive choices. There are alternative tools and methods to protect the mangrove ecosystem for the growth of the blue economy. Such as the (³⁴DME) Development of Mangrove Estimated value, of the specific group of mangrove species this ecological economic method evaluates the impact of the damage which is caused by various events such as overexploitation of fishing, freshwater flow, unmonitored animal grazing, and so on. Pakistan should consider the (ESI) Environment Sensitive Index of the (NOAA) National Oceanic and Atmosphere Administration, The function of this organization is to elaborate on the significance of flora and fauna and suggest the protection of mangroves preservation which is declining all over the world and estimation of the economic values of the specific groups of mangrove ecosystem, every mangrove

³³Muhammad Ramzan Rafique, "Wetlands of Pakistan: Management and Conservation," Agri Hunt - A Hunt for Agricultural Knowledge, January 6, 2011, access on 29, Dec 2023 available at <https://agrihunt.com/articles/pak-agri-outlook/wetlands-of-pakistan-management-and-conservation/>.

³⁴Salem and Mercer, "The Economic Value of Mangroves." accessed on 27, Nov 2023 available at <https://www.mdpi.com/2071-1050/4/3/359>

services have the vast range of values and ecological economics breakdown these mangrove ecosystem services into direct utilization, indirect utilization and entirely non-use values. Abrupt use of mangrove ecosystems depletes natural resources and direct physical engagements with the services of the mangrove ecosystems are considered the outputs which include overexploitation of fish, transportation, fuelwood, and recreation.

4. Research Gap

Urbanization, Industrialization, and overexploitation of timber and fish, these major human activities are posing a threat to Sindh and Balochistan's mangrove ecosystem and there is no legal framework for the implementation of international conventions and national policies for the preservation of marine resources.

5. Conclusion

Pakistan has a gigantic mangrove biodiverse ecosystem but these mangrove sites are facing severe threats due to human activities such as overexploitation of fish, and timber, industrialization, urbanization, construction of ports, and illegal forest cutting, human economic activities are causing the depletion of natural resources. A decline in natural resources established the imbalanced equilibrium among the ecological and mangroves ecosystem biodiverse organizational structure where every component of this biodiverse system is interconnected and interdependent on one another and change in the cognitive patterns of these systems generates a reactionary impact on every level from disturbed equilibrium among natural patterns to depletion of natural resource leads to the decline in the blue economy therefore, this complex and interlaced concept can be understood by establishing the multidisciplinary approach through the lenses of the ecological, hydrological, environmental and economically diverse and complexly multicentered framework. Pakistan has launched various projects and campaigns for the preservation of mangrove forests but (SFD) Sindh Forests Development authorities are not trained to incorporate ecological economics and (ICZG) Integral Coastal Zone Governance into their policies they are wholly relying on the conventional economist models to generate the blue economy which is causing decline in the marine resources to gain temporary economic gains and posing the long term threats to the biodiversity of the mangrove ecosystems. Therefore, policymakers should incorporate ecological methods for the management, preservation, and economic evaluation of the mangrove ecosystem services. These ecological methods present certain parameters and measures to balance the sediment levels on the mangrove sites as port construction should adopt the environmentally friendly mechanism, contaminated water should be diverted through small channels and grass area should not be depleted during the site cleaning for the construction because these grassy areas act a filter for the high sediment and block the solid particles and slow the freshwater flow into the mangrove sites. Therefore, ecological economics should be part of marine policies with the cooperation and collaboration of (SFD) Sindh Forests Development and Pakistan Ministry of Climate Change for the remodeling of new marine policies for the preservation and protection of mangrove ecosystems services for direct, indirect, and non-use of the biodiversity of this natural capital for the sustainable growth of the blue economy and to presume the balanced equilibrium in

ecological and ecosystems biodiversity because equilibrium among natural organizational structure is a blueprint for the sustainable environmental conditions to preserve the mangrove ecosystem and that protected ecosystem will provide the marketable services which will boost the blue economy.

Conflict of Interest

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