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Climate Change, Migration and Local Vulnerabilities in the Indus Delta, Pakistan

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ABSTRACT

This research study investigates the interlink between climate change and human migration in the Indus Delta, Pakistan. It explores how climate change influences the migration of local fisher and farmer communities in the deltaic region of Sindh province. The objective of the paper is to explore: What are the key climatic factors that result in the migration of the local fishers and farmers of the Indus Delta? This study uses ethnographic methods, including interviews and focus group discussions (FDGs), along with a review of published articles to investigate how climate change has become an important factor in the migration of local communities. The findings suggests that in the past two decades, the deltaic region of Pakistan has experienced large-scale human migration due to the uneven rainfall patterns, reduced flow of freshwater from the Indus River, drought, changes in weather patterns, and a rise in the frequency of natural disasters, including coastal flooding and intense cyclones. The research recommends exploring the interplay of climatic and social factors triggering migration and changing the socio-economic dynamics of the local communities.

Keywords: Climate change, Climate change migration and vulnerabilities, Soil erosion, and Indus Delta.

INTRODUCTION

Over the last many decades, our planet's climate has been changing slowly and gradually with fluctuations in the global average temperatures. However, the 21st century has witnessed drastic changes in climatic conditions largely due to human activities that aim to power and ease our modern lives. This has been done at the cost of burning fossil fuels, promoting deforestation, and changing our land use. These anthropogenic activities have resulted in higher temperatures, rainfall changes, frequent weather events, heatwaves, and super floods, among others. Although climate change has impacted other spheres of life, it has also induced widespread displacements of local communities from their ancestral lands. The consequences of climate change on migration pose a serious threat to human beings in different regions across the world. Climate events such as cyclones, heatwaves, floods, and widespread rains have been reported to increase manifold in the last three decades, and the world is faced with unprecedented challenges (IOM, 2009). The climate-migration challenge is being debated on local, national, and international forums, and a lot of investment is being made by developed nations to adapt and mitigate the adverse impacts of climate change and address the issue of human migration. Therefore, it has developed an interest among scholars, researchers, and sociologists to investigate the link between climate change and human migration.

The impacts of climate change have been so huge on a global and regional scale that Pakistan is among the top ten countries most affected by climate change. According to the report by the Asian Development Bank (2017), in the last 50 years, the annual mean temperature in Pakistan has been reported to rise by 0.5^o C. This increase in temperature has resulted in uneven rainfall patterns, droughts, floods, Glacial Lake Outburst Floods (GLOFs), wildfires, and heatwaves. These changes in temperature and other associated factors of climate have led to human migration in highly vulnerable areas of the country, including the mountainous regions, forest areas, and coastal communities. These climate change related migration should be investigated to develop a deeper understanding of this issue and formulate better policies and projects in Pakistan to address it effectively.

Therefore, to explore the impacts of climate change on the local population, two coastal communities located in the Indus delta, mainly Keti Bunder and Kharo Chann, located in Thatta and Sujjawal districts of Sindh province, were selected. These deltaic areas have been reported to be highly prone to impacts of climate change, mainly coastal flooding, cyclones, sea intrusion, rise in temperature, and other such challenges. In addition, the settlements/ slum areas established by migrant people from the Indus delta were studied, particularly those in Gharo in Thatta and Rehri Goth in Karachi. This study showed that the urban and semi-urban areas in Sindh have witnessed a significant number of migrants from the Indus Delta. These migrants experienced an inadequate freshwater supply, reduced fish catch, loss of livelihoods, and risks to their lives in the Indus Delta. Thus, these local communities have been highly affected by the climatic factors. The current study investigates the consequences of climate change on the movement of the local fisher and farmer

population in the Indus Delta. The broader question this paper asks: *How and to what extent climatic change induces human migration from the Indus Delta to urban areas?*

LITERATURE REVIEW

Pakistan Faces the Brunt of Climate Change

The monsoon rains in 2020 in Pakistan, which caused urban flooding in Karachi and forced many local populations in Kaccho in Sindh and parts of Balochistan, indicate that the country is facing a serious challenge of climate change. Back in June 2015, Karachi witnessed a severe heatwave that killed more than 1300 people in the port city (BBC, 2015). During this period, temperatures of over 40 degrees were recorded, which affected large parts of Sindh and Balochistan. Later in April 2018, the upper and central parts of Sindh were under the influence of an intense heatwave. Nawabshah, located in Shaheed Banazirabad, Sindh, witnessed a 50.6 centigrade temperature, which raised serious concerns about the impacts of climate change in Pakistan (The Express Tribune, 2018).

Pakistan experienced super floods and widespread rains in 2010 and 2011. According to Anadolu Agency, more than 2 million people were displaced by floods that inundated one-fifth of the country in 2010, triggering mass migration from rural areas to cities in Pakistan (Latif, 2019). According to the 2020 Long-Term Climate Risk Index Report by German Watch, Pakistan ranks as the 5th most affected country by the impacts of weather-related events during the last 20 years, from 1998 to 2018. Despite huge loss of lives and livelihoods, the disaster has also led to an estimated 3.8 billion US dollars in damage to the economy and infrastructure. According to the report, during these 20 years, Pakistan has gone through more than 152 major climatic events, causing serious loss to the infrastructure, livelihoods, and economy. Further, a detailed report on Climate Change Profile of Pakistan by Asian Development Bank (2017) mentions that the annual mean temperature in Pakistan has increased by 0.5 centigrade while heat wave days per year have increased approximately fivefold in the last thirty years. This report predicts that by the end of the 21st century, the annual mean temperature is expected to increase by 3 to 5 centigrade. These temperature estimates can cause serious climatic events and lead to the destruction of infrastructure and livelihoods and can force human migrations from the coastal belt of Pakistan. This, in turn, will increase pressure on cities and urban resources and infrastructure.

However, the climate change policy documents produced at various levels in Pakistan do not reflect any specific clauses in connection with climate-induced migrant people of coastal communities. The National Climate Change Policy (NCCP) of Pakistan has only one clause, which says that 'curbing rural-to-urban migration' by developing short-term 'agro- based towns in rural areas and periphery urban areas' (National Climate Change Policy, 2012). This clause clearly indicates that migration of people is seen as something negative by the government, which they believe should be stopped from happening. Over the past couple of years, the INGOs, donors, civil society, and government in Pakistan have played a proactive role in working on

Climate Change in general and its impact on people in particular (NDMA, 2008). While some of the national and sub-national documents are in place now, many of them still lack specialized provisions applicable to climate change and climate-related migrants.

Climate Change Theory of Migration

There are some theorists who consider the environment or climate change as important factors in human migration. Parrish et al. (2020) believe that the environment is an important factor that determines human migration. The authors shed light on various aspects of climate change, including flooding, changes in rainfall patterns, temperature fluctuations, land-use changes, sea-level rise, soil erosion, and other natural hazards. According to Tacoli (2017) and Black et al. (2011), climate change may act as a direct driver of human displacement, but in some cases, it is linked with other factors such as demographic, political, social, and economic. Historically, people have always been searching for environments that are considered the best fit for their survival and provide them with enough resources for their sustenance. Migration is generally the outcome of a combination of drivers categorized as social, political, economic, demographic, and environmental. Neumann and Hermans (2015) are of the view that climate change is considered an external driver that acts as a threat magnifier, which exaggerates the push factors for communities prone to climatic events. The recent studies on the subject state that climate change significantly influences human mobility, along with other economic, social, and demographic factors.

Writing about the migration trend in Pakistan, Nazeer (2019) shares that people migrate from one place to another because of three major reasons: socio-economic, cultural, and environmental. Other than these factors, Henry et al. (2003) using different modelling approaches share that high literacy rate and economic status work as push factors. Further, Ezra and Kiros (2001) also found poverty and marital status as drivers for human migration. The current study applies the conceptual model adopted by Parrish et al. (2020) to understand the relationship between the two. To investigate the link, two deltaic communities in the Indus delta, such as Keti Bunder and Kharo Chan, have been selected for the study. Located in Thatta and Sujawal districts of Sindh, both areas are more prone to climate change, and mass-scale migration has been reported. In the broader context, the conceptual model takes into consideration three key climate aspects that increase populations' vulnerability to climate-induced migration. These aspects are i. Physical ii. Ecological and iii. Anthropogenic.

The key climatic determinants affecting communities of Keti Bunder and Kharo Chan are a reduction in the availability of freshwater, uneven rainfall patterns, changes in land use, depletion of fish stocks, degradation of agricultural land, sea intrusion, soil erosion, rise in temperature, among others, as shown in the table given below.

Table 1: Key climate change factors that increase vulnerability of local communities and force them to migrate.

S#	Climatic Factors	Determinants
1	Physical Aspects	Changes in rainfall patterns, extreme weather events such as cyclones, strong winds, etc., soil erosion, sea intrusion, changes in land use, fluctuations in temperature.
2	Ecological Aspects	Soil degradation, deforestation, desertification, changes in freshwater ecosystem, marine ecosystem, and terrestrial ecosystem;
3	Anthropogenic Aspects	Changes in crop yield, fish production, soil productivity, water availability, and security.

Table 2: Shows determinants of human migration.

S#	Migration Factors	Determinants
1	Social	Family and social relationships, social networks, ethnicity, education, marital status
2	Economic	Cost of living, income, economic activity, land availability, and rate of employment.
3	Political	Level of institutionalization and infrastructure, policy incentives, governance, decision making by the government for migrants.
4	Demographic	Gender, age, sex, marital status, population density, and population growth rate.
5	Environmental	Food security, water security, air quality, soil quality, and land use.

By integrating the social, economic, political, demographic, and environmental determinants of migration into the Indus delta, with climatic factors such as physical, ecological, and anthropogenic, a case-specific conceptual model can be produced for the Indus delta. This model will help explore the link between climate factors and human migration in Keti Bunder and Kharo Chan.

The Relationship between Climate Change and Human Migration

The predictions about mass climate-related migration have been making headlines in top newspapers. Declare et al. (2020) argue that the ‘Great Climate Migration has already Begun’, providing impetus to researchers to explore the relationship between the two (Parrish et al, 2020). Since the 2015 migration crisis in Europe, this topic has received a lot of non-evidence-based rhetoric and controversy in the media. As climate change has been predicted to continue in the 21st century, this would serve as a key migration driver across different climate-vulnerable regions (Watts et al, 2017). Shedding light on the consequences of natural disasters, which are produced because of climate change, Mbaye and Zimmermann (2016) share that the relationship between environmental disasters and migration is possibly one of the biggest challenges that future generations will face.

Parrish et al. (2020) shed light on the types of migration shares that may occur over a range of spatial scales, such as movements from rural to urban areas; national

to international, and it can be on a temporal scale, like circular to temporal and permanent migration. The decision to migrate is a combination of macro-level (society) and micro-level (individual) drivers. Debating on the climate-related mobility and displacement of people, Warner et al. (2010) have observed that migration, both permanent and temporary, internal and external, has been a coping strategy for people confronting environmental changes such as disasters, climate conditions, and creeping processes. Reid (2014), further states that the possibly most extreme adaptation strategy to climate change and climate-induced natural disasters is migration. Likewise, it is observed in deltaic communities of the Indus River that whenever coastal flooding or cyclones are about to hit their settlements, they shift to safer places for a certain period, and when the water recedes, they return to the original settlements. There are also the migrants who have moved away from their ancestral lands and have never returned, though their kith and kin still live in the deltaic areas.

Push and Pull Factors of Human Migration

Migration studies typically emphasize 'push' and 'pull' factors. The push factors are in the context of origin, while the pull factors relate to the destination (Muriuki et al. 2011). These factors can be either economic, social, environmental, political, or even household-related (Black et al. 2011). However, understanding the relationship between human migration and climate mainly focuses on push factors. Craven (2015), writing about the adverse impacts of climate-related migration, says that it can also lead to loss of labor, knowledge, and skills from the community. However, on the other hand, migration as an adaptive strategy to climate change may affect these factors and may bring positive changes in the living standard of migrants due to the pull factors. Therefore, migration has the potential to be either maladaptive or adaptive to climate change in the long run (Jacobson et al. 2018).

Further, Sattar (2014) argues that there is no straightforward and mono-causal relationship between the two. In recent years, escalating population displacements have been witnessed due to extreme weather events such as water scarcity and drought, especially in Africa and Asia; the heat wave in Karachi, Sindh, in 2015 that killed more than 12,000 people, and flash floods in Pakistan for three consecutive years of 2009, 2010, and 2011. Pakistan Economic Survey (2011-2012) noted that climate change is an area that has become increasingly important in recent years and raises issues of equity and global justice. The richer industrialized countries are primarily responsible for greenhouse gas emissions, and the poorer developing countries are heavily bearing the brunt of climate change. Likewise, the communities in the coastal belt of Sindh are experiencing such drastic changes that escalate the tendency of migration to more stable areas. Residents of different villages located in creeks of the Indus deltaic region, unaware of the political and economic situation of the country, encounter climatic events. They are only concerned about their livelihood but worry about life security. Sea water that was once the lifeline of these people is posing threats to them in the shape of sea level rise and coastal flooding.

METHODOLOGY

This research employs a mixed-method research design applying a triangulation approach. This approach refers to the collection and analysis of both qualitative and quantitative data (Johnson and Onwuegbuzie, 2004). This approach brings together the strengths of both methods in the study of climate change and human migration. In this regard, qualitative research methods were developed about the context and meaning of events related to climate change impacts on the local population of Keti Bunder and Kharo Chan, and how these influenced people's decision to migrate. The quantitative research methods were useful in tracing the sea intrusion, soil erosion, temperature rise, rainfall patterns, and other associated climatic determinants. Qualitative research is an inquiry process of understanding based on a methodological tradition of inquiry that explores a problem (Shone, 2020). It complements and strengthens the quantitative data. It allows research to explore the problem in-depth, understanding the knowledge, perception, and attitude of the people on climate change and migration.

A total of 33 semi-structured interviews were conducted for the said research topic. These interviews with community members from Keti Bunder (n=9), Kharo Chan (n=9), and Rehri Goth (n=9). Moreover, interviews (n=6) were also conducted with representatives of organizations working on climate change and human migration in the Indus delta, such as the Planning and Development Department, Government of Sindh; World Wide Fund for Nature-Pakistan (WWF-Pakistan), Sindh Coastal Development Authority (SCDA), and International Union for Conservation of Nature (IUCN). During the research, 4 FDGs were conducted with local people. Additionally, various research studies, project reports, and relevant research articles were studied. Using these important methods, researchers got the chance to listen to different categories of people at one time. They shared their views about the scarcity of freshwater, degradation of the Indus delta, depletion of fish stocks, folklore, culture, and change in living style over 30 years. During these FDGs, 7 to 10 respondents participated and discussed the issues.

Findings and Results: Climate-Migration in the Indus Delta

The climate change-induced migration is largely due to gradual or sudden changes in environmental factors, which drastically affect the lives and livelihoods of local fisher and farmer communities in the Indus delta. The climate migration observed in the deltaic region is either seasonal, temporary, or permanent. However, the present study takes into consideration the permanent migration of people, whether it is internal or external. The internal migration involves the displacement of people from one creek that is located far away in the delta to another creek that is near the inland area. External migration denotes the mobility of people from the Indus delta to urban and semi-urban settings such as Karachi, Hyderabad, and Gharo in Thatta district, Sindh.

Local testimonies, existing research, and grey literature reveal that mass migration has occurred in the Indus Delta. It has been reported by The Dialogue Earth (2020) that around 1.2 million people from the delta have already migrated to Karachi.

Therefore, in the wake of a changing climate, the coastal communities in the coastal belt of Sindh, mainly Thatta and Sujjawal districts, are migrating on a mass scale. It was indicated by the study that these people were unsafe and living under pathetic conditions, as the sources of livelihood were being depleted. According to Mahar and Solangi (2017), almost 70 per cent of people in these communities depend on fishing, whereas the remaining populations are engaged in agriculture, livestock, labor, dairy, poultry, and other professions. Locals reported that due to environmental degradation, pollution, freshwater shortage, and climatic factors, the fisheries and agriculture sectors were adversely affected. The climate-induced migration in the deltaic areas of Sindh is presumably one of the biggest human challenges and poses a significant threat to human populations, which is going to only increase in the future. Under this scenario, the entire deltaic belt is vulnerable to climate change impacts, and it could face unprecedented human displacement soon.

Deltaic communities in the Indus delta are facing several climate change issues, which are driving the local populations to migrate to urban areas. In the past, people lived in large numbers in the delta, but due to different climatic factors, they started to move away from their ancestral lands. There are several push factors, such as cyclones, heavy rains, floods, sea level rise, seawater intrusion, sea erosion, droughts, freshwater scarcity, pollution, overexploitation of natural resources, and depletion of livelihood resources, which compel people to migrate.

In the past, the Indus delta received an adequate supply of freshwater flow from the Indus River. According to Giosan et al. (2006), the Indus delta received a mean annual discharge of around 90 ($\text{m}^3 \times 10^9$) of freshwater from the Indus River. With abundant freshwater resources, the Indus delta had fertile agricultural lands, plentiful fisheries resources, and lush mangrove forests. It was also home to a myriad of fish species, migratory birds, diverse animals, and thick mangrove forests. According to locals, the entire deltaic area was rich in natural resources, and they raised many livestock and exported milk to Karachi and even Mumbai.

Local communities in the Indus delta considered freshwater as the lifeline of the Indus delta and said that they completely depended on the flows of the Indus River. They informed that historically they received abundant freshwater from the Mighty Indus (*Sindhu Darya Badshah in local parlance*), which started to reduce after the construction of the Sukkur Barrage in 1932, and other such barrages constructed after the Independence of Pakistan. Chacha Ghani Kaiyar and Anwar Jatt from Kharo Chan informed that the Indus delta witnessed a sharp decline in the freshwater flow in the 1990s, which led to the slow migration of people from the creek areas. They shared that the reduction in freshwater was due to two main reasons. First, the government of Pakistan set up dams and canals on the river Indus, which stopped its natural flow to the delta. Secondly, the delta witnessed a sharp decline in rainfall. Both these reasons reduced the livelihood resources for the local communities, forcing them to migrate. The significant reduction of water flows from Kotri downstream has resulted in increased saltwater intrusion in the river's lower reaches, which is discussed below.

Coastal erosion is a slow process that is mostly influenced by sea tides. As the sea level varies, seawater starts eating away at the land, and eventually, the land becomes part of the sea. By assessing the situation of sea level rise and intensity of waves, some safety measures can be taken in advance to secure people and land if they are in vulnerable coastal areas. Regarding this environmental issue facing the Indus delta, local people shared that most of the areas in the deltaic region were being eroded by seawater. 58-year-old Anwar Jatt from Kharo Chan shared that large areas of land where they used to grow crops and vegetables had come under seawater. He said that there were many people residing in the creek areas, which were no longer there. He was of the view that people did not expect such drastic changes in the deltaic landscape, but the delta was changing abruptly, and most of the people blamed dams and barrages that trap the water and sediment upstream as the main cause.

During a Focus Group Discussion (FGD) at Muhammad Siddique village of Kharo Chan, locals informed that there was Sokhi Bunder in the Indus delta, which was an important center of trade and was mostly run by Hindus. They said this trade center had markets, and people from far-flung areas used to visit it. The entire trade and transport in the Indus Delta were carried out through the Sokhi Bunder. Some aged and experienced people of the village said that they vividly recall how the daily business ran over there. But, with the passage of time, that area of Sokhi Bunder started to degrade as freshwater was not available in the required quantity, and businessmen started to migrate. Over the past few decades, large portions of coastal land have been completely wiped out, and coastal waters in the creek have considerably increased in length and breadth due to erosion.

Although the impacts of rising sea levels and subsequent sea intrusions are witnessed throughout the world, the coastal and deltaic area of Sindh is no exception. The sea intrusion has left the deltaic region prone to coastal floods, cyclones, and other natural disasters. Moreover, mangrove forests that assist in reducing land erosion and act as barriers between the coastal region and the sea are also steadily depleting. Therefore, the surrounding communities, once thriving with marine, agricultural, and human life, have been left parched for water. It is equally affecting the fertile soil, reducing the crop yield. The rise in sea level accelerates the saltwater movement inland and upstream into aquifers. The depleting water quantity and quality have already caused great economic and health problems in the coastal region. This has been one of the major push factors as the degradation of the overall ecosystem has seriously affected the livelihood of communities, and in many areas, people have no alternative but to migrate to other areas.

Members of the local communities shared that in the 1970s, groundwater in Kharo Chan could be used for drinking and household consumption. They had an ample supply of freshwater through the Indus River and the rainfall system, so water was available in considerable quantity. People of the Indus delta, particularly dwelling in the Kharo Chan, Shah Bunder, or Sokhi Bunder, had never thought of such serious scarcity of freshwater due to changes in water flow coupled with climate change and rising temperatures. Presently, the freshwater quality in the deltaic region

depends upon the freshwater flow downstream of the Kotri barrage. Most of the canals, which were once a source of freshwater supply to far-flung areas in the deltaic region, have converted into pools with high salt content. The fertile agricultural land was changed into barren patches with salt contents 10 to 20 times higher than the riverbank bed. The backflow of seawater along with the river is also affecting the underground water in the Delta region.

Most of the residents of Kharo Chan, who used to have farmlands, have turned to being fishermen. According to Chacha Ghani Katiar, the government Fisheries Department does not provide fishing permits to fishers of Kharo Chan as the department considers them farmers due to their association with agriculture in the past. He went on to say that, as they did not practice any agriculture now due to scarcity of freshwater and changes in rainfall patterns, the government should issue them fishing permits so that these people could decently earn their living. Local farmers and fishers also shared those natural resources, including the land and coastal waters, were degraded as they could neither cultivate crops nor catch fish well.

With annual mean increase in temperature and reduction in rainfall patterns coupled with reduced freshwater flow from the Indus River, the frequency of cyclones has increased in the deltaic region. Writing about cyclones, Rasul (2012) noted increased intensity of torrential rains, frequent tropical cyclones, persistent drought, recurring floods, increased intensity of storm surges, and erratic behavior of monsoon rains in the Indus delta. Locals were of the view that they did not witness strong winds or powerful cyclones in the past, but now they were witnessing them after every two or three years. According to a 70-year-old Chacha Gilli, Gilli Sholani village in Khobar creek of the Indus delta, in the past, people did not experience strong cyclones in the Indus delta. What they witnessed used to be of median intensity. He further continued and said, but now the frequency of cyclones has increased. He recalled that last year they witnessed cyclone '*Kyarr*', which had caused serious damage to their houses and boats. This cyclone was also reported in the media.

According to the Pakistan Meteorological Department, the *Kyarr* was the strongest cyclone after the '*Goryu*' super cyclone that hit the coastal areas of Pakistan in 2007. It is the ninth super cyclone to have developed in the North Indian Ocean after '*Goryu*'. This situation has not happened for the first time in the region, but several cyclones have hit Pakistan's coastal communities from time to time in the years 1948, 1964, 1985, 1999, 2007, 2010, and 2019, according to the Pakistan Meteorological Department.

Pakistan is one of the countries that is most vulnerable to the impacts of rising sea levels and other associated climatic factors. These facts in terms of the Indus delta are very true, as one can witness changes in the landscape of the deltaic region. According to locals, the entire Indus delta was rich in natural resources, including fertile lands, sediments, thick mangrove forests, abundant fish stocks, and a variety of fish species and other wildlife, including resident and migratory birds. People at Keti Bunder and Kharo Chan also informed that the area was known for red rice in the region. The farmers in the past used to export that rice through boats to other

countries, India, and Sri Lanka. It was considered the prized crop in the Indus delta, and people used to cultivate it with great interest. The soil in Kharo Chan and Keti Bunder was so productive that this crop was grown over large areas of land. 40-year Saleem Dablo from Mero Dablo village at Keti Bunder informed that during the harvesting of rice crops, people from Punjab used to come over the Indus delta and harvest it. In return, those people were paid by the local farmers during the harvesting season.

Moreover, people shared that they grew orchards of banana, papaya, and guava fruits, which were of high market value. These orchards, once farmed in the Kharo Chan, are almost nonexistent now. The reason lies in the lack of freshwater, land degradation, sea intrusion, and a reduction in the sediments. Siddique from Abu Bakr Goth is one of the locals who informed that “these barren lands you see here were once agricultural. We cultivated bananas, mangoes, and paan here. These lands were irrigated by the Indus River; however, the building of dams has curbed the flow of freshwater, while the seawater has intruded, causing increased salinity that has left agricultural lands barren and led to the loss of our livelihood. Resultantly, many people have abandoned these lands”.

Hence, reduction in downstream water discharge due to water diversions, dams, and decrease in rainfall has caused seawater to overcome the coastal plains and has led to depletion of mangrove forests, which further have accelerated the process by allowing erosion and high tide occupation of coastal lands. Consequently, a large fertile area of Thatta and Sujawal districts is now under seawater. According to locals, in recent decades, the rate of erosion has increased along the Sindh coast, and most of the mudflats and islands in creeks have been severely eroded. The creeks, which are near the present outfall of the Indus River, were facing erosion due to natural hydraulic forces, such as a reduction in the supply of sediments by the river, wave reworking in the comparatively recently formed delta, together with the arid conditions prevailing in the deltaic region.

People of the Indus delta believed that the area was rich in natural resources, which is now the reminiscence of a glorious past – roars in the Indus River, sufficient freshwaters, fertile lands, large patches of green cover, abundant fish stocks, diverse wildlife, and flocks of migratory birds. Respondents were of the view that the situation abruptly changed as freshwater flow started to reduce, coupled with other changes in the climate. Nadeem Sheikh, who lives in Rehri Goth, informed that they had hundreds of buffaloes, cows, and sheep, but due to freshwater shortage and reduction in grazing grounds, they had to sell them out in Gharo and other towns. He informed that as the productive lands started to become barren; grazing grounds disappeared. In the past, one could graze the livestock in areas near the villages, but as the water situation became worse, the grazing grounds were found only in the far-off places. Therefore, the grazers or livestock herders had to travel long distances, at least 3 to 5 kilometers, in search of the feeding grounds. He also said that people could only find more food during the monsoon season, which was available throughout the year. As the feed and freshwater were no more, livestock started to die. While

Siddique Ahmed from Kharo Chan town said that they had abundant grazing grounds in the past and people never thought of losing such green covers, which looked like a green quilt on the Indus delta. Livestock was so healthy that people from far-flung areas came there to purchase it. It was so nutritious that people exported it through boats on the sea.

Locals said that with the rise in sea intrusion, coastal flooding, and soil erosion, grazing grounds for livestock were lost, and people sold out most of the livestock. Coastal flooding has emerged as a devastating phenomenon for people dwelling in the creek areas of the Indus Delta. According to a 40-year-old Muno who resides in Mero Dablo at Keti Bunder, when they lived in a hamlet at Turchan creek in the Indus Delta, seawater inundated their homes, and they had to climb onto the roofs. He told people to shift their household utensils and kitchen items to a raised platform. He informed them they did not sleep until seawater receded after high tide. This coastal flooding issue had increased to a greater extent in creek areas, therefore, they, along with some other relatives, decided to migrate to Keti Bunder town. It was because of this issue that the entire Mero Dablo village, which consists of more than 200 households, decided to migrate from the creek area and settled at this place. Therefore, it can be inferred that climatic factors had a very serious impact on the feeding grounds where animals could graze throughout the year.

This issue of sea level rise and coastal flooding was also discussed at the FDG in Keti Bunder town. Shakeel Memon, an activist and teacher by profession at Keti Bunder, shared that in the past, when freshwater was abundant and the area had sufficient rainfall, people in creeks rarely discussed the rise in sea level and coastal flooding. But, now with every passing day, fishermen are complaining about these issues and hear about some people shifting to Keti town or other areas in Thatta or elsewhere. The gradual changes in deltaic climate and other ecological factors drastically affected the life of local communities and triggered human migration. The people migrated to inland or urban areas where options and opportunities of freshwater, education, health, livelihood, income, and other amenities of life could easily be accessed. Most of the respondents shared that they lived in very pathetic conditions in the creeks. They said that the water situation was so appalling that they could not take a bath for many days. They sometimes mix it with seawater and then use it for washing utensils and clothes.

Further, Saleem Dablo, who resides at Mero Dablo village in Keti Bunder, took a deep sigh when the researcher asked him about the reason for his migration to a new setting. He said that the entire village of Mero Dablo lived in Kharyon, which is located around an hour boat travel from Keti Bunder. He went on to say, people did not have health, transport, and freshwater facilities, and they had to face such problems daily. Therefore, they decided to migrate to the inland area in Keti Bunder, and others went to Karachi. He informed that other fisher communities in creeks are also thinking of moving away from there, but they have no land to settle in Keti Bunder or resources to shift to Karachi. Sajid Bilawali, who has shifted to Gulshan-e-Hadeed, Karachi, said that his family is happier now as they have set up their business

in the city and engaged some other people in it. Bilawali further said that they have also started schooling their children and have access to better health facilities, which were rare in the Delta. He disclosed that they have some agricultural land in Keti Bunder, but they plan to sell it and invest more in the business. He was of the view that the network of roads was so bad that it took them more than two hours to cover 10 kilometers, and during the rain, it was more difficult to travel on them.

Nadeem Sheikh was of the view that the education system in the coastal areas of Karachi is far better than that in the Indus Delta. He said that there was no proper schooling system. He informed that his 5-year son is enrolled in a private school in Pakistan Air Force (PAF) and he managed his fees by working in an NGO. He was satisfied with the performance and schooling system that he could afford by living in Rehri Goth. He further told that most of the people who migrate from the Indus Delta prefer to enroll their children in either public or private schools, which are easily accessible in Rehri and Ibrahim Hyderi, Karachi. He also said that his two sisters had also migrated around two years ago and had been living in Reri Goth. He informed that though they are facing challenges in terms of earning income and household expenditure, they are nevertheless hopeful that their children will have a better future.

Asad Malah, who lives in Ibrahim Hyderi with his family, had migrated from Keti Bunder. Presently, he works in a private factory near the Pakistan Air Force base. He is working as a supervisor and earns around PKR 40,000 per month. He informed me that he is the sole earner of his family and has three sons and one daughter. He was of the view that in the past, he used to go fishing in the Indus delta, but as the fish stock was depleted and he had nothing to feed his family, he thought about selling his fishing boat. The amount he got from the boat was around PKR 200,000, and then he decided to move to Ibrahim Hyderi, where some of his other relatives had already migrated. He shared that now he lived a decent life and was no longer anxious for the future of his children.

DISCUSSION AND CONCLUSION

The forced climate change migration, as this article argues, is not a sudden phenomenon; decades of water governance policies have transformed the Indus Delta, which has in turn forced the people to migrate. The scarcity of freshwater, the decline in biodiversity and agricultural lands, as well as recent climate change shocks, all contributed to this migration. The communities in Keti Bunder and Kharo Chan were under the influence of these changes, impacting their lives and livelihoods. The flourishing delta with freshwater flows sustaining fisheries, mangroves, and livelihoods slowly become fragile. This is due to the construction of dams and barrages upstream that interrupt the flow of the Indus River towards the delta. As freshwater from upstream diminishes, other climate change stresses such as sea-level rise, cyclones, and coastal erosion become perennial. This gradual fall of the flourishing environment of the delta transform becomes insecure for human settlement. Together, these environmental stressors have depleted the natural resources for

fishing and agricultural communities. In this context, migration of people becomes more as response to these stressors and is more about survival strategies than a voluntary movement.

The findings of the data collected confirm these issues. Multiple people informed that climate change is causing sea intrusion engulfing their lands and villages, cyclones putting their lives at risk, and diminishing river flows as the fisheries are degraded, while droughts put more pressure on them. These factors push them to leave their ancestral lands and villages to find alternative livelihoods in cities and towns. Among them, one of the most critical issues is the decreasing availability of freshwater, especially drinking water for the people. In the past, when the Indus River was flowing unleashed, the groundwater and the river water were drinkable. Now, when the river does not flow towards the delta, even the groundwater is undrinkable. This imbalance forced people to migrate either from deep creeks to Keti Bunder and other towns of the delta, and more people migrated to Karachi. Moreover, this migration not only displaces economic lives but also disrupts the social and cultural lives of the people. People who have migrated to Karachi, Rehri Goth, Ibrahim Hyderi, or smaller towns such as Gharo, Garho, Baghan, and Buhriyon not only find new ways of living but also change their relations with land, water, fishing grounds, kinship networks, and local traditions. This is a rupture of this identity, memory, and belonging with the Indus Delta. In this context, climate change migration is more than the movement of people from one place to another. It is a loss of land, livelihood, relations, stories, culture, and people's lives.

Another important argument this paper makes is that migration does not necessarily solve the vulnerabilities of the people. People have migrated from the Indus Delta because they have been facing challenges, especially regarding their livelihood. However, it was found that in cities, they face similar challenges, where finding work is very difficult. This is also because most people do not have any technical skills other than fishing and agriculture. They are usually involved in an irregular labor market where finding work is an everyday challenge. Moreover, these migrations have taken place without any government assistance. People have either migrated on their own or have used their extended kin networks, who are already settled in different towns and cities. In such situations, they use these networks to find work or try themselves. These challenges put them in a vicious cycle of poverty.

Finally, on the question of the possibility of their return, people said that it seemed almost impossible to return to the delta. The conditions in the delta were worsening day by day, and more people were migrating. In such a situation, returning seemed like a scary dream to them. However, with wet eyes, they expressed the willingness that if the Indus River flows again and revives the fisheries and agricultural lands, they would return to their ancestral lands, indicating that displacement was deeply linked to environmental restoration and governance decisions. They also expressed their intimate connection with the places - the ancestral lands they cultivated and houses they built. They had the memories of those days when they lived happily in the Indus Delta. However, they also shared concerns

about the basic amenities of life and threats posed by frequent coastal floods and cyclones.

Overall, this article argues that climate change-induced migration in the Indus Delta is creating challenges for the local people. The affected people have not contributed to climate change, yet they are bearing the burden of it. Their displacement creates numerous problems for them, and it also showcases the failure of governance in terms of managing the impacts of climate change. Following the people of the Indus Delta, this paper argues for a sustained flow of the Indus River towards the delta that can restore the ecological life, including fisheries, mangroves, and agricultural lands. However, for immediate support of the local people, the administration must provide health facilities, drinking water, and livelihood support. Without such interventions, climate-induced displacement in the Indus Delta is likely to deepen, with serious implications for human security, social stability, and the future of deltaic communities in Pakistan. The following are some recommendations based on the findings of this research

Recommendations

To reduce the further displacement of people from the Indus Delta, short- and long-term measures should be taken. Government and civil society organizations should formulate development plans for the uplift and betterment of local communities. Some of the key recommendations to address the challenge of climate-induced migration are given below.

1. The climate-induced migrant policy must be formulated to address the issues of people moving away from their ancestral lands in the Indus Delta.
2. First and foremost, the priority of the government should be to address the issue of the supply of freshwater to the Indus Delta. The government should ensure the release of at least 15 MAF of freshwater flow from the Indus River on an annual basis. This flow should be regularized to cater to the water needs of people in the region. This will also help communities to cultivate crops, vegetables, and fruit plants in the deltaic areas.
3. Far-flung settlements and villages on creeks in the Indus Delta should be equipped with Reverse Osmosis (RO) plants that should operate on alternative energy sources such as solar or wind energy. This helps provide safe drinking water for the communities.
4. A joint initiative of the government in partnership with NGOs should be implemented to set up small freshwater ponds in the villages located along the creek area of the Indus Delta. These freshwater ponds will store freshwater during the monsoon season when it is available in adequate quantity in the Indus delta.
5. The government should also help set up climate-resilient housing schemes for deltaic communities. Climate-resilient houses with raised platforms can help address the issue of coastal flooding and high tides in the creek areas of the Indus Delta. This initiative can help mitigate the damage caused to the houses during cyclones and other natural disasters facing these communities.

6. An early warning system must be ensured to inform coastal communities about coastal flooding, cyclones, sea level rise, severe weather conditions, and widespread rains.
7. Apart from this, alternative livelihood opportunities should be provided to the local fisher and farmer communities so that they enhance their income generation capacity and earn a decent living. These alternative livelihood options can include constructing crab fattening ponds, establishing fish nurseries, mangrove nurseries, and the development of handicrafts, among others.
8. Moreover, nature-based tourism should be promoted in the Indus Delta. There is great potential in the area where various activities can be planned for visitors. These activities should include Bird Watch, Dolphin Watch, Recreational Fishing, Boat Safari, Trip to Mangroves Ecosystem, and Traditional Cuisine, among others. Income generated through these activities will contribute to the uplift and development of deltaic communities.
9. Education and awareness should be raised among children and youth of the coastal communities, who should lead in the conservation and protection of deltaic resources and become future custodians of the Indus delta.

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