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# Environmental Cooperation: An Imperative for Subcontinental Thinking

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This paper looks at some of the environmental issues that have been adversely impacting the Indian Subcontinent in recent years. While India and Pakistan may have their differences, climate change poses a more potent threat to them than they do to each other, and this document is a call to action to try and mitigate some of its repercussions.

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# Executive Summary

India-Pakistan relations have been strained since the partition of the subcontinent, and efforts to overcome differences and improve bilateral relations have been largely unsuccessful. However, today, both countries face serious environmental issues, which, if not addressed, can potentially hurt them more than they can hurt each other. Climate change knows no borders, and subcontinental action is the need of the hour. India and Pakistan have young populations– India has a median age of 28[1] while Pakistan has a median age of 20[2]– who will bear the brunt of environmental issues in the coming decades if urgent action is not taken.

Their shared climatic and geographical characteristics mean that India and Pakistan face many of the same issues in tandem, and climatic events in one country often affect the other. Heat waves, air pollution, rising water levels, and glacial melting are four areas that impact both countries on a large scale. They have far-reaching implications- ranging from affecting the liveability of cities[3] and catalysing major health issues to impacting food and water security. This discussion document looks at some of these problems and explores mechanisms for them to be addressed. Through the example of the locust swarms that ravaged both countries in 2020, it explores instances where cooperation has effectively brought about changes.

This document has been formatted to be read conveniently on screens with landscape aspect ratios. Please print only if absolutely necessary.

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# I. Why Climate?

The dynamic between India and Pakistan has been fraught with tensions for as long as the two nation-states have existed. Numerous efforts to overcome differences have proven to be unfruitful. On the contrary, each potential confidence-building measure has been internalised as a trigger that escalates tensions further. Even a shared love for cricket has been divisive—with the sport often being overshadowed by the history of terrorist attacks[4] surrounding matches that have led to an institutionalisation of hatred.

Even efforts at memorialising the freedom struggle have been tainted by the memories of Partition and the strained relationship, with India commemorating 'Partition Horrors Remembrance Day' on Pakistan's Independence Day.

However, today, the two countries are at a juncture where it is imperative to look beyond borders and past conflicts. As temperatures rise globally at a concerning rate of increment, India and Pakistan face several similar issues facilitated by similar geographical characteristics. By 2050, with high emissions, temperature increase progressions for India and Pakistan range from 1.8 °C to 2.5 °C on average[5][6]– not considering regional variations.

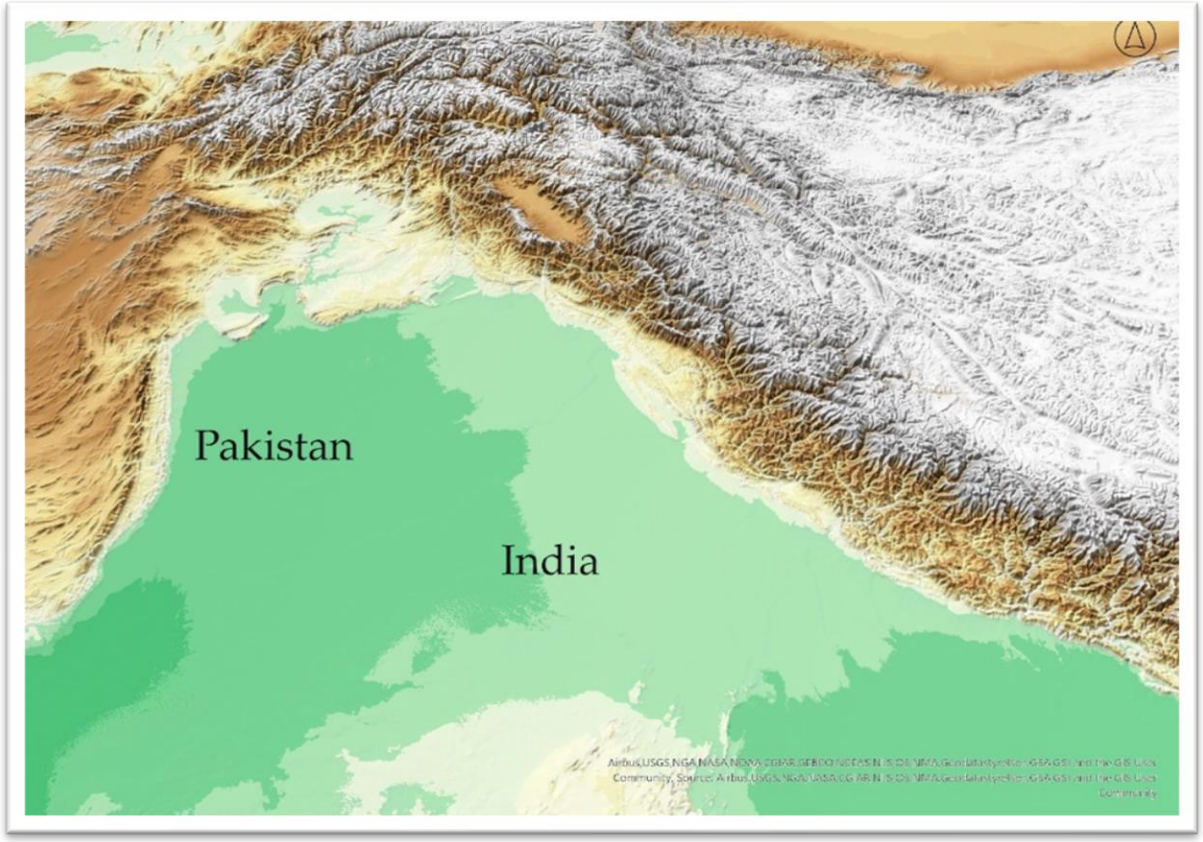


*Figure 1. The Geographical Characteristics That Are Common to Pakistan and Northern India. Source: Base layer – ESRI, Map created by Y Nithiyanandam*

With the western Himalayas stretched across both countries (fig.1), the Indus River Basin, which flows through both countries before joining the Arabian Sea and the Thar desert that spans across sections of the border, both countries

have large areas that are similar climatically as well, in addition to cultural similarities. As a result, they both battle several environmental issues today that transcend human-made borders and collaborating to overcome them could potentially help establish a bilateral relationship that benefits both countries.

While there are many issues that India and Pakistan face in common, the threat that climate change poses to both countries is becoming increasingly more pressing. With rising temperatures, natural disasters, and rampant air pollution, both countries' cities are becoming increasingly unliveable, and large proportions of both countries face food and water scarcity. These are not issues that can be addressed by any one nation-state; political boundaries do not apply to the climatic issues that plague the region indiscriminately, and the solutions to them cannot be effective if they come from only one country.

Additionally, subcontinental cooperation to combat the effects of climate change also has the potential to open the door for future collaborations across realms. At present, however, for India and Pakistan to effectively mitigate the many issues they face, it is imperative to work together on specific climate-related issues.

The El Nino refers to the periodic warming of the central and eastern Pacific ocean. During periods of El Nino, trade winds blow westwards towards Asia, pushing warm surface water with them. During an El Nino event, India and Pakistan can potentially experience much higher temperatures, including but not limited to during peak monsoon. These disruptions in temperature can lead to heat waves and uneven rainfall patterns.

# II. Issues in Focus

Climate-related issues can have hugely detrimental repercussions for both India and Pakistan. According to the World Bank[7], climate-related disasters such as floods and drought could reduce Pakistan's GDP by as much as 18-20% by 2050. The floods in Pakistan in 2022 cost over 30 billion dollars[8]. Similarly, India's agricultural sector, which contributes 15% of its GDP, is projected to face immense losses due to climate change[9]. Some of these issues have immediate consequences not only on the overall quality of life but on more fundamental things such as the liveability of cities. Due to many factors, including but not limited to fossil fuel combustion, the El Nino, heat radiating architecture, deforestation for agricultural and industrial land, vehicular emissions, and glacial melt, there are many direct repercussions on temperature and air quality, affecting water levels and agriculture. While there are a multitude of issues due to climate change today, the following sections explore three such issues: air pollution, glacial melt, and urban heat. These three issues, in particular, have been chosen because they do not exist in silos, and events in Pakistan affect India and vice versa. Hence, it is imperative to take collaborative action.

# A. Air Pollution

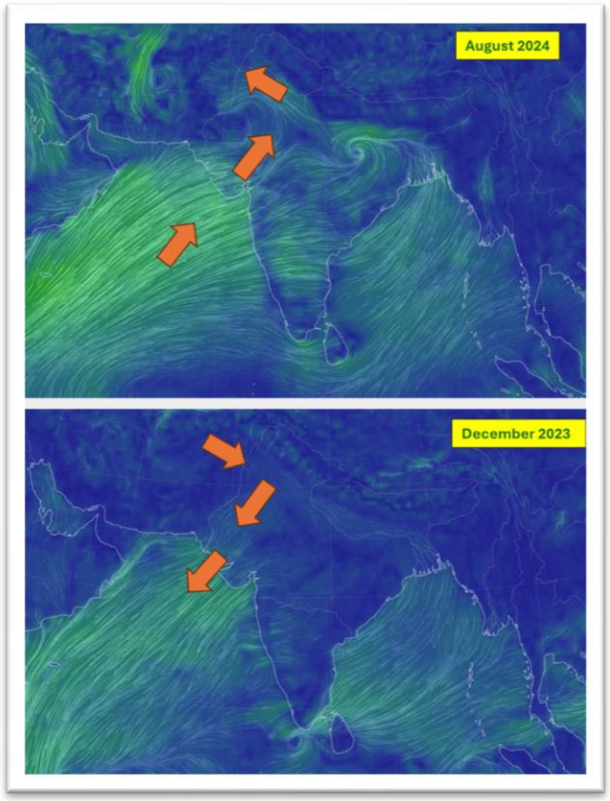


*Figure 2. Wind patterns across Northern India and Pakistan Figure 2 presents the wind direction at various times of the year. In order to illustrate the wind patterns from*

*either country during distinct periods, the images presented here are merely representative. Source: Windy.com*

Airsheds are areas that act in a cogent manner regarding the dispersion of pollutants due to shared geographical and meteorological conditions

According to research by the World Bank, one of the most significant issues in trying to mitigate the impacts of air pollution is that cities are targeted instead of tackling the problem at its source[10]. In reality, the issue is much larger because a large proportion of air pollution originates outside of cities, according to The Economist.

Air pollution continues to plague India and Pakistan every year, and political boundaries have no impact on its effects. The six major airsheds encompassing the subcontinent span multiple polluted cities, including Delhi and Lahore (figure 4). As a result, following wind patterns, pollutants will be transmitted across the region, and issues such as farm stubble burning and vehicular emissions in one area affect the larger region.

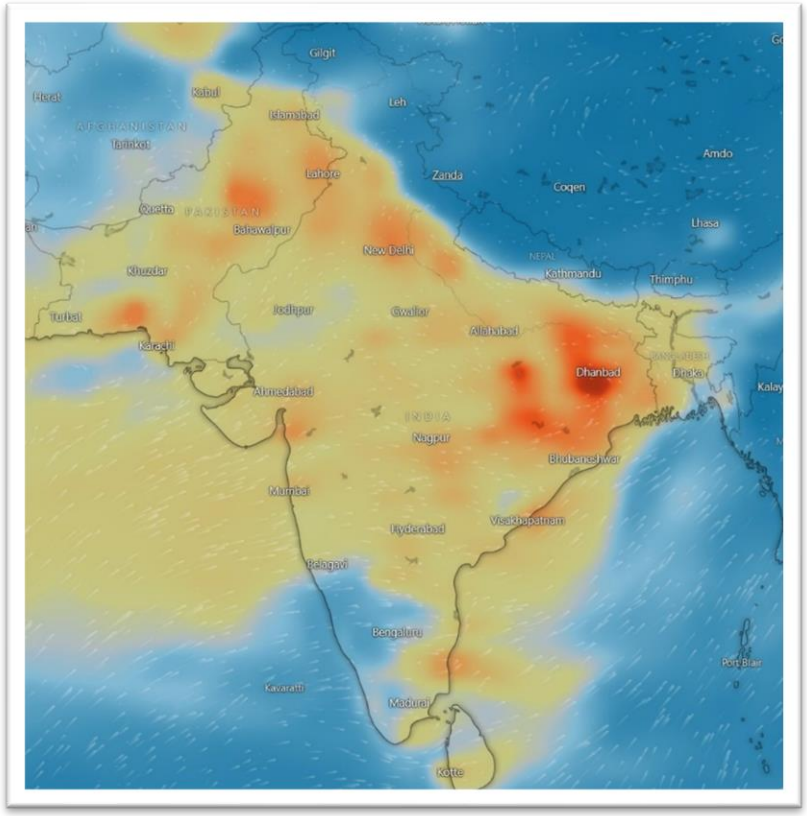


*Figure 3. Sulphur Dioxide levels on a day in August; dark shades of yellow indicate a higher concentration of Sulphur Dioxide. Indicative of transboundary dispersion of pollutants. Source: Windy.com*

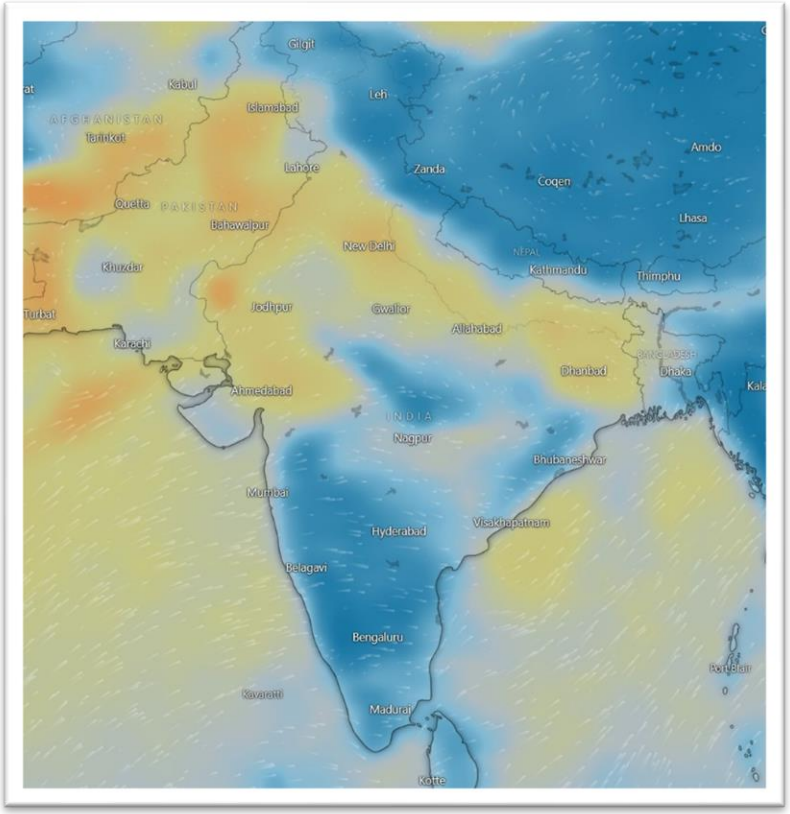


*Figure 3. PM 2.5 levels on a day in August; dark shades of yellow indicate a higher concentration of PM 2.5. Indicative of transboundary dispersion of pollutants. Source: Windy.com*

PM 2.5 refers to particulate matter in the air that is up to 2.5 micrometres in diameter. It can include liquid particles and aerosols, smoke, soot, dust particles etc. The inhalation of PM 2.5 can have serious health repercussions.

According to the European Environment Agency, in 2020 there were 238,000 premature deaths due to PM 2.5 exposure in the EU.

An increase in pollutants such as PM 2.5 (fig. 3) and PM 10 in the atmosphere not only leads to respiratory issues that significantly **burden healthcare systems**[11] but contributes to higher temperatures since these particles can absorb and retain heat. Due to the airsheds across the subcontinent, the increase in pollutants across one country spreads to the other. Similarly, Carbon Dioxide, Carbon Monoxide, Nitrogen Dioxide and Sulphur Dioxide are some pollutants that increase during extreme heat and tend to be produced through industrial processes and vehicular pollutants. Data for India and Pakistan indicates increasingly high levels (fig. 3)– revealing the heat levels in the subcontinent. These gases are closely connected with several health issues ranging from respiratory to heart conditions.

This also translates into economic losses. According to the Lancet, in 2019, the Indian Economy lost a whopping 37 billion dollars to pollution-related illnesses and deaths. This translates to 1.4% of India's GDP the same year. In the same year, India lost 1.3 billion working days, with employees calling in sick because of respiratory issues. Pakistan's Punjab region, which accounts for a large proportion of its outputs, has also seen significant issues due to air pollution, with school holidays extended and flights cancelled or diverted due to the sheer volume of smog. Lahore is one of Pakistan's most polluted cities, and this is reflected in data that the WHO collected which revealed citizens in Lahore lose over five years of their lifespan due to air pollution. Moreover, according to the World

Bank, Pakistan loses more than 47 billion dollars annually due to air pollution[12].

## B. Heat

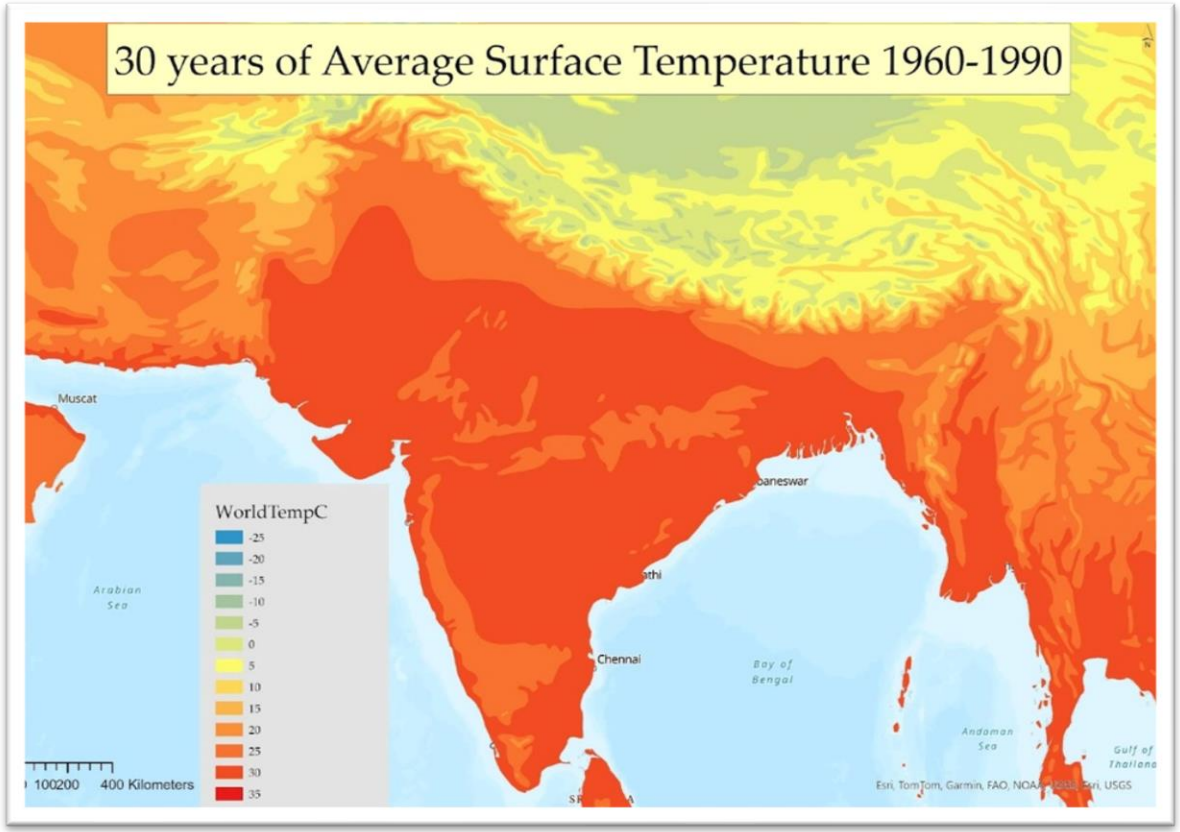


*Figure 5. Average long-term temperature of India and Pakistan (°C) Source: Base map – ESRI, Map prepared by Y Nithiyanandam*

As major cities in both countries undergo rapid urbanisation, they face many common challenges, with urban heat being a critical factor that significantly affects the quality of life. The expansion of urban areas and the dramatic increase in impervious surfaces have exacerbated this issue. Although urban heat is often viewed as a local problem resulting from microclimatic variations within cities and human activities, it poses a significant threat due to the morphology of urban landscapes. Over the past three decades, the entire region has experienced a notable rise in heat levels, driven by urban heat islands and the broader impacts of heat waves. This intensifies the stress on cities and, ultimately, on the lives of their inhabitants. Addressing this shared challenge requires joint efforts to mitigate local and regional heat impacts. Collaborative research in early warning systems, the exchange of best practices, and cooperation in space-based technologies and research can play a vital role in reducing the adverse effects of urban heat.

According to Carbon Brief, this May Delhi reported its highest ever temperature, at 52.3 degrees Celsius.

Poor-quality urbanisation has led to the creation of **urban heat islands**. These areas tend to be warmer than their surrounding rural counterparts because infrastructure made of materials such as concrete absorbs and retains heat more than agricultural land[13]. According to NASA, heat waves in the region have also led to fires and a decrease in agricultural yields, in addition to causing severe health issues as well as death due to heat stress[14]. Lahore and New Delhi are examples of poorly equipped cities that are unable to deal with heat waves. As populations within these cities have grown exponentially, built-up areas have replaced what used to be farm-land and

The departure from traditional architecture with features such as mud walls and arched windows only makes heatwaves worse. According to Time Magazine, materials such as cement and tin roofs that are increasingly common radiate heat much more than traditional construction. While there is a wave of sustainable architects today, our cities are far away from being geared for these temperatures.

forested areas. To make things worse, only a tiny portion of the population can access amenities that help combat the heat. For instance, only ten per cent of Lahore's population reportedly can afford air-conditioning in their homes. This is further compounded by the fact that large proportions of the population live in cramped, informal settlements with poor ventilation and cooling mechanisms that are virtually absent. 15.5 lakh people in Delhi[15] and 17 lakh people in Lahore[16] reportedly reside in slums.

Additionally, the demand for energy continues to rise annually as temperatures rise, with industrialisation and urbanisation increasing. More and more energy is expended on cooling mechanisms in both residential and industrial areas. Industrial processes tend to be temperature-sensitive, and high-temperature environments need advanced cooling systems for large areas. The production of this energy, which is currently largely reliant on fossil fuels, only further contributes to global warming. Additionally, this adds an economic strain on countries as electricity prices continue to rise. This is reflected in Pakistan's electricity tariffs, which were raised significantly this July[17]. Rising energy prices make cooling mechanisms even more unaffordable for low-income households who bear the brunt of hot living conditions as it is, and prolonged exposure to heat makes them even more susceptible to related health conditions. Those who choose to prioritise electricity consumption for their health will likely have to choose between paying electricity bills and other essentials, adding further economic burden as well. In addition to increasing expenditure for households, operational

costs for businesses also increase. Sectors such as IT, agriculture and manufacturing will face higher costs, forcing them to increase prices to compensate or cut expenses elsewhere which can lead to a decrease in productivity.

Urban heat islands can have a spillover effect on the surrounding areas as heat transfers occur through convection, and hot air from cities combines with cooler air in surrounding areas, raising overall temperatures. While heat waves in India and Pakistan may not be directly responsible for each other, an overall rise in temperatures exacerbates other phenomena, such as the melting of glaciers, which impacts both countries' food and water security.

## C. Glacial Melt

The melting of the glaciers in the **Hindu Kush and Karakoram regions**[18] impacts surface temperatures and has far-reaching effects on multiple spheres.

In addition to the increase in temperatures, the reduced Albedo effect[19] due to the presence of pollutants that settle on glacial surfaces also speeds up the glacial melt. Surfaces such as snow with high Albedo reflect more heat than darker surfaces meanwhile, surfaces with relatively lower albedo values

induces the melting of glaciers and icecaps in the Himalayan region. Pollutants such as black carbon only catalyse the melting of glaciers, worsening the situation[20]. When dark matter settles on glaciers, it absorbs more energy, consequently speeding up the melting rate.

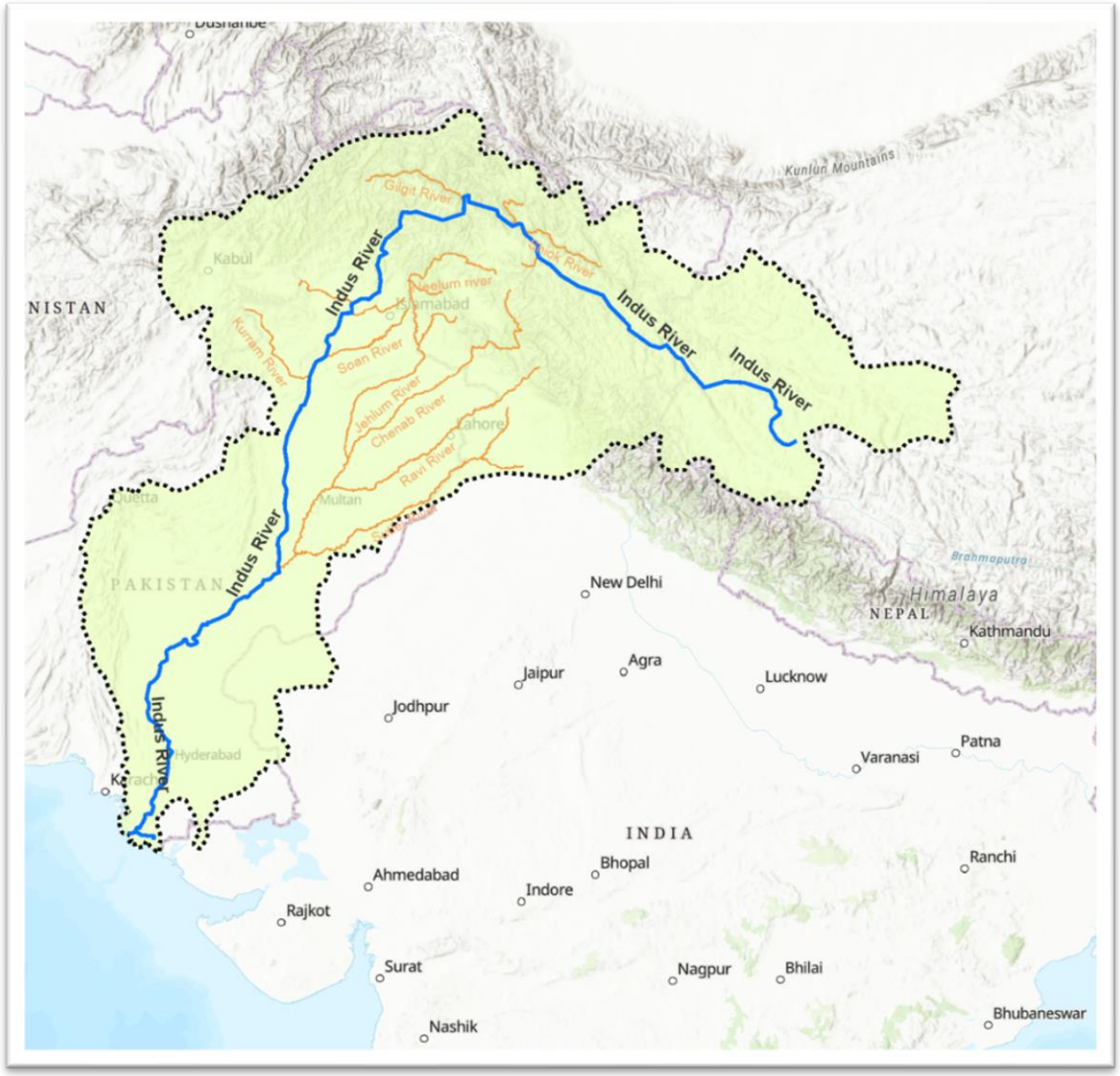


*Figure 4. The footprint of the transboundary Indus basin in Parts of India and Pakistan. Source: Base layer – ESRI, Map prepared by Y Nithiyanandam*

The Indus, Ganges and Brahmaputra River systems are the primary water source for a large proportion of the subcontinent (fig. 4), and changes in rainfall patterns and water flow have the potential to have **detrimental effects on food and water security**. According to reports, the Hindu Kush region's glaciers could diminish by as much as 80% by the end of the 21st century.

As many as 300 million people reside in the Indus River basin. The melting of glaciers is likely to have both short and long-term repercussions for those living in the region. In the short-term, there is likely to be a drastic increase in water availability, with an exponential increase in the volume of water in rivers. This will provide a temporary boost in the availability of water. With the passage of time, if things progress in the direction they are currently headed, as glaciers melt and recede, their contribution to the flow of rivers in the Indian subcontinent will diminish, drastically reducing water availability. In dry conditions, this means drought conditions will be exacerbated and considering that the region already faces issues with water-sharing, it could lead to heightened tensions.

As glacier-fed rivers carry less and less water, irrigation systems that were once fed by the same rivers will fall under strain. The Indus, Ganges and Brahmaputra River systems are vital for producing crops that feed a large proportion of the subcontinent. Key staples such as wheat and rice are also water-intensive crops, and a shortage of glacial waters will lead to an

increased dependence on groundwater. In regions where the extraction of groundwater is already taking place rapidly at rates that are arguably unsustainable, the further extraction of groundwater can lead to a degradation of soil and an increase in its salinity—which in turn will reduce agricultural productivity.

Furthermore, the melting of glaciers also leads to unpredictable rainfall patterns- threatening agricultural systems and catalysing natural disasters such as floods. Both India and Pakistan have developed and continue to develop hydroelectricity projects that will be severely affected by changes in water flow. The floods in Pakistan in 2022[21] that affected a third of the country and the Kedarnath floods in India in 2013[22] are a testament to the repercussions of glacial melt and glacial lake outburst floods (GLOF). In addition to costing both countries massive amounts in damages, they killed thousands of people and displaced millions. Additionally, crops and fertile soil were submerged and washed away– devastating farmers' livelihoods. Both extreme repercussions of climate change– drought and flooding, have the potential to have catastrophic impacts on agriculture and food security.

## D. Storm Surges and Changing Rivers

The consequences of numerous factors, including the alarming rate of glacier melting, are leading to a rapid rise in water levels. This threat,

looming over both India and Pakistan, is not a distant future scenario but a pressing issue that demands immediate attention.

According to DownToEarth magazine, global sea levels are rising twice as fast as at the end of the 20th century[23]. There are also regional variations depending on local changes. A model by NASA (seen below in figure 5) shows different scenarios depicting global sea level rises in the coming century. It paints an alarming picture. Between 2013 and 2021, sea levels globally rose at a rate of about 4.5 millimetres per year. In parts of the Indian Ocean region, they rose as much as 2.5 millimetres more than the global rise[24].

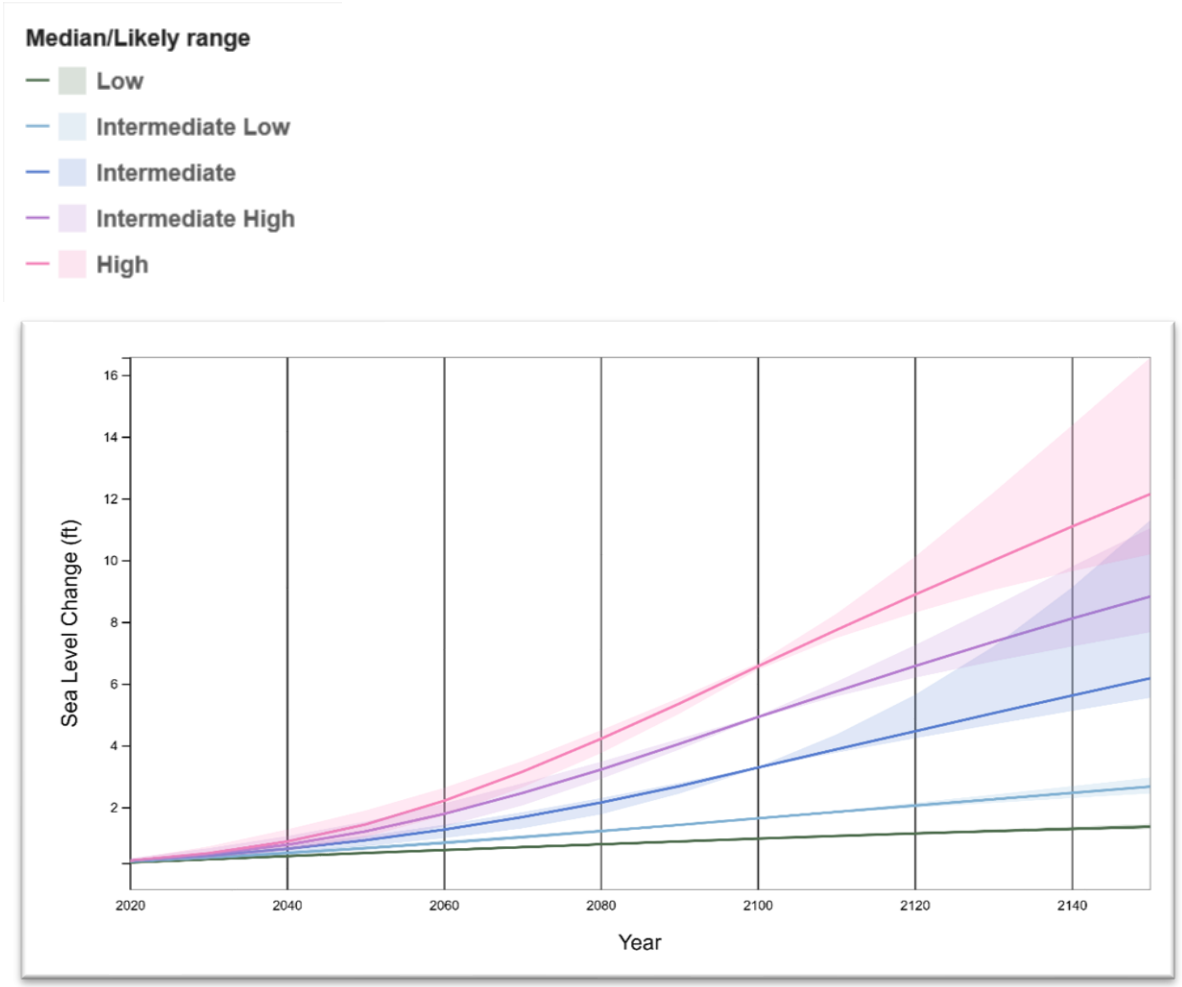


*Figure 5. Scenarios depicting rising sea levels, a snapshot by NASA*

One direct repercussion of rising sea levels is an increase in the frequency of storm surges. A storm surge refers to the "increase in the height and energy

of sea waves during a cyclone" high tide and a higher volume of water means an increase in the intensity of storm surges, which leads to saline water being brought inland—which can lead to flooding as well as agricultural and infrastructural damage. As sea levels in the region rise, storm surges are only likely to become more frequent.

Many low-lying areas in both countries are vulnerable. For instance, the Indus Delta in Pakistan—where the Indus joins the Arabian Sea, has already lost as much as 12% of its coastline to coastal erosion and rising sea levels[25]. Anecdotal evidence in an article on the region by the Scroll, speaks of entire villages migrating because water is too salty for consumption or irrigation, and fishing communities struggle to survive[26]. The rapid withdrawal of groundwater only speeds up the sinking of the delta, as sea waters penetrate. As many as 1.5 million people have been forced to migrate to inland villages and larger cities[27].

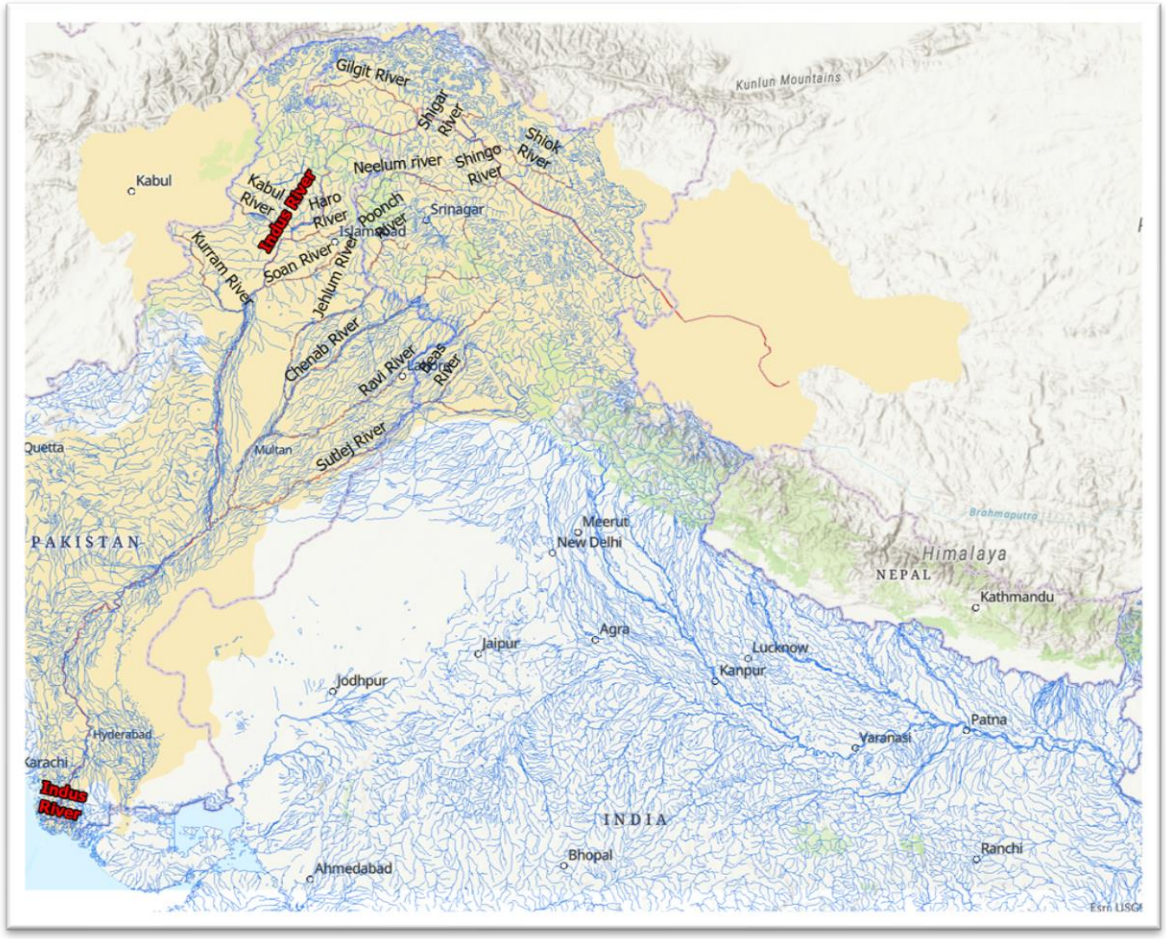


*Figure 6. The hydrology of Northern India and Pakistan, Source: Base layer – ESRI, Map prepared by Y Nithiyanandam.*

The Indus Basin, fed by the Indus river system, spans across the Indo-Pak border, with several rivers and their tributaries cutting through both countries(as seen above in figure 6).

In addition to the implications of the melting of glaciers in the region, causing food and water insecurity and floods, the construction of dams and hydropower projects has also impacted the water flow. India and Pakistan have constructed dams on the upper reaches of the Indus River, which alter the river's natural direction and volume of water. Dams trap sediment that would otherwise deposit on deltas and embankments, reinforcing them. This causes issues both downstream in the Indus Delta and in the basin. The absence of deposits leads to much more erosion, which is further exacerbated by irregular rainfall patterns[28].

Flood management infrastructure in the basin also has ample room for improvement, with insufficient levees and embankments to combat erosion and flooding issues. The 2010 floods in Pakistan were a testament to the need for better flood management policies and infrastructure[29].

Flooding in the Indus Basin, especially along the border between India and Pakistan, can have broader geopolitical implications. The Ravi, Sutlej, Jhelum and Chenab all flow across the border, with their respective basins feeding the populations of both India and Pakistan. In addition, smaller rivers and tributaries also criss-cross the region in an intricate network as seen above.

Flooding in this area, could potentially have unprecedented consequences, further complicating the already complex relationship between the two countries. The flow of floodwater can modify river channels and physically cause topographical changes that can shift the landscape along parts of the border. Despite both countries being signatories of the Indus Water Treaty, changing water flows can lead to disputes over territory and flood control. Furthermore, rising sea levels in the delta and flooding and erosion in the Indus basin can lead to forced cross-border migration which will only exacerbate tensions.

Both countries have access to this network of rivers at different points along their courses. As a result, efforts made by any one party will not be adequate to fully prevent flooding from altering the landscape

Locust swarms have hugely detrimental repercussions for crops. According to BBC, they can devour as much food as 35,000 people in a single day, erasing months of agricultural efforts. Globally, 45 million square kilometres of land, spanning across 90 countries, are vulnerable to locust swarms. If left unchecked, locusts can damage food security and even cause famine. Heavy torrential rain makes for ideal breeding conditions as locusts lay their eggs in moist soil. This is why the infestations in 2020 can partially be explained due to cyclones in 2018 and 2019.

# III. The way forward?

## A. Mechanism for Cooperation

These issues only provide a mere glimpse of a wider challenge, and this document does not delve into the widespread impact of climate change-related issues on the subcontinent. However, it is abundantly clear that

subcontinental action is the need of the hour. The road ahead may be paved with challenges, but despite their history of animosity, the two countries have had instances where successful collaborative efforts have paid off.

Interestingly, during the Cold War, the United States and the USSR cooperated on several endeavours. One such notable instance was the negotiation of the non-proliferation treaty in 1998. Both nations also implemented several confidence-building measures (CBMs) to try and reduce the risk of an accidental nuclear war.

For instance, efforts were made on multiple fronts to combat the locust swarms that ravaged the region in 2020[30]. Through the United Nations Food and Agriculture Organisation, India and Pakistan met regularly for talks and shared data to help each other prepare for locust swarms. Both nations cooperated through the Locust Warning Organisation (LWO)[31] to monitor locusts and provide early warnings of their presence. Joint border patrols, which coordinated pesticide spraying, were conducted as well. Moreover, India, Pakistan, Afghanistan, and Iran decided to work together, and technical and operational teams were set up in each region that worked in tandem to curb outbreaks of locusts.

In other domains, India and Pakistan, along with other countries in the region, cooperate through the SAARC Disaster Management Centre to build capacity in disaster management and provide humanitarian aid when needed. On the economic front, initiatives such as the Pakistan-India Joint Business Forum (PIJBF)[32] aim to promote bilateral trade through cooperation. Despite strained ties, in 2023, the issuing of visas for religious pilgrims[33] from both countries to be able to travel was an indication that in specific contexts, cooperation *is* possible.

## B. Potential Endeavours for Climate Collaboration

When it comes to mitigating the impact of climate change-related issues, several measures can be taken. Integrated Water Resource Management (IWRM) networks can be implemented to coordinate the management of water resources dependent on shared basins. The Indus Basin Knowledge Forum– which exists to enable data sharing and alleviate stress on the river system, can be better utilised to make policy changes and facilitate better resource management.

Similarly, joint glacial monitoring systems and efforts to reduce carbon emissions, stubble burning, and vehicular pollution will help reduce air pollution in the region and improve the chances of slowing glacial melting.

Additionally, setting up joint air quality monitoring stations could help both states better understand pollution patterns so synchronised plans can be implemented to reduce emissions. Both countries monitor air quality at present, but routine data sharing is not taking place. Using advanced air quality monitoring systems such as AERONET[34] and LIDAR and sharing the data would enable India and Pakistan to take collective action to improve air quality.

Cooperation to facilitate knowledge sharing and joint research initiatives that focus on developing sustainable and drought-resistant agriculture will help ensure continuing food security in the region. Collaborating on developing and utilising more sustainable forms of energy, such as solar energy, will also help reduce the further strain on the environment caused by an overreliance on fossil fuels.

# IV. Reaping the Benefits

These are just a few of the initial initiatives that can be implemented to address the looming threat of environmental issues that cast a shadow across the subcontinent. Once there is a channel for dialogue and successful collaboration on issues that go beyond the shared history of conflict, India and Pakistan will potentially have a platform for further engagement and cooperation.

For India, this could be a step in the right direction towards achieving the goal of having a zero-carbon economy by 2070[35]. At COP26 in 2021, India pledged to try and meet a net-zero target. Although collaborating with Pakistan on the issues discussed would not directly meet the target, it would contribute by addressing several of its components. Indian cities also rank poorly on the global liveability index– with both Delhi and Mumbai tied at

141 out of 173 countries[36]. One of the metrics the index looks at is environment, so improvements in air quality and temperature would make a marked difference.

For Pakistan, having support from India would help with bearing the brunt of climate disasters– such as the recent floods in 2022[37]. These events bear a significant burden on Pakistan and its economy, and better relations with India and working together to tackle climate events could also help raise finance– from India directly as well as from other countries in the region.

Significant proportions of both countries' populations are employed in the agricultural sector, and addressing climate change will enable them to retain their livelihoods. Future collaboration on projects such as hydropower and green energy will also generate livelihood opportunities in the subcontinent.

# V. Concluding Remarks

Today, India and Pakistan are both nuclear states, and their ability to destroy one another has led to a low-level equilibrium; large-scale war is now an unlikely event. However, frequent terrorist activity and continued tensions across the border lead to continuing strain and skirmishes. A seemingly endless cycle of distrust and conflict continues, and despite the seven decades that have ensued since partition, Indo-Pak relations have not improved

drastically. Every potential avenue for collaboration is contentious and steeped in a history of dispute. Climate change, however, cannot afford to be put on the back burner for decades to come. While disagreements and distrust may continue, ignoring environmental issues has impacted and will continue to impact the subcontinent detrimentally, potentially irreversibly changing the world as we know it. The region faces a host of climate-related issues– glacial melt, urban heat and air pollution are only the tip of the iceberg. Nevertheless, these are three problems with far-reaching implications that need to be addressed collectively. If there is adequate subcontinental action and the efforts to mitigate these issues are even a little bit successful, there can be potential to collaborate further and improve bilateral relations in various other spheres as well.

While working together to tackle climate change may not eradicate memories of a fissured past, it will allow for a different trajectory in the future, allowing coming generations who do not have memories tainted by the traumas of partition to look beyond issues that prevail.

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