

# Climate Change will Impact Natural Calamities, Socio-Economic Activities, Health, Nutrition, Crops, Biodiversity, Costal & Marine Life and Regional Diplomacy in CPEC Region

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## Abstract

*Although China Pakistan Economic Corridor was envisaged by former Chinese Prime Minister Zhou Enlai in 1963 as a link to the Middle East market for Chinese product, however was formally announced in 2015. Since its inception, most of the China Pakistan Economic Corridor Phase-I projects, including electricity, communication infrastructure, Gwadar Port and Gwadar International Airport have been completed, however a phase comprising of social sector development projects is under progress. Focus of future development includes cooperation among industrial, science, technology and agricultural sectors. Development of Special Economic Zones, oil and natural gas pipelines, Gwadar Port and Main Line-1 Railway Project needs special attention for an early completion. The progress of China Pakistan Economic Corridor, especially being a flagship component of ever-expanding Chinese Belt Road Initiative has emerged as a point of concern for a few Extra Regional and Regional Powers, which are endeavouring to implicate China Pakistan Economic Corridor by creating terrorism-based security scenario in Pakistani coastal Balochistan province. Both Chinese and Pakistani nations are working relentlessly to end the malicious menace of terrorism. Apart from the threat of terrorism, China Pakistan Economic Corridor is also facing the hazardous impacts of climate change in form of cloud bursts, glacier melting and floods due to increasing temperatures. It needs to be analysed by conducting qualitative research by collecting the available information and deducing the fact pragmatically that the hazards of climate change can cause more damage in comparison with terrorism hence there is a need to address such impacts diligently for prudent solutions.*

**Keywords:** Climate change; impact; CPEC; challenges; infrastructure; rising temperature and terrorism.

**JEL Classification:** Q51, Q54, Q56

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## 1. Introduction

The China Pakistan Economic Corridor (CPEC), initially envisioned by former Chinese Premier in 1963 to connect China with Middle East and markets beyond, was formally announced in 2015 (Brigadier, 2011). Over the decade, almost all the projects have been completed, and significant efforts are being put in for the completion of rest of the projects of social development. Since the launch of CPEC, Beijing and Islamabad have made significant progress in various sectors. The Success of CPEC has resulted in the addition of 888 km road infrastructure, 880 km of electricity transmission line, provision of about 8904 MW electricity for Pakistan (Minister, 2024). Road infrastructure includes highway construction along the Eastern, Central and Western CPEC routes, expansion of Gwadar Port, and construction of the Gwadar International Airport.

With the completion of the major projects it will be prudent to work for the development of Special Economic Zones (SEZ), oil and natural gas pipelines, and the expansion of Gwadar Port and construction of Main Line-1 Railway Project. Initially, nine SEZs were identified out of those four have been prioritised (Parliamentary Committee, 2025). The prioritised SEZs include Allama Iqbal Industrial City at Faisalabad, completion of which is expected by mid-2026, Rashakai expected to be completed by Dec 2027, Bostan in Pishin construction phase has already been launched and in case of Dhabeji development work is in progress and utilities are being provided at the door step of the zone. A few of the principal CPEC projects including ML-1 Railway initiative from Karachi to Peshawar, hydrocarbon pipelines, industrial cooperation, science & technology collaboration, are in progress. CPEC 2.0 is being envisaged as a reinvigorating phase of CPEC concentrating on industrialisation, innovation, and sustainable socio-economic development for Pakistan. It is being signified that CPEC 2.0 will transform Pakistan into an industrial and agricultural regional hub, however it will be pragmatic to evaluate that there are a few challenges for the development of CPEC which needs to be addressed prudently by Beijing and Islamabad. Various problems including bureaucratic wrangling, financial issues, and land acquisition, domestic politics, geopolitical and security scenario have been or are being dealt pragmatically, however one of the most important facet of climate change and it's on CPEC has not been evaluated significantly and is not being addressed meaningfully (Ahmad, 2020).

The vitality of CPEC for China and many other countries is being envisaged as a serious concern by various regional and extra regional countries (Sial, 2014). The U.S is not only among such countries but is also supporting the terrorists as a tool to re-formulate the U.S priorities in Afghanistan and Central Asia so as to use to serve as a military and diplomatic base for the U.S (Hagopian, 2015). It is a strong possibility that the U.S would use this force to resist the Chinese expansion in Afghanistan, Iran and Central Asia, which can affect the CPEC and BRI, however Beijing and Islamabad are cognizant of the fact and are making efforts to secure CPEC against any such incident. In this regard, Pakistan has provided troops and China is providing intelligence support to fight out this menace of terrorism for pragmatic, potent and prudent expansion of BRI and CPEC development (Alkhidmat, 2025).

Although serious issues like security and geopolitical are being addressed however the critical hazards of climate change over the areas encompassing CPEC are aggravating which unfortunately have damaged the CPEC infrastructure much more than the security issue. Hence, it will be prudent to evaluate the damages which have occurred or can arise in future to formulate a pragmatic and a continuous policy. Recent heavy monsoon rains, cloudbursts, glacier melting, and flash floods in Khyber Pakhtunkhwa have caused widespread destruction along CPEC routes including the death of 321 individuals. During 2025, floods triggered by pre-monsoon rains and monsoon rains in Pakistan from July to September 2025, impacting 6.9 million people nationwide, causing large-scale destruction, displacement, and disruption to daily life. Punjab remains the worst-hit province, with over 4.7 million people impacted, while 1.6 million in Khyber Pakhtunkhwa, 171,000 in Sindh, and 356,000 in Gilgit-Baltistan have also been severely affected. Climate change has caused, the displacement of 2.9 million, has also damaged the Karakoram Highway (KKH) which is the principal CPEC route between Kashgar and Gwadar Port. The critical of facet of climate change has not only damaged the KKH but has also affected the road infrastructure along western and central routes of CPEC from Hasan Abdal to Gwadar Port. climate change has and is continuously affecting the sea water along the Pakistani coastline by causing sea level rise, ocean warming, acidification, and increased storm frequency, leading to coastal erosion, saltwater intrusion, loss of wetlands, damage to infrastructure, and harm to marine life and coastal communities. The Indus River is particularly vulnerable and can affect the CPEC as the river runs along KKH and Western route, with the potential for significant land loss and increased salinity affecting vital coastal ecosystems and livelihoods like fishing and agriculture.

## 2. Literature Review

During the conduct of literature review it has been observed that a little research has been carried out on the subject of Impact of climate change on CPEC and overcoming its Implications, that too by various researcher on single aspect each. Mostly the researcher has restricted to the increase of heat waves resulting in increased population and temperature in coming decades. It has also been informed that Thar Coal Power Plant can cause an increase of 51 million tons in greenhouse gas emissions affecting the entire ecosystem due to increasing Coal and Carbon emissions (Hina Aslam, 2021). It has also been informed that precipitation in Balochistan converts into flash floods due to its topography. A few researches have also highlighted the efforts which China has made to mitigate the damages of climate change.

The CPEC is part of a climate change-sensitive region, facing frequent and intense heat waves (HWs). CPEC is expected to experience an instantaneous increase in population and temperature in the coming decades. The results indicate that the CPEC region will probably experience the highest number of night time HWs, followed by daytime and compound HWs in the northern and southern areas of CPEC (Tatyana, 2023). The largest population would likely be exposed in the eastern and southwestern CPEC. The results reveal that the climatic and interactive effects could significantly escalate the population exposure to future HWs in the CPEC (Saif Ullah, 2023).

Pakistan's extensive coal reserves in the Thar Desert have long been seen for their potential for power production. Thus, nearly half of the proposed CPEC energy-generation projects make use of coal, contradicting the environment friendly rhetoric surrounding the economic corridor. It is assessed that coal and carbon emission and toxic waste will cause water pollution, air pollution, damage to the entire ecosystem and disastrous influence on health. Electricity being produced from the Thar Coal Power Plant can cause an increase of 51 million tons in greenhouse gas emissions. Such a scenario causes lack of the country to lose the opportunity to enhance the potential of renewable energy to achieve the Sustainable Development Goals (Hina Aslam, 2021).

Most of the CPCE is part of Balochistan province consisting of plains, mountains, rugged terrain, and coastline with an extreme climate affecting the precipitation pattern, transforming into flash floods due to Balochistan's landscape. This study focuses on one of the main facets of variation in precipitation patterns along CPEC route. Precipitation data for selected weather stations along the CPEC route were taken from Pakistan Meteorological Department (PMD) (Aamir, 2021).

During 2010 and 2022 Pakistan suffered from an unprecedented flood due to torrential rainfall that hit Balochistan displacing about 33 million people in Pakistan (J. S. Nanditha, 2023). Pakistan due to economic stagnation, requires foreign funding to overcome such tragedies. A qualitative research has been carried out to analyse the climate change in the perspective of China and Pakistan. For data extrication, conceptual analysis was carried out and it has been found that Chinese model of dams' construction will be highly beneficial during drought in Balochistan (Naveed, 2023).

Rising global temperatures, driven by anthropogenic greenhouse gas emissions, have precipitated a cascade of environmental disruptions, including melting polar ice caps, rising sea levels, and increased frequency of extreme weather events such as hurricanes, typhoons, and storm surges, which devastate coastal communities, erode shorelines, and threaten critical infrastructure (Rabail, 2025).

## 2.1 Research Gap

Evolution of literature review highlights that researchers have not discussed about the Impact of climate change on CPEC in totality, however a few have mentioned various repeated facets individually. Firstly, only Implications of HW, resulting into population and temperature increase have been mentioned. Secondly, the effects of Thar Coal Power Plant have been highlighted in contiguous areas. Thirdly the precipitation patron and terrain of Balochistan have been concluded as causes of flash floods in Balochistan. Finally, the policy and efforts made by China to mitigate the effects of climate change have been discussed. It has been observed that little has been researched about Impact of climate change on CPEC in totality.

## 2.2 Reproach Questions

Considering the observed research gap, the recent impact of climate change in CPEC areas and value of subject as it involves more than one country it will be pragmatic to find the answers to following questions:

- What is the topography of CPEC?
- What type of climate change hazards can affect or continue affecting the CPEC?
- What will be the implications of climate change hazards in CPEC?
- What be the impact of climate change on diplomacy, especially in CPEC region?

## 2.3 Academic Discourse

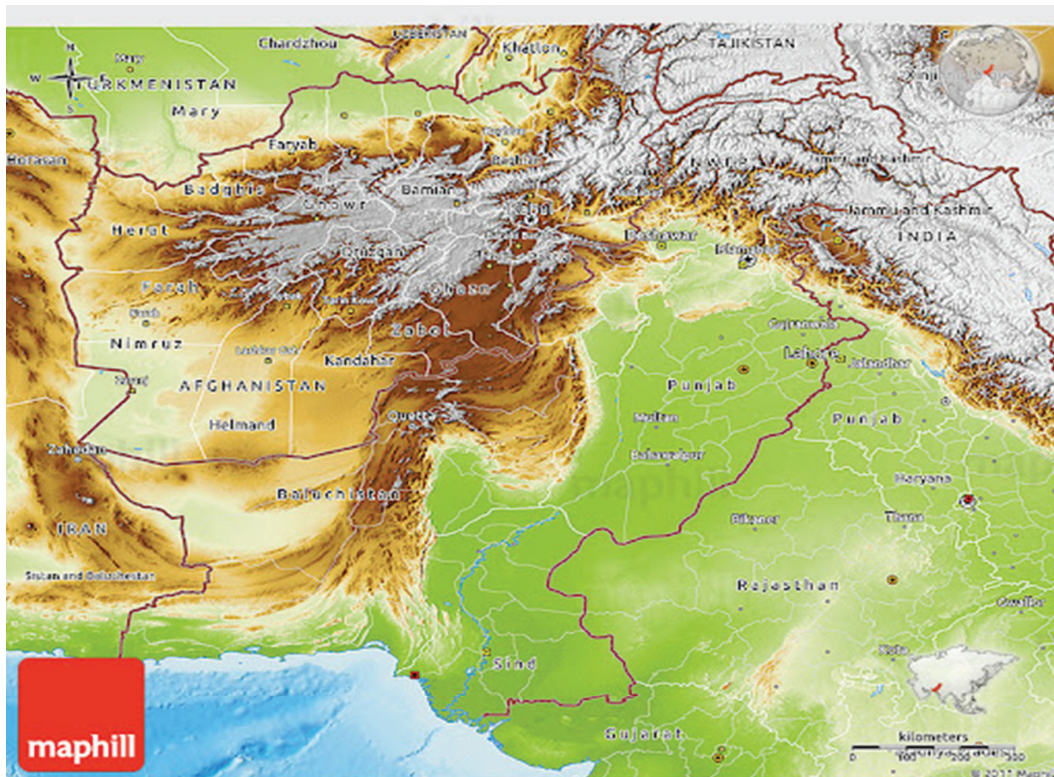


Figure 1: Topography of CPEC Zones

Source: <http://www.maphill.com/pakistan/3d-maps/physical-map/>

Before delving into the impact of Climate change in CPEC Region it will be pragmatic and prudent to understand its topography. The CPEC is 3000 km long corridor connecting Kashgar in Chinese Xinjiang region to the Gwadar Port in Arabian Sea along Pakistani coast (Schwarzman, 2017). The corridor criss-crosses four extensive topographic sectors animating from the Xinjiang plateau passing through the Karakoram ranges, Hindu Kush mountains, the Indus River plains, Pothohar plateau, Balochistan plateau and culminating at coastal zone (Rashid, 2016). Each sector with distinct features and climate sensitive is risking infrastructure, health, food security and socio-economic development. Xinjiang plateau consisting of north-western highland covers a wide variety of arid to semi-arid environmental zones, with high elevations, lakes, and seasonally frozen terrain near Kashgar. Soil is mostly saline characterized by active wind erosion with extreme temperature. Infrastructure in this region is vulnerable to thermal stress. Dust hazards and water scarcity not only impact human life but also complicate construction activities.

Karakoram and Hindu Kush Mountain ranges climbs quickly through the Karakoram ranges through Khunjerab Pass at the height of 4700 m, narrow river valleys, and steep slopes that necessitate tunnels, bridges, along mountainous infrastructure. This mountainous region is highly vulnerable to melting glaciers and steep slope. Varying precipitation patterns are not only increasing seasonal flood but are also enhancing the frequency of glacial lake outburst floods (GLOFs), rainfall-triggered landslides and debris flows, hence threatening the much-needed roads, rail infrastructure and tunnel.

Indus and Pothohar plains run along the central and western stretches of Pakistan, while descending south traverses fluvial Indus and Pothohar plains is low relief topography is hydraulically complex due to river channels, floodplains, and agricultural lands. Climate change intensifies extremes, encompassing more intense monsoon downpours and an increased risk of droughts, endangering bridges, embankments, communication infrastructural foundations due to higher flood, sedimentation, and droughts.

Balochistan plateau and Gwadar coastal zones include arid, rocky plateaus before emerging into low-lying coastal Gwadar zone (A.H. Kazmi, 1997). Balochistan's topography comprises sharp cliffs, dry riverbeds (wadis) and sandy coastal lands. Gwadar peninsula due to its low elevation and being built on unconsolidated sediments, makes it extremely vulnerable to sea-level rise, coastal erosion, storm surge and strong monsoon cyclones.

CPEC's linear shape makes it vulnerable to even a single extreme event, severing the corridor. Northern mountains face increasing numbers of landslides, avalanches and seismic hazards. Central plains mostly confront both flood and drought challenges and Southern terminus is vulnerable to rising sea-levels and violent coastal storms. Current assessments of heat waves, landslides, and seismic hazard along CPEC signify that climate change will surge operational interruptions, maintenance costs, and the likelihood of catastrophic failures unless adaptive measures are taken to mitigate the challenges.

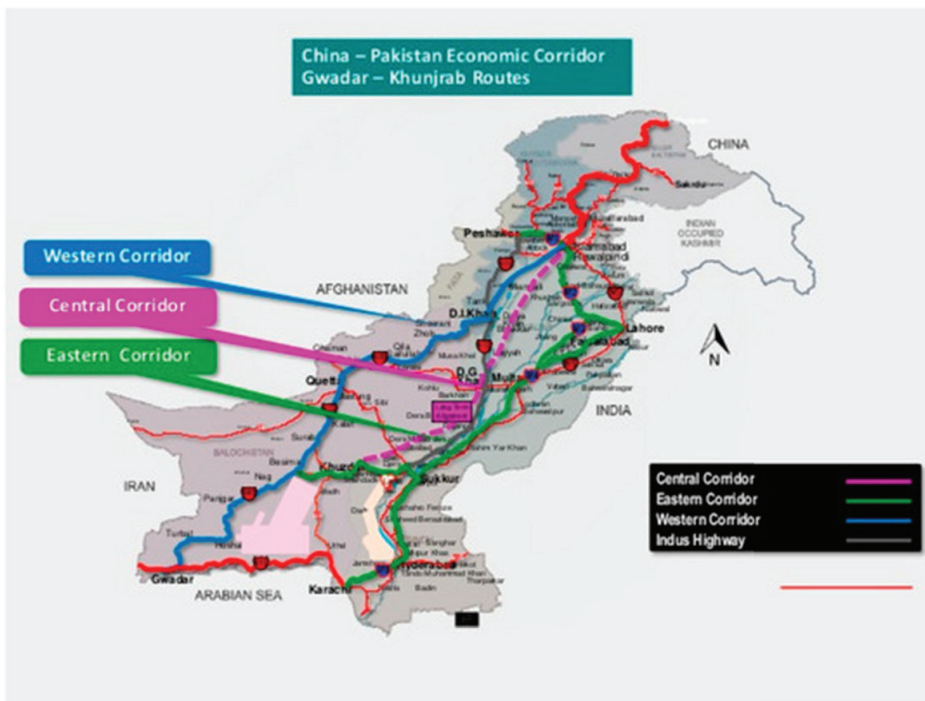


Figure 2: CPEC Alignment to precisely understand the impact of Climate Change

Source: <https://www.mdpi.com/2227-7072/7/3/41>

CPEC includes port, infrastructure, energy, and industrial projects, agricultural development, education, public health and people-to-people communication. CPEC aims at linking three billion people of South Asia, China and Central Asia. The project aims to add about 1,272 km of roads to network, which includes linking Gwadar Port with National highways and motorways network through following routes:

**Western Route:** Originates from Gwadar passes through Turbat, Panjgur, Naag, Basima, Sorab, Kalat, Quetta, Qilla Saifullah, Zhob, Dera Ismail Khan, Mianwali, and Hasanabdul terminates at Islamabad.

**Central Route:** Originate from Gwadar, leads through Basima, Quetta, Khuzdar, Sukkur, Rajanpur, Liya, Muzaffargarh, and Bhakkar terminates at Dera Ismail Khan.

**Eastern Route:** Originates from Gwadar, passes through Basima, Khuzdar, Sukkur, Rahim Yar Khan, Bahawalpur, Multan, Lahore, and Islamabad terminates at Mansehra.

## 2.4 Impacts of Climate Change

### 2.4.1 River Erosion and Flash Flooding

One of the extreme climate challenges to the KKH is faster river erosion caused due to ever increasing glacial melt and changing rainfall patterns. During August 2025, a significant portion of the KKH in Upper Hunza (Morkhun) area was destroyed due to river erosion, affecting CPEC transportation (Jamil, 2025). Similarly, in 2010, a huge landslide damaged 26 homes, slain 20 persons, and displaced about 1,500 in the Attabad area blocking Hunza River hence transforming river into a massive lake that completely sunk the sections of the KKH (Michon, 2010).

Table 1

*Major Disruptions to the KKH since 2010*

S/no	Year	Location	Calamity	Impact
1	2010	Attabad	Land Slide	20 deaths, 1,500 displaced, highway blocked
2	2022	Multiple locations	Glacial Lake Outburst Floods	Bridge destruction, road damage
3	2025	Upper Hunza	River Erosion	Highway severed, China-Pakistan link cut
4	2025	Hasan Abad	Glacier Burst	Bridge destroyed, homes swept away

### 2.4.2 Glacial Lake Outburst Floods (GLOFs)

Due to rapid melting, more than 7,200 glaciers in Pakistan have caused tens of glacial lakes, most of those are vulnerable to abrupt outbursts (National Disaster Management Authority (2025). In accordance with the reports of Ministry of Climate Change, “More than 3,044 glacial lakes have been identified in Gilgit-Baltistan and Khyber Pakhtunkhwa out of which, 33 lakes are highly prone to bursting” 9 Ministry of Climate Change and Environmental Coordination (2025). Such incidents have devastating impacts on infrastructure During 2022 Shisper Glacier was activated with outburst floods, destroying a KKH bridge (Hamna, 2022). Similarly, in 2025, a glacier burst in Gulmit swept away houses, agricultural farms, and a 45-year-old bridge hence impacting the CPEC transportation (Salamuddin, 2025). It is estimated that by mid-century, due to temperature increase up to 1.5-2°C can meaningfully change hydrological cycles which will affect water availability for CPEC’s energy and agricultural projects (Anni Deng ,2025).

### 2.4.3 Threat and impact of Landslides

Climate change has also increased the frequency and intensity of landslides along the KKH. Research using Sentinel-1 Synthetic Aperture Radar data from 2015 to 2024 detected 1,037 active landslides in the KKH region (Sajid, 2023). A few of these landslides indicate alarming displacement rates, with line-of-sight velocities reaching up to 81 mm per annum. The research highlights that the hazard of debris flows is increasing due to climate change and the maximum threat was, was projected for the 2025 along various parts of KKH including Ghizer River and

Tashkurgan-Khunjerab sections. Research indicates that Climate change has already enhanced the landslide vulnerability by nearly 40 per cent (Aastha, 2024).

#### 2.4.4 *Economic and Social Consequences*

The damage to the KKH has deep socio-economic implications for CPEC's regional trade and domestic sustenance. The KKH is a vibrant corridor for CPEC, and its closure unwaveringly influences trade between the two nations. The Sost Dry Port on China-Pakistan border remains open only during summers, transportation time is further reduced due to closure of KKH because of often land sliding and floods. Since the completion of CPEC additional 7000 vehicles are passing through KKH, which will significantly increase the economic costs of any disruptions.

Domestic communities along the KKH also endure substantial hardships due to closure of KKH. These people are mainly depending on the KKH for access to markets, healthcare, education, and other essential services. Climate change has also affected the tourism industry. During 2022, more than 2 million tourists visited Gilgit-Baltistan (Sajid, 2025). Moreover, destruction of irrigation systems and reduced drinking water supplies caused due to Climate change related incidents are causing serious food security challenges for domestic populace.

Table 2

#### *Economic Implications of Disruptions on KKH*

S/no	Sector	Impact	Consequences
1	Regional Trade	Disruption of China-Pakistan goods movement	Reduced economic benefits from CPEC
2	Tourism	Road closures limiting access	Loss of livelihood for tourism-dependent communities
3	Agriculture	Damage to irrigation systems	Food insecurity and loss of farming livelihoods
4	Local Transportation	Route alternatives longer and more dangerous	Increased costs and safety risks for local communities

#### 2.4.5 *Coastal implications*

Coastal erosion is yet another substantial challenge and a significant environmental concern, particularly in Balochistan and Sindh province. Coastal erosion is the natural course of land loss to the sea along the shoreline due to the strong waves, wind, tides, and currents that removes sand, soil, and rock. This course has been aggravated due to human events and climate change, which can impact coastal communities, infrastructure, and ecosystems regrettably impacting communication infrastructure. Rising sea levels are also posing continuous threat to coast along Balochistan and Sindh, with more pronounced impact on cities like Karachi and Gwadar. Scientific research estimates that potentially sea-level is going to rise from 0.5 to 1 meter by 2100, which would inundate portions of the port facility and infrastructure, moreover extreme heat can decrease labour efficiency, by 15 to 20 per cent during summer months (Rebecca, 2023).

### 2.4.6 Damages to Makran Coastal Highway

Apart from the KKH vital facet of climate change has also affected the 635 km long Makran Coastal Highway (MCH) which was inaugurated on 16 December 2004 (Business Recorder, 2005). The damages to MCH have been caused due to natural calamities like torrential rains, flash floods washing away sections of MCH during 2005 and 2007, and continuous coastal erosion aggravated due climate change (A, Panhwar, 2024). During 2005, torrential rains and breach of the Shadi Kaur dam not only caused complete destruction of MCH but also destroyed the culverts and bridges, which resulted in road closures hence impacting the CPEC transportation. In 2005, just a year after the construction of MCH a large section of road was destroyed in Pasni due to torrential rain falls. In 2005, heavy rains in the Pasni remained a major cause of damage to the highway. It is significant to understand the rising temperatures and sea water which can be more dangerous for the Sindh coastline as the sea water can intrude more easily into the creeks and Mangroves forests, hence making Thatta city more vulnerable. Consequently, the damages to MCH not only hinders the much-needed transportation activity for a considerable time but also adds to the repair costs. Only during 2005 Rs. 500 mn were spent on the repair of MCH in only six months (NHA, 2005). The repair cost is subject to increase of 25 per cent per annum.

Table 3

#### *Impact of Climate Change on MCH*

S/no	Area	Damage	Cause	Impact
1	Agore Bridge in Liari	75 M breach on 400 M long bridge	12 hours rainfall	Transportation Blocked
2	Agro-Ormara	125 km long road section remain under severe pressure	Flash Flood	Transportation remained disturbed
3	Ormara	500 M long road shoulders were washed away hence 5 to 6 km portion of road remained submerged	Water pools astride MCH	Transportation Blocked
4	Ormara-Pasni	15 km portion remained submerged	Flash Flood	Transportation Blocked
5	Bosal River	Approach slabs of Bosal River Bridge, including two adjacent culverts washed away. 29 km MCH remained submerged. Damaged downstream Ormara Water Supply	Flash Flood	Transportation Blocked
6	Ormara	Collapse of Shadi Kore Dam Bridge. 6 km road washed away Inundation of Pasni Town.	Flash Flood	Transportation Blocked

### 2.4.7 Impact of Climate Change on Crops

Climate change is severely impacting cultivation pattern in CPEC areas due to continuously rising temperatures, irregular rainfall pattern, floods, droughts, and cyclones disturb

the crops growing spells and harm crops, leading to reduced crop yields and declining quality (Tayyaba, 2023). Results showed that in comparison with the base line period Base Line the average temperature increased by +4 °C, precipitation decreased 37%, crop cycle duration declined by 5 d/decade, reference evapotranspiration diminished to reach 511 mm, irrigation requirements rose to 736 mm, years requiring irrigation increasing from 3 Base Line to 9 and yield gap augmented to reach 55% by the end of the 21st century (Hiba, 2025). Pakistan is struggling with water shortage, it is anticipated availability of water will reduce by 30 per cent by 2030 (Sahar, 2025). Water shortage aggravates the problems like reduced soil moisture, waterlogging and nutrient discharge. Climate change also adds to diseases and pests, which further deteriorate the crop quantity quality. Warmer temperatures nourish the insect species like brown plant hopper damaging the paddy crop. Small farm owner farmers have been and are being extremely affected due to food insecurity and income reduction. Climate change is also changing crop-growing periods profoundly and farming areas all across the CPEC region, disturbing food security and livelihoods.

#### **2.4.8 Loss of Biodiversity**

Climate Change has caused loss of biodiversity, intimidating environments and species survival. Rising temperatures are causing glaciers melting in Himalayan region which is adversely affecting fresh water fish and downstream environments. Moreover, deforestation augmented due to climate change is decreasing animal habitats for species like snow leopards, migratory birds and sea life. It is estimated that without urgently mitigating the causes of biodiversity it will be difficult to balance much needed ecology, ensure food security, avoid socio-economic affects in CPEC areas.

#### **2.4.9 Malnutrition and Hunger**

Climate Change impacts hunger and health in CPEC region as rising temperatures, irregular rainfall, and severe weather environments are reducing crop yields. Decreasing livestock health further presage nourishment among females and rural societies. Furthermore, climate-induced shift aggravates food uncertainty (Shahroo, 2022).

#### **2.4.10 Climate Risks vs Terrorism**

While terrorism aims at targeting a specific target of prescribed region, climate change impacts on wider front hence has much larger impacts as it includes disasters like cloud bursts, floods, heatwaves and droughts. Such incidents increasingly damage life, property, agriculture, infrastructure, and displacing large populations. The financial damages caused due to climate change related disasters are enormous as it affects the agriculture, infrastructure, health systems, and ecosystems, hence directly affecting socio-economic development at national level national. Terrorism can also have long lasting impact; however, these are mostly restricted to an area or a targeted community for a specific purpose, however the purpose. The examples of Balochistan

and GB are point in case. Situation in Balochistan is being exploited by various regional and extra regional powers against the interest of Pakistan due to Chinese investment in Gwadar Port and Pakistan's involvement in CPEC and BRI. Since the end of World War-II U.S occupied a place of importance in the Afghanistan's economic and social development. Afghanistan believed that good and active relations with U.S were not only important for the economic and social development but also for the maintenance of their policy balance (Ghaus, 2021). The emerging power; China is an eyesore for U.S objectives in the energy transporting Indian Ocean (Hasan Yaser Malik, 2012).

In case of GB since the start of CPEC India is claiming it as its part to influence and disturb Chinese BRI and CPEC. It will be prudent to evaluate the history according to which GB was formulated into Gilgit Agency in 1935 by British as it was taken on 60 years lease which was cancelled on 1st Aug 1947 (Ashish Shukla, 2019). Later inhabitants of GB revolted against Hindu ruler; under command of Major Brown, Captain S. A. Mathieson and Subedar Major Babar Khan on 13 Oct 1947 which resulted in capture of GB and arrest of Governor Ghansara Singh was on 16 Nov 1947; hence an area of 29,814 square miles came under the administrative control of Pakistan (Manoj, 2016). It is substantial to understand that successful revolt is also a source of law (Kermit, 2002).

Table 4

*Climate Vulnerabilities along the CPEC Route*

<b>CPEC Segment</b>	<b>Climatic Challenges</b>	<b>Key Infrastructure at Risk</b>
Northern GB	Glacial melt, landslides, flooding	Karakoram Highway, bridges, tunnels
Punjab Plains	Extreme heat, flooding, droughts	Power plants, agricultural zones
Sindh & Balochistan	Drought, water scarcity, sea-level rise	Gwadar Port, coal plants, roads
Coastal (Gwadar)	Sea-level rise, cyclones, erosion	Port infrastructure, naval facilities

**2.4.11 Impact on CPEC Energy Sector**

CPEC energy projects are likely to have a significant impact of the facet of climate change as 63.7 per cent of power electricity generating project are coal fired based which has increased Pakistan's coal-based electricity production capacity from 3 in 2015 to over 16 per cent during 2024. This dependence on fossil fuels creates a carbon lock-in effect, hypothetically obligating Pakistan to high-emission conduits for decades. Thar Coal Power Project alone is assessed to upsurge Pakistan's greenhouse gas emissions by 51 million tons annually, not only contributing to global climate change but domestic environmental degradation as well. Such emissions intensify climate vulnerabilities that can threaten CPEC's infrastructure that undermines long-term sustainability (<https://cpec.gov.pk/energy>).

Table 5  
*Climate Risks from CPEC Energy Projects*

Power Category	Capacity	Percentage	Challenges
Coal Fired	7220	63.7	Carbon emissions
Hydro Power	2708	23.9	Methane gas
Solar	1000	8.8	Waste management
Wind	400	3.5	Localised turbine warming
Combination	11328	1000	Mix

**2.4.12 Impact of Climate Change on Regional Diplomacy**

As predicted in Fifth Assessment Report by Intergovernmental Panel on climate change the worldwide temperature is liable to increase from 0.3 °C to 4.8 °C over a span of 21st century due to greenhouse gases as in absence of these global average temperature would have been about 33 °C colder than the present temperature of 14 °C. Increase in temperature is accepted to raise the sea level up to 4 feet by 2100 which is likely to influence all spheres of life including Blue Diplomacy.

In case of South Asia rise in sea level can transform the 96 km long Sir Creek into navigable water channel that would strengthen the Indian claim which may cause a nuclear conflict in CPEC region (Hasan Yaser Malik, 2024).



Figure 3: Sir Creek Dispute

Source: [https://www.google.com/search?q=sir+creek+dispute&sca\\_esv](https://www.google.com/search?q=sir+creek+dispute&sca_esv)

**2.4.13 Melting of snow in significant corridors**

Snow melting in Himalayas is likely to impact ‘Silk Route’ through Wakhjir Pass, which is part of 220 km long and 64 km wide Wakhhan Corridor in Northern Afghanistan linking it with China (Hasan Yaser Malik, 2024).



*Figure 4: Melting Glaciers in Wahkhan Corridor*

**Source:** <http://www./search?q=Melting+of+snow+in+significant+wakhan+corridors>

However, being at the height of 4827 m it remains close due to snow for the most of the year, however due to increasing temperatures this route is likely to remain open. Hence will be adding to geo-political and economic value of CPEC region (Hasan Yaser Malik, 2014). The opening up of this route throughout the year will allow a pragmatic exploration and trade of Central Asian hydrocarbon reserves in the region.

Increase in temperature will also have influence on the conflict zones like Siachin Glacier where the glaciers are melting, so snow is causing multiple effects on the mountainous conflict zone. Melting ice is causing hazardous slides and avalanches. Unfortunate Gayari Glacier Incidence of 12 April 2012 are still fresh, where 138 soldiers and civilians were buried alive under the snow.



*Figure 5: Siachin Glacier*

**Source:** <https://www.google.com/search?q=Siachin+Glacier&rlz>

### 3. Recommendations

- Policy guidelines to address Climatic Challenges in CPEC region are required to be integrated. Although both Beijing and Islamabad are articulating assurances to CPEC environmental

sustainability. However, CPEC needs a comprehensive and an integrated climate resilience structure.

- Environmental Impact Assessments (EIAs) conducted for CPEC projects have been criticised for inadequate considerations to climate hazards and little public involvement. Provincial environmental protection agencies often lack technical capacity to conduct rigorous assessments for complex infrastructure projects. Ensure qualitative, timely and continuous environmental impact assessments involving public involvement, especially in sensitive areas such as Balochistan and GB.
- Though Pakistan's Alternative and Renewable Energy Policy 2019 aims to achieve goal of 30 per cent renewable energy by 2030, However it has been observed that 63.7 per cent of CPEC energy projects are coal fired and only 12.3 are renewable energy projects, which makes the achievement of goal more difficult.
- Conception of a "Green CPEC" involving the plan to plant ten billion will help to restore much needed ecosystem, however it will be pragmatic to make timely allotment of funds for a prudent response.
- Domestic Capacity Enhancement is vital for adaptation of climate policies by imparting practical training, knowledge exchange from Chinese experts for a prudent community-based adaptation initiative.
- The Earliest completion of critical CPEC projects including industrialisation, ML-1 Railway Project, hydrocarbon pipelines, completion of port projects at Gwadar and the functioning of at least four out of nine SEZs should so that damage occurring to CPEC is not prolonged, rather allowing an early opportunity to overcome the challenges.
- Integrate climate adaptation into project planning to strengthen disaster risk mitigation including improved early warning systems, pragmatic watershed management, glacial lake monitoring, reforestation, protection of watersheds, maintaining and enhancing small dams and filtration systems, improving drainage in CPEC areas.
- Ensuring security not only from a terrorism point of view but from an environmental perspective as well. Protect supply chains, infrastructure, workforce, and communities from both human threats and environmental ones. Having pragmatic and prudent geopolitical and trade relations with neighbouring countries can not only avoid the menace of terrorism but will also help to make the climatic environments more conducive through mutual support.
- Adoption of policies and measures against Climatic challenges will also be supportive for achievement of Sustainable Development goals, adopted by all United Nations members

in 2015 to be achieved by 2030. With the aim of “peace and prosperity for people and the planet” while tackling the hazards of climate change with a view to preserve oceans and forests.

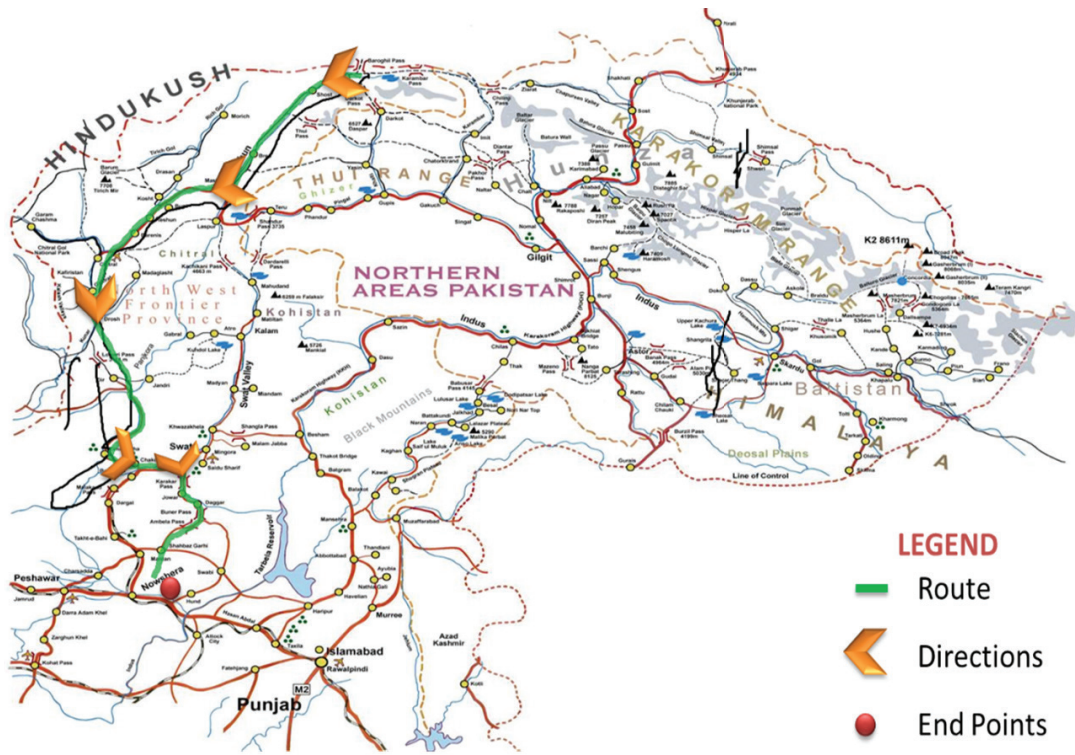


Figure 6: Proposed Chitral River alignment as an alternate to KKH  
 Source: <https://www.scholink.org/ojs/index.php/elp/article/view/1795>

- KKH constructed from 1958 to 1978 is a pivotal link of CPEC with in the ambit of BRI, The construction of 804 km long KKH from Khunjerab to Hassan Abdal is symbol of friendship and sacrifice of 806 lives. It is imperative to understand that this vital link running along Indus River; passing through Karakoram and Himalayan Mountain Range, scaling heights up to 14,199 feet and extreme cold temperatures down to -30 Celsius lies in an area which is under constant push between Indo-Pakistan and Eurasian plates is causing highest seismic activity. The 2005 earthquake measuring 7.5 on Richter scale played havoc in Kaghan, in 1974 Pattan was completely destroyed, Shishkat and Hunza were rocked in 1974 and lately in 2010; 21 km long and 330 feet deep Attabad Lake was formed near Karimabad (Muhammad, 2019). Increasing CPEC transportation will continue to adversely affect the overall traffic flow. It is estimated that since 1978, traffic has increased more than ten times. However, apart from 180 km long Hazara Motorway no major expansion has been done on the KKH. Hence it will be prudent to adopt an alternate route to KKH. Route along Chitral River Valley

(CRV) can originate from Baroghil Pass in Hindu Kush Mountain Range (South of Wakhan Corridor) and while passing through Mastuj, Booni and Chitral it links up with M-1 south of Mardan. The route through CRV will, apart from being an alternate will also dissipate the concentration of climatic challenges hence making it easier to mitigate the effects.

- Pakistan has a large network of rivers likes the Indus, Jhelum, Chenab, Ravi and Sutlej supported with 12 inter-rivers long canals and rivers with a total length of about 30,000 km (18,641 miles), however unfortunately most of it is not used for navigation and transportation. The Indus Basin alone with the length of 3180 km and an extensive canal and river system that can provide a robust inland waterway transport system with significant economic and environmental benefits to overcome the challenges of climate change in CPEC zone as the Indus River mainly runs along the CPEC from Western China to Arabian Sea near Karachi.
- Inland water transportation, utilising rivers, canals, and lakes, remains a vital and efficient artery for global trade and mobility with prominent examples including the extensive Mississippi River system in the US. The Rhine and Danube rivers in Europe, Yangtze River in China. Bangladesh is making use of it's in land water channels to transport 30 per cent of its cargo. With an inland waterway system of more than 5600 navigable rivers and 2000 inland ports, China has the most developed ICT subsector in the region. IWT development thrust is being concentrated on 5 specific areas (Yangtze River, Pearl River, Beijing-Hangzhou Grand Canal, Yangtze River Delta and the Pearl River Delta (Md. Mahmudul, 2022).

### 3.1 Conclusion

- CPEC was envisaged in 1963 by the Chinese Premier to link with Middle Eastern market. It has been observed that climate change and terrorism is impacting the progress of CPEC climate change is impacting KKH, MCH, GLOF, landslides, health, corps, malnutrition, costal erosion, marine life and emissions. Major under progress CPEC projects including SEZs, hydrocarbon pipelines and Gwadar Port are mainly part of Balochistan, mostly vulnerable to terrorism supported by Extra Regional Forces to hinder BRI. CPEC encompasses varied topography, starting from snow clads mountains to plain, deserts coastline and vast water sprains. Apart from impacting the physical features, climate change is impacting the geopolitics and regional diplomacy. Melting snow will melt the snow at Siachin glacier, rising sea waters will affect the Sir Creek claims between India and Pakistan. It will be prudent to pragmatically follow the policies, carry out continuous assessment, use inland water for transportation and keep friendly relations with neighboring countries at least for trade, geopolitics and diplomacy. The future research can further investigate Policy guidelines to overcome Climatic issues in CPEC region for Pakistan. Research gaps exit to evaluate the performance of Provincial environmental protection agencies to conduct for better maintenance of infrastructure projects. Local Capacity Improvement is vibrant for adaptation of climate strategies by imparting hands-on training, knowledge exchange

through experts from China. The facet of Inland water transportation, by making use of rivers, canals, and lakes, is a vital and an effective artery for trade and mobility with noticeable examples including the extensive Mississippi, Rhine and Danube and Yangtze River can be investigated further to conclude better options for Pakistan.

“Clean air is everyone’s right and responsibility” (Zareen & Malik,2025).

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