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GEOGRAPHIC DIVERSITY AND LANDSCAPE IN TRANSITION: ANALYZING THE PHYSICAL FEATURES OF GILGIT BALTISTAN REGION

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ABSTRACT

This study presents multidimensional analysis of the Gilgit Baltistan region, focusing upon its geographical, environmental, and socio-economic aspects. Employing both qualitative and quantitative methodologies, the research defines the region's physical features, climatic conditions, and hydrological characteristics. It quantitatively assesses distribution of glaciers, rivers, and forests, utilizing statistical data to realize trends in hydrology and ecology. Qualitatively, study explores hazards and vulnerabilities inherent in region, including natural, man-made hazards, their intensity, and socio-economic implications. Also, it conducts a comparative analysis to examine strategic significance of mountain passes in facilitating the trade, travel and cultural exchange. Study reveals region's significant hydrological resources, with glaciers and snowmelt serving as principal water sources. Strategic status of mountain passes in facilitating trade and connectivity, with key passes like Khunjerab and Babusar serving as vital links between Pakistan to China, as well as connecting the region with other provinces of Pakistan. The analysis further reveals that among natural hazards the region is vulnerable to flash floods, landslides, and snow avalanches, intensified by its rugged terrain and climatic conditions.

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INTRODUCTION

Geographic diversity and landscape variations are fundamental components of the Earth's natural environment, shaping ecosystems and influencing human societies worldwide (Ali, 2019; Walter, 2022). Across the globe, diverse landforms, ranging from expansive plains & rolling hills to rugged mountains and dense forests, create a setting of habitats that support a myriad of life forms (Fürst,

Luque & Geneletti, 2017). Coastal regions, with their dynamic interface between land and sea, host rich biodiversity and provide crucial ecosystem services such as shoreline protection and fisheries (Gottwald, Albert & Fagerholm, 2022). In contrast, arid deserts, with their sparse vegetation and extreme temperatures, present unique challenges for both flora and fauna, requiring specialized adaptations for survival (Kreutzmann, 2013). The landscape not only effects ecological processes but also profoundly impacts human activities and cultural practices (Díaz, Turnhout & Beck, 2019). Mountainous regions, such as Andes in South America or Himalayas in Asia, shaped development of isolated communities, cultural traditions, fostering resilience & resourcefulness amid inhabitants (Riffat et al., 2023). River valleys, like Nile in Egypt or Ganges in India, are centers of civilization for millennia, providing fertile lands for agriculture, facilitating trade and transportation networks (Albert at al., 2014).

The interaction between humans and landscape, mediated by factors such as climate, topography, and natural resources, continues to shape the course of history and the trajectory of environmental change on a global scale (Khan, 2012). Gilgit Baltistan, located in the northern reaches of Pakistan, is a region of unparalleled geographic diversity and breathtaking landscapes (Ali, 2014). This area, often referred to as 'Jewel of Pakistan,' encompasses a mosaic of towering mountain ranges, pristine valleys, and sprawling plateaus (Hussain, 2015). The physical features of Gilgit Baltistan have not only shaped its natural beauty but have also played a crucial role in influencing socio-economic and cultural dynamics of the region (Zafar, Ahmed, Farooq, Akbar & Hussain, 2010). Analyzing its physical features provides insight into the region's natural beauty, environmental challenges, and strategic significance. This research provides a holistic understanding of Gilgit Baltistan physical features, acknowledging their effect on region ecological balance, economic activities, and cultural heritage. Understanding physical features of Gilgit-Baltistan requires a comprehensive look at its topography, climate, hydrology, and the ongoing changes affecting its landscape. By scrutinizing the dynamic interplay between the geography and human experience, research aims to contribute valuable insights that can inform sustainable development practices & policies in this remarkable part of the world.

LITERATURE REVIEW

Gilgit-Baltistan region, located in northernmost part of Pakistan, is renowned for its extraordinary physical geography and topographic diversity. The region is home to some of the world's highest and most formidable mountain ranges, including the Karakoram, western Himalayas, and Hindu Kush. K2, the second-highest peak globally, stands as a testament to the region's extreme elevation and rugged terrain. These mountains are not only significant for their altitudinal records but also for their extensive glaciations. The Baltoro and Biafo glaciers, among the largest outside the polar regions, exemplify the region's glaciated landscapes, which play a crucial role in the hydrology and ecology of the area (Ali, 2009). Gilgit-Baltistan's climate is characterized by stark variability due to its diverse topography. The region is part of the greater Himalayas, Karakoram, and Hindu Kush Mountain ranges, creating rugged and mountainous terrain. Lower valleys experience a semi-arid climate, with hot summers and cold winters, while higher altitudes endure cold desert climate with severe winters and relatively mild summers Climate of Gilgit-Baltistan varies significantly with

altitude and location and this climatic variation significantly effects region's hydrological patterns, vegetation, and biodiversity.

The low precipitation levels, especially in the valleys, contrast sharply with the heavy snowfall in higher altitudes, impacting agricultural practices, water availability, and livelihoods. The region's glaciers serve as critical water reservoirs, feeding major rivers such as the Indus and its tributaries, that are vital for both local and downstream communities (Keesing & Irvine, 2005). The biodiversity of Gilgit-Baltistan is equally remarkable, shaped by its complex topography & climatic conditions. Understanding the physical features and ongoing transitions in this region is crucial for sustainable development, disaster risk reduction, and preserving its natural beauty. The region's flora ranges from alpine meadows and coniferous forests to arid shrub lands, supporting a wide array of plant species. Its fauna includes several rare and endangered species, such as snow leopard, Himalayan brown bear, Marco Polo sheep, and ibex. These species are not only ecologically significant but also culturally important to indigenous communities. As climate change and human activities continue to reshape the landscape, proactive measures are needed to manage these impacts and protect the unique environment of Gilgit-Baltistan. The conservation efforts have been ongoing, with various studies highlighting need to protect these habitats amidst increasing anthropogenic pressures The unique biodiversity of Gilgit-Baltistan underscores the region's ecological importance on a global scale (Benz, 2016).

RESEARCH METHODOLOGY

The research methodology employed in this study involves a comprehensive analysis of various geographical and environmental aspects of Gilgit Baltistan region based on the both qualitative and quantitative data. Firstly, the descriptive approach is utilized to delineate the absolute and relative location of the study area, along with its area, elevation, and physical features. This involves mapping the geographical coordinates, identifying prominent mountain ranges, peaks, glaciers, and rivers, as well as characterizing the climatic conditions prevalent in the region. Secondly, the quantitative analysis is conducted to examine the hydrological and ecological characteristics of Gilgit Baltistan. This includes assessing distribution and extent of glaciers, lakes, rivers, and forests, as well as quantifying water resources and forest cover within the region. Therefore, statistical data provided on the weather stations and forest areas are utilized to understand patterns and trends in hydrology and ecology.

Thirdly, a qualitative exploration is undertaken to investigate hazards and vulnerabilities inherent in the Gilgit Baltistan region. This involves identifying natural and man-made hazards, analyzing their intensity and frequency, and assessing their impact on the local population and environment. In this connection, the research draws on insights from scholarly sources to understand the socio-economic implications of hazards and the region's capacity for disaster preparedness and response. Lastly, a comparative analysis is conducted to examine strategic significance of mountain passes in Gilgit Baltistan across the region with diverse significant influence from diverse parameters. This involves evaluating connectivity and accessibility facilitated by key passes, assessing their role in trade, travel, cultural exchange, and understanding their historical and geographical significance within the region.

Location of Gilgit Baltistan Region

The study area projected for this research manuscript, 'Gilgit Baltistan region' formerly known as northern areas of Pakistan is the north most mountainous territory of Pakistan. Its absolute location is 32° 10′ 0″ to 37° 20′ 0″ N latitude, 72° 40′ 0″ to 80° 50′ 0″ E longitude (Figure, 1). It borders with Azad Jammu Kashmir to South, province of KP to West, Wakhan Corridor of Afghanistan to North West, Xinjiang region of the China to North, North East and Jammu and Kashmir to South East (GOP, 2000).

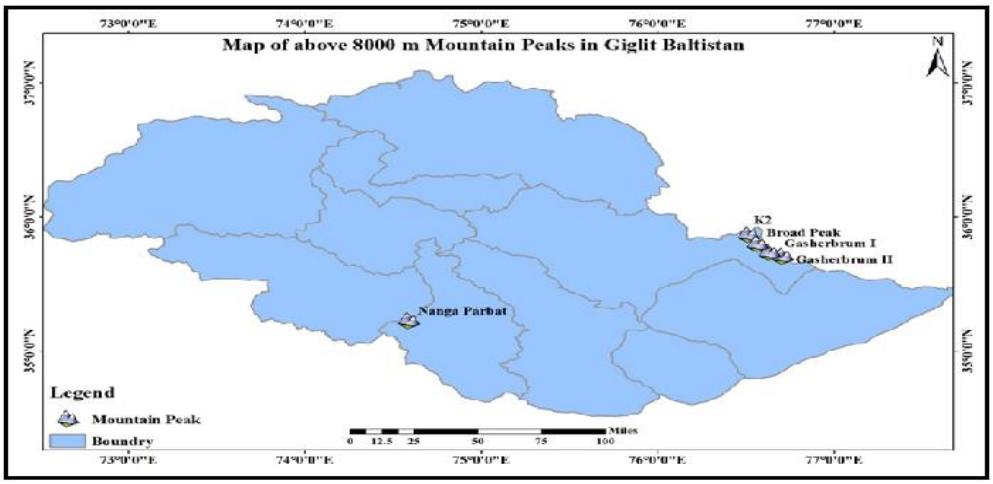
Figure 1 Location of Gilgit Baltistan

Area & Elevation

Total area of GB region is 72,971 km2 (28,174) miles with varying elevation of 3,000 ft. to 28,250 ft, in accordance with sea level.

ANALYSES & DISCUSSIONS

Figure 2 Locations of Eight Thousanders in Gilgit Baltistan



Physical Features (Mountain ranges, Peaks, Glaciers)

Gilgit Baltistan hosts prominent mountainous ranges and chain of planet, comprising "Himalayas, Karakoram, Hindukush, Pamir, Pishkom, Kunlun, Tienshah & Transalay". The congregation of deep gorges, valleys, highlands and hilly and rocky zones are recognition of its landscape (Khan, 2017). The region is seismically active, with landslides and changes in topography. This region is dwelling of five of "eight – Thousanders" out of fourteen, having the height more than eight thousand meters (Figure 2; Table 1).

Table 1 Eight thousander Peaks in Gilgit Baltistan

SN	Mountain Name/ Range	Height in Meters	Location District	Mountain Range	World Mountains Ranking
01	K2 (Chogho-Ri)	8611 m	Shiger	Karakoram	2nd
02	Nanga Parbat	8126 m	Diamer	Himalaya	9th
03	Gashebrum –I	8068 m	Shiger	Karakoram	11th
04	Broad Peak	8047 m	Shiger	Karakoram	12th
05	Gashebrum –II	8035 m	Shiger	Karakoram	13th

Source: (GoGB, 2020)

Similarly, Gilgit Baltistan has estimated 2,200 square miles, (12%) of area covered with snow and glaciers (Table, 2). Consequently, the five main glaciers are; "Siachen, Biafo, Hispar, Baltoro and Batura" (Figure, 3).

Figure 3 Locations of Main Glaciers in Gilgit Baltistan

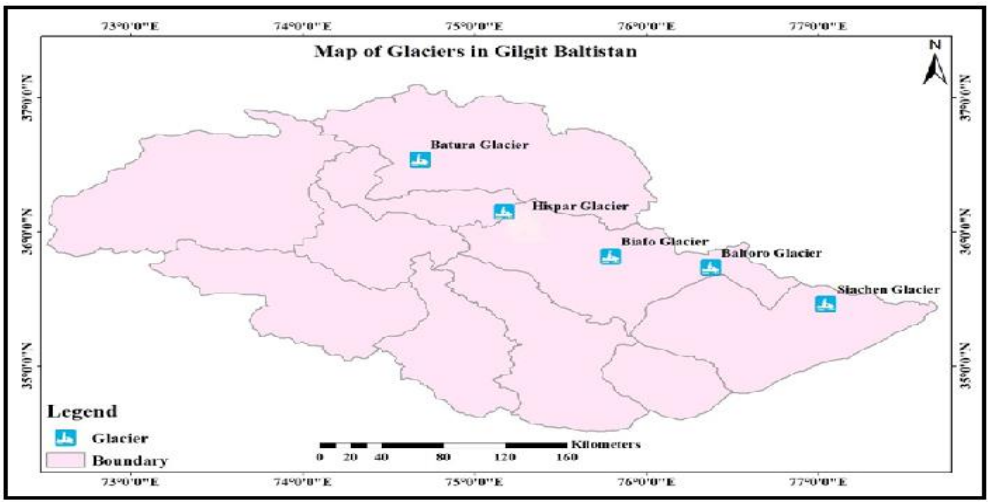


Table 2 Main Glaciers of Gilgit Baltistan

SN	Name of Glacier	Area in km	Location	Mountain Range
01	Siachen Glacier	76 km	Ganche	Karakuram
02	Biafo Glacier	62 km	Shiger	Karakuram
03	Hispar Glacier	61 km	Nagar	Karakuram
04	Baltoro Glacier	58 km	Shiger	Karakuram

05	Batura Glacier	58 km	Hunza	Karakuram
06	Gashebrum	38 km	Shiger	Karakuram
07	Chogho Lungma	38km	Ganche	Karakuram
08	Passu	32km	Hunza	Karakuram
09	Nabandi	32km	Baltistan	Karakuram
10	Baraldu	30km	Shiger	Karakuram
11	Rupal	29km	Astore	Himalaya

Source: (GoGB, 2020)

Climatic Conditions

As the Gilgit Baltistan is a mountainous range which is a mountain locked region. Mainly it is covered by the mighty Karakuram and Himalaya range along with the five mountains peaks with more than 8000 m. covered with snow through year. So, these mountains certainly have influential role in the climate determination of region. Overall, the GB region's climate is warm in summer and cold in winter. The areas of western part of region generally have arid to semi-arid condition and areas in eastern part have somehow moist conditions (WWF, 2010). To determine the atmospheric condition in Gilgit Baltistan region PMD (Pakistan Meteorology Department) has seven stations at different areas of three divisions. These stations are highly elevated stations in country as stations are 1200 m high above sea level (Table, 3). The extensive range of annual temperature is recorded in these stations as winter temperature falls minus 00 C & summer temperature reaches above 400 C (PMD, 2020).

Table 3 Weather Stations in Gilgit Baltistan

SN	Weather Stations	District	Elevation in Meters
01	Gilgit	Gilgit	1460 m
02	Hunza	Hunza	2326 m
03	Gupis	Ghizer	2156 m
04	Chilas	Diamer	1250 m
05	Bunji	Astore	1372 m
06	Astore	Astore	2168 m
07	Skardu	Skardu	2317 m

Source: (PMD, 2021)

Forests in GB

The major portion of natural forests in GB region is extended on the grand mountain ranges of the area including Karakuram, Himalaya and Hindukush. These mountains cover 60% natural forest area of the country (Shinwari et al, 2000). Forest is the main source of livelihood in Diamer division as the people here fulfill domestic needs through forest production (Ali, 2004; Akber et al., 2014). In Gilgit Baltistan the estimated area of land use for forest is 64,512 hectare and regulation of forest here are under "Northern Areas Forest Rules, 1983". The area under forest cover in Gilgit and Nagar valleys is 17,028 hectares having mostly sub-alpine dry montane temperate flora. 7,740 hectare of forest area in Ghizer valley also has the same characteristics of plant life. The forest covered area in Diamer and Astore is 30,960 hectare and most of forested land in Darel valley, Tangir valley and

Chilas valley are owned by private individuals with independent authorization of fuel and timber production. The 9,228 hectares of forest in Skardu district also has the characteristics of sub-alpine flora of dry temperate atmospheric condition. In this linking, the forests in the region highly provide habitat for endemic wildlife, strengthen the eco-tourism and encourage the biodiversity (Hussain et al., 2010).

Hydrology in Study Area

Gilgit Baltistan is enriched in fresh water resources. As the region is a mountainous region with snow covered peaks and world largest glaciers outside the Polar region, so the melting snow and glaciers are the principal sources of water. The main source of water for Pakistan, the Indus River also flows over here. The glaciers and snow after melting become part of mountainous streams and enter in to the channels (manmade) to irrigate the agricultural land, and to fulfill the domestic and livestock demands of different areas of the region. According to a report, 40% of the population in Gilgit Baltistan has piped water access; the remaining population takes their required water from open water sources including small flowing channels, ponds, wells and springs (Muhammad, 2014a) Majority of the population in GB region use surface water which becomes abundant in summer season due to rapid melting process of snow. In winter flow of surface water decreases due to freezing and accumulation of snow at mountains and glaciers. Use of ground water is not common in Gilgit Baltistan region as a whole but a little population use ground water by digging wells of few feet (Muhammad, 2014b).

For the provision of pure and clean water to masses, public water filtration plants are constructed across the region. According to the Ministry of Planning currently 102 water filtration plants are functional in different districts of GB and 79% of population has easy access to these plants (GoGB, 2020). The Gilgit-Baltistan region is endowed with several significant rivers that play a crucial role in shaping its landscape and providing vital water resources. The mighty Indus River, with a total length of 2900 kilometers, originates from Lake Mansarovar in Kargil and traverses through Baltistan before reaching Arabian Sea in Karachi. It serves as a lifeline for the region, facilitating agricultural activities and supporting local communities. Another prominent river in Baltistan is the Shyok River, spanning 550 kilometers and originating from Ghondogoro Glacier. It eventually joins Indus River near Ghursa village in Ganche, contributing to the region's hydrological network. The Shiger River, originating from Baltoro and Biafo Glaciers, and the Braldu River, sourced from Baltoro Glacier, are vital tributaries of Indus River, adding to water resources of Skardu & Tingstun valley in Shiger.

The Hushe River, stretching 42 kilometers and originating from the Ghondogoro Glacier, is the significant tributary of the Saltoro River, meeting it in Haldi Khaplu, Ganche. In the Gilgit division, the Ishkuman River, with a length of 30 kilometers, originates from the Ishkuman stream and joins the Ghizer River in Gupis. The Shimshal River, emerging from the Shimshal Pass, contributes to the Khunjerab River and meets it in Passu, Hunza. The Ghizer/Gilgit River, spanning 240 kilometers, starts from Shandur Lake and joins the Indus River in Juglot, contributing to the Ghizer and Gilgit districts. The Hunza River, with a length of 190 kilometers, originates from glaciers at Chapursan and Khunjerab, joining the Gilgit River in Naltar, Hunza. The Hispar River, sourced from the Hispar

Glacier, and the Rupal River, originating from the Rupal Glacier, are notable water bodies in Gilgit and Diamer divisions, respectively. Lastly, the Astore River, originating from Burzil Pass, flows 120 kilometers and joins the Indus River in Juglot, Astore. These rivers collectively form a complex and interconnected network, providing water for many purposes & contributing to diverse ecosystems of Gilgit-Baltistan.

Table 4 Main Rivers of Gilgit Baltistan Region

SN	Name of River	Division	Total Length	Starting	Tributary/ Distributary	Junction Location	Location
01	Indus River	Baltistan	2900 km	Lake Mansarovar (Kargil)	Arabian Sea	Karachi	Baltistan
02	Shyok River	Baltistan	550 km	Ghondogoro Glacier	Indus River	Ghursa village	Ganche
03	Shiger River	Baltistan	62 km	Baltoro & Biafo Glaciers	Indus River	Skardu	Shiger
04	Braldu River	Baltistan	78 km	Baltoro Glacier	Shiger River	Tingstun valley	Shiger
05	Hushe River	Baltistan	42 km	Ghondogoro Glacier	Saltoro River	Haldi Khaplu	Ganche
06	Ishkuman River	Gilgit	30 km	Ishkuman stream	Ghizer River	Gupis	Ghizer
07	Shimshal River	Gilgit	-	Shimshal Pass	Khunjerab River	Passu	Hunza
08	Ghizer / Gilgit River	Gilgit	240 km	Shandur Lake	Indus River	Juglot	Ghizer and Gilgit
09	Hunza River	Gilgit	190 km	Glaciers at Chapursan and Khunjerab	Gilgit River	Naltar	Hunza
10	Hispar River	Gilgit	38 km	Hispar Glacier	Hunza River	Hunza valley	Hunza
11	Rupal River	Diamer	-	Rupal Glacier	Astore River	Asotre valley	Astore
12	Astore River	Diamer	120 km	Burzil Pass	Indus River	Juglot	Astore

Source: (GoP, 2000; Khan, 2017; GoGB, 2020)

Gilgit-Baltistan boasts a myriad of enchanting lakes, each contributing to region's breathtaking natural landscape. Sadpara Lake (Baltistan - Skardu): Nestled near Skardu, Sadpara Lake offers serene surroundings against the backdrop of towering mountains. It is a popular spot for both locals and tourists, providing a tranquil escape. Upper Kachura Lake (Baltistan - Skardu): A gem near Skardu, Upper Kachura Lake captivates visitors with its crystal-clear waters and the stunning reflection of nearby snow-capped peaks. Boating is a common activity on the lake. Lower Kachura Lake (Forog Xo - Baltistan - Skardu): Also known as Forog Xo, Lower Kachura Lake is adjacent to famous Shangrila Resort. The lake's vibrant hues and surrounding greenery make it a picturesque destination. Katpana Lake (Baltistan - Skardu): Katpana Lake adds to Skardu's charm with its idyllic setting. Surrounded by mountains, this lake is often visited for its peaceful ambiance and

scenic views. Blind Lake (Baltistan ~ Shiger): Situated in Shiger, Blind Lake offers a unique allure with its remote location and untouched beauty. It is a destination for those seeking a more off~the~beaten~path experience.

Ghandus Lake (Baltistan ~ Kharmang): Tucked away in Kharmang, Ghandus Lake is surrounded by lush greenery and provides a serene environment for those seeking tranquility away from the bustle of urban life. Borith Lake (Gilgit ~ Hunza): Located in Hunza, Borith Lake is known for its reflective surface mirroring the surrounding peaks. It serves as a habitat for migratory birds, adding to its ecological significance. Ata Abad Lake (Gilgit ~ Hunza): Formed after a landslide in 2010, Ata Abad Lake captivates visitors with its turquoise waters. Boating on the lake allows for a unique experience amid the submerged trees. Rush Lake (Gilgit ~ Nagar): Among the highest alpine lakes globally, Rush Lake offers awe~inspiring vistas of Nagar Valley. It is trekker's delight and provides panoramic views of nearby peaks. Khalti Lake (Gilgit ~ Ghizer): Situated in Ghizer, Khalti Lake is surrounded by picturesque landscapes. Lake's tranquility and the surrounding mountains make it a serene destination.

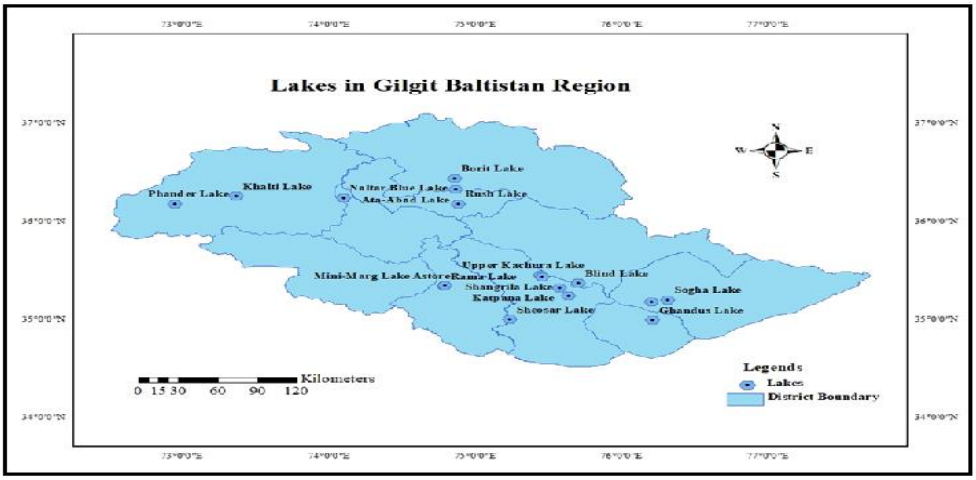
Phander Lake (Gilgit ~ Ghizer): Phander Lake, located in Ghizer, is renowned for its clear waters and the lush green valley that surrounds it. The lake reflects the grandeur of the Himalayan region. Karambar Lake (Gilgit ~ Ghizer): Tucked away in remote Ghizer region, Karambar Lake is a high~altitude glacial lake enclosed by pristine wilderness. It offers serene retreat for nature enthusiasts. Rama Lake (Diamer ~ Astore): Situated in Astore, Rama Lake is surrounded by alpine meadows and provides breathtaking views of Nanga Parbat. It's a trekker's paradise. Sheosar Lake (Diamer ~ Astore): Astore's Sheosar Lake is captivating high~altitude lake, fenced by stunning landscapes of Deosai National Park. It stands as one of highest lakes globally, offering mesmerizing panoramas. These lakes collectively contribute to region's allure, attracting visitors with their unique features and tranquil environments.

Table 5 Main Lakes of Gilgit Baltistan

SN	Name of Lake	Division	Location
01	Sadpara Lake	Baltistan	Skardu
02	Upper Kachura Lake	Baltistan	Skardu
03	Lower Kachura Lake (Foroq Xo)	Baltistan	Skardu
04	Katpana Lake	Baltistan	Skardu
05	Blind Lake	Baltistan	Shiger
06	Ghandus Lake	Baltistan	Kharmang
07	Borith Lake	Gilgit	Hunza
08	Ata Abad Lake	Gilgit	Hunza
09	Rush Lake	Gilgit	Nagar
10	Khalti Lake	Gilgit	Ghizer
11	Phander Lake	Gilgit	Ghizer
12	Karambar Lake	Gilgit	Ghizer
13	Rama Lake	Diamer	Astore
14	Sheosar Lake	Diamer	Astore

Source: (GoP, 2000; Khan, 2017; GoGB, 2020)

Figure 4 Lakes in Gilgit Baltistan



Junction Area of Mountain Ranges & Rivers

Gilgit Baltistan region provides stunning view for viewers to observe all three mighty mountainous ranges at one place as Karakuram, Himalaya and Hindukush ranges intersect each other at Jaglot Gilgit and both Indus River & Gilgit River meets at same place. So, this place is known as Junction area (Khan, 2017).

Minerals

Gilgit-Baltistan (GB) has set ambitious targets for the extraction of various metallic ores, reflecting a strategic focus on mineral resource development in region. The targets encompass a diverse range of minerals, emphasizing the potential economic and industrial significance of these resources. The extraction goals include 493 points for copper, highlighting the region's aim to tap into significant copper deposits. Similarly, targets for nickel (487), zinc (352), lead (280), cobalt (255), gold (168), platinum (106), bismuth (67), palladium (46), iron ore (3), antimony (2), molybdenum (1), and arsenic (1) showcase the comprehensive approach towards harnessing a variety of metallic resources. These targets underscore GB's commitment to leveraging its mineral wealth for the economic growth, job creation, and industrial development. The pursuit of such targets reflects the region's recognition of the importance of responsible and sustainable mineral resource management to contribute to its ~ economic advancement.

Table 6 Targets Established for Metallic Ores Extraction in GB

SN	Minerals	Targeted Points
01	Copper	493
02	Nickel	487
03	Zinc	352
04	Lead	280
05	Cobalt	255
06	Gold	168
07	Platinum	106

08	Bismuth	67
09	Palladium	46
10	Iron Ore	03
11	Antimony	02
12	Molybdenum	01
13	Arsenic	01

Gilgit-Baltistan (GB) has identified specific targets for the extraction of gemstones, both precious and semi-precious, showcasing region rich geological endowment. The extraction goals encompass various coveted gemstones, emphasizing potential for gemstone mining as a significant economic driver. The targets include 15 points each for topaz and garnet, reflecting the substantial presence of these gemstones in the region. Additionally, there are targets for aquamarine (12), tourmaline (4), moonstone (4), pargasite (4), morganite (3), zircon (3), epidote (3), ruby (3), emerald (2), sapphire (2), spinal (2), amethyst (2). These targets exemplify GB's recognition of its diverse gemstone resources and intention to harness them for economic development, including gemstone industry, which holds promise for both local and international markets. The pursuit of these gemstone extraction targets aligns with GB's strategy to leverage its geological wealth for sustainable economic growth and job creation in region.

Table 7 Targets for Extraction of Gemstones (Precious, Semi-Precious) in GB

SN	Gemstone Mineral	Targeted Points
01	Topaz	15
02	Garnet	15
03	Aquamarine	12
04	Tourmaline	04
05	Moonstone	04
06	Pargasite	04
07	Morganite	03
08	Zircon	03
09	Epidote	03
10	Ruby	03
11	Emerald	02
12	Sapphire	02
13	Spinal	02
14	Amethyst	02

Source: (IUCN, 2003)

Hazards in GB Region

The rigid formation of geological features, typical location according to geography and delicate environmental setting of Gilgit Baltistan make the region more prone to different types of natural hazards. In this connection, the poor condition of accessibility along with the scattered settlements, the fragile quality of building construction and design, exploitation of the natural vegetation as well as discouraging level of awareness among the people escalate the vulnerability possibilities

of the region for the natural assorted hazards (Gilgit Baltistan Disaster Management Authority (GBDMA, 2015).

Natural Hazards

Natural hazards in Gilgit Baltistan are due to the peculiar landscape and rugged topographical feature. The snow-covered mountain ranges and peaks with the glaciated surfaces make this region vulnerable to many natural hazards and some of hazards occur frequently in different villages and valleys (Abbas & Khan, 2020). The "hydro-metrological hazards" stimulated by climate action and prolonged specific weather condition increase risk of vulnerability of natural hazard in Gilgit Baltistan. These include flash floods, land sliding, cloud burst, river bank erosion & heavy snowfalls. The critical condition of facilities, weak capacity of local administration and community to cope with the hazard and lack of awareness intensify the vulnerability in the region (Ali et al., 2015). The risk of natural hazards in Gilgit Baltistan region especially in Nagar, Hunza and Shiger valley are increasing as the increasing trend is obvious under inducing indicators. The nature of risk in region will be alarming and unexpected and more areas will become prone to hazards in upcoming years (Abbas et al., 2016).

Manmade Hazards

As far as man-made hazard is concerned in Gilgit Baltistan region, the region is mainly vulnerable to two main hazards which are cross border firing due to mutual conflict between Pakistan and India and the injuries as well as life losses in road accident. As the GB region especially Baltistan division shares borders with Indian occupied territories across different sides, so cross-border firing and war is observed by people of Gilgit Baltistan many times in near past. Number of mountainous villages across the border namely Brolmo, Hamzigon, Gultari and Kharmang Olding has become vacant and majority of population has shifted in faraway places from borders. The effected families of war left behind their properties and belongings in their native villages (Qasim, 2018). Gilgit Baltistan (GB) faces a spectrum of natural and man-made disasters, each characterized by varying levels of intensity and frequency. Earthquakes, a high-intensity disaster, pose a significant threat to region, given its seismic vulnerability. Landslides, rockfalls, mudflows, glacial movements, falling in the high & medium intensity categories, contribute to geological hazards, impacting both infrastructure and human settlements.

Avalanches, particularly in mountainous areas, are another formidable challenge, occurring at a medium to high intensity level. Flash floods and riverine floods, categorized as high and medium intensity disasters, respectively, are recurrent, especially during monsoon seasons. The glacial lake outburst events, though less frequent, are high-intensity disasters with the potential for widespread damage. Snowstorms, windstorms, lightning, and droughts represent various climatic challenges, each with its intensity level, impacting agriculture, infrastructure, and daily life. Epidemics and cross-border firing present unique challenges, with former affecting public health and the latter contributing to security concerns. Road accidents & life losses, wild fires, and other hazards further add to array of disasters faced by GB, each with its associated level of intensity. This comprehensive overview climaxes diverse range of disasters in GB, stressing need for robust disaster preparedness,

response, and mitigation strategies to safeguard lives and enhance region's resilience against these multifaceted challenges.

Table 8 Types of Disasters with Level of Intensity and Frequency in Gilgit Baltistan

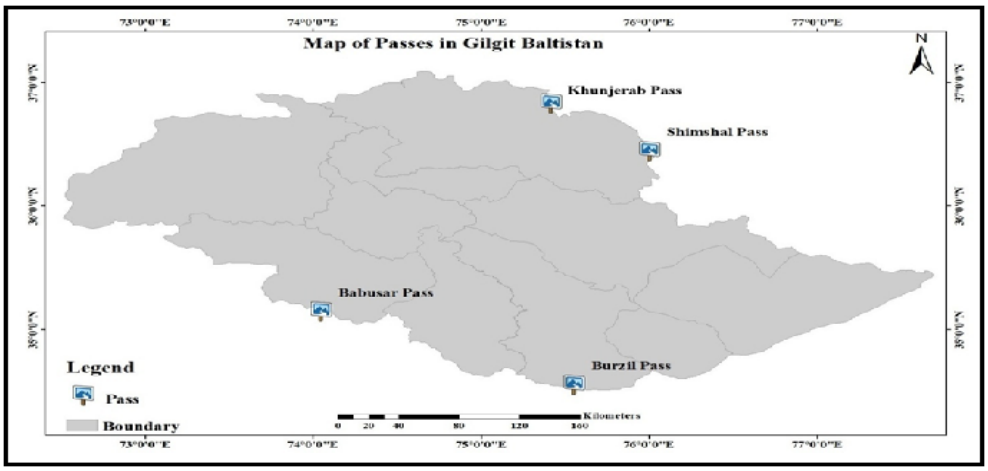
Types of Disaster	High	Medium	Low
Earthquake	■		
Landslide / Rock fall / Mudflow	■		
Glacial Movement / Avalanches	■		
Flash Floods / Riverine Floods	■		
Glacial Lake Outburst		■	
Snow Storm		■	
Wind Storms			■
Lightening		■	
Drought		■	
Epidemics		■	
Cross border Firing		■	
Road Accidents and life losses			■
Wild Fires			■

Source: (Qasim, 2018)

Passes in Gilgit Baltistan Region

Passes are mountainous, elevated and narrow routes which connect two different areas or localities. Passes play significant role in movement of human, transport of trade goods and land accessibility (Maharana et al., 2000). As GB region is a mountain locked region covered by ranges of mountains of world, consequently the passes in region are providing accessibility for local, inter – provincial & international boundaries.

Figure 5 Location of main Passes in GB



Gilgit Baltistan (GB) is endowed with diverse and challenging topography, categorized by many mountains passes that serve as crucial links between different areas. One of the prominent passes is

the Khunjerab Pass, connecting Pakistan and China at an elevation of 4693 meters. Located in the Hunza division, it stands as a significant gateway for international trade and connectivity. Babusar Pass, at an elevation of 4173 meters, facilitates the connection between Gilgit Baltistan and Khyber Pakhtunkhwa (KPK), specifically in Diamer division near Chilas. Another vital pass, Burzil Pass, at 4100 meters, links Astore with Srinagar, showcasing the historical and geographical connections in the Diamer division. In this linking, Shimshal Pass, situated at 4735 meters in the Hunza division, serves as a crucial route between Hunza and China, contributing to trade and cultural exchanges. Karambar Pass, at 4300 meters in the Ghizer division, connects Ghizer with the Chitral, reinforcing regional connectivity.

The Mintaka Pass with an elevation of 4700 meters, stands as an essential link between Hunza and China and further emphasizes the strategic importance of the Hunza division. Chillinji la Pass, towering at 5300 meters in the Ghizer division, connects Ishkoman Ghizer with Hunza, showcasing the challenging terrains of the region. Gondogoro la Pass, positioned at an impressive elevation of 5940 meters in the Baltistan division, links Concordia in Shiger with Hushe in Ganche. This pass is renowned for its breathtaking views and plays a significant role in trekking and mountaineering activities, showcasing the diverse and rugged landscapes of the Baltistan. These passes collectively underline the geographical complexity and strategic significance of Gilgit Baltistan, serving as critical conduits for the trade, travel, and the cultural interactions across various divisions of this mountainous region.

Table 9 Main Passes of GB region

SN	Name of Pass	Connected Areas	Elevation	Division	Location
01	Khunjerab Pass	Pakistan – China	4693m.	Gilgit	Hunza
02	Babusar Pass	Gilgit Baltistan – KPK	4173m.	Diamer	Chilas
03	Burzil Pass	Astore – Srinagar	4100m.	Diamer	Astore
04	Shimshal Pass	Hunza – China	4735m.	Gilgit	Hunza
05	Karambar Pass	Ghizer – Chitral	4300m.	Gilgit	Ghizer
06	Mintaka Pass	Hunza – China	4700m.	Gilgit	Hunza
07	Chillinji la Pass	Ishkoman Ghizer – Hunza	5300m.	Gilgit	Ghizer
08	Gondogoro la Pass	Concordia Shiger – Hushe Ganche	5940m.	Baltistan	Shiger

Source: (GoP, 2000; Khan, 2017; GoGB, 2020)

CONCLUSION

The Gilgit Baltistan region presents captivating blend of geographical diversity & environmental significance. Through a combination of qualitative and quantitative analyses, this study has shed light on the various aspects of the region, ranging from its physical features to its socio-economic dynamics. The region's absolute and relative location, spanning across mountain ranges like the Himalayas, Karakoram, as well as Hindukush, showcases its strategic position. Its vast area, varying elevations, notable geographical landmarks, including prominent peaks and glaciers, underscore its unique landscape. Climatically, Gilgit Baltistan experiences diverse conditions, influenced by its mountainous terrain, with the warm summers and cold winters prevailing across the region. The presence of extensive forests not only adds to its scenic beauty but also supports local livelihoods

and biodiversity. Water resources play a crucial role in the region, with glaciers and rivers serving as primary sources.

However, the area is also vulnerable to natural hazards such as floods, landslides, and avalanches, necessitating robust disaster preparedness measures. Furthermore, the region boasts the significant mineral and gemstone deposits, highlighting its potential for economic development. However, this potential must be balanced with environmental conservation efforts to ensure sustainable growth. Furthermore, Gilgit Baltistan's network of mountain passes serves as vital links for connectivity, trade, and cultural exchange, emphasizing its importance in regional and international contexts. In essence, Gilgit Baltistan's rich natural resources, coupled with its strategic location and diverse topography, make it a region of the immense significance. However, addressing its environmental vulnerabilities and promoting the sustainable development are crucial for ensuring its long-term prosperity and resilience.

REFERENCES

Abbas, N., Afsar, S., Jan, B., Waseem, A., Naqvi, A., Hameed, A., & Hussain, Z. (2016). Environmental Disaster Assessment Using Geospatial Techniques for Hunza-Nagar District, Gilgit-Baltistan, Pakistan. *Science International*, 28(6), 5319-5328.

Abbas, S., & Khan, A. A. (2020). Socio-economic Impacts of Natural Disasters: Implication for Flood Risk Measurement in Damas Valley, District Ghizer, Gilgit-Baltistan, Pakistan. *Pakistan Geographical Review*, 75(1), 71-83.

Akbar, M., Shaukat, S. S., Ahmed, M., Hussain, A., Hyder, S., Ali, S., … Ali, K. (2014). Characterization of diameter distribution of some tree species from Gilgit-Baltistan using weibull distribution. *Journal of Biodiversity and Environmental Sciences*, 5(4), 2222-3045.

Albert, C., Aronson, J., Fürst, C., & Opdam, P. (2014). Integrating ecosystem services in landscape planning: requirements, approaches, and impacts. *Landscape Ecology*, 29(8), 1277–1285.

Ali, F., Khan, B., Khan, G., Abbas, Y., Hussain, E., Masud, A., … Karim, R. (2015). Hazard Vulnerability Risk Assessment of District Gilgit, Gilgit-Baltistan, Pakistan. *Modern Environmental Science and Engineering*, 11(5), 255-268.

Ali, J., & Benjaminsen, A. (2004). Fuel wood Timber and Deforestation in the Himalayas the case of Basho valley, Baltistan region, Pakistan. *Mountain Research and Development*, 24(4), 312-318.

Ali, N. (2009). Re-Imagining Nature of Development: Biodiversity Conservation & Pastoral Visions in the Northern Areas, Pakistan. In: McMichael, Philip (ed.) Contesting Development: Critical Struggles for Social Change. *Routledge*.

Ali, N. (2019). Delusional States. Feeling Rule and Development in Pakistan's Northern Frontier. Cambridge, UK: Cambridge University Press.

Ali, N. (2014). Anthropology of the Gilgit Baltistan, Northern Pakistan. Ethnoscripts, 16(1), 115 123.

Benz, A., (2016). Framing modernization interventions: Reassessing the role of migration and translocality in sustainable mountain development in Gilgit-Baltistan, Pakistan. *Mountain Research and Development*, 36(2), pp.141-152.

Derbyshire, E., Fort, M., & Owen, L. A. (2001). Geo morphological hazards along the Karakoram Highway: Khunjerab Pass to Gilgit River, northernmost Pakistan. *Erdkunde*, 55(1), 49-71.

Díaz, I., Turnhout, E., & Beck, S. (2019). Participation and inclusiveness in the intergovernmental science–policy platform on biodiversity and ecosystem services. *Nature Sustainability*, 2(6), 457–464.

Fürst, C., Luque, S., & Geneletti, D. (2017). Nexus thinking–how ecosystem services can contribute to enhancing cross-scale and cross-sectoral coherence. *International Journal of Biodiversity Science Ecosystem Services and Management*, 13(1), 412–421.

GBDMA. (2015). Contingency Plan for Floods 2015 for Gilgit-Baltistan. GoGB. (2015). Climate Change in Gilgit Baltistan region, Pakistan.

GoP. (2000). Tourism Master Plan for Pakistan: Year Book 2000-21. Ministry of Tourism. Retrieved November 30, 2020 from http://www.tourism.gov.pk/.

Gottwald, S., Albert, C., & Fagerholm, N. (2022). Combining sense of place theory with the ecosystem services concept: empirical insights and reflections from a participatory mapping study. *Landscape Ecology*, 37(2), 633–655.

Hewitt, K. (2014). Glaciers of the Karakoram Himalaya: Glacial Environments, Processes, Hazards and Resources. Springer.

Hussain, A., Farooq, M. A., Ahmad, M., Akbar, M., & Zafar, M. U. (2010). Phyto sociology and Structure of Central Karakoram National Park (CKNP) of Northern Areas of Pakistan. *World Applied Sciences Journal*, 9(12), 1443-1449.

Hussain, S. (2015). Remoteness and Modernity. Transformation and Continuity in Northern Pakistan. New Haven, CT: Yale University Press.

Keesing, J., & Irvine, T. (2005). Coastal biodiversity in the Indian Ocean: The known, the unknown and the unknowable. *Indian Journal of Marine Sciences*, 34(1), 11–26.

Khan, E. M. (2017). Constitutional Status of Gilgit Baltistan: An issue of human security. *Margalla Papers*, 21(1), 85-103.

Khan, K. (2012). "Tourism Downfall. Sectarianism An Apparent Major Cause in Gilgit-Baltistan (GB), Pakistan." *Journal of Political Studies*, 19 (2): 155–68.

Kreutzmann, H. (2013). "Preservation of Built Environment and Its Impact on Community Development in Gilgit-Baltistan." *Berlin Geographical Papers*, 42 1–40.

PMD. (2020). Gilgit Baltistan at a glance 2020: Government of Gilgit-Baltistan Planning & Development Department Statistical & Research Cell.

Qasim, M. (2018). Impact of migration on family structure in Skardu city. [Master of Philosophy, Government College University Faisalabad]. Departmental Library Geography, GCUF.

Riffat, M., Esmail, B. A., Wang, J., & Albert, C. (2023) Biodiversity and ecosystem services dashboards to inform landscape and urban planning: a systematic analysis of current practices, *Ecosystems and People*, 19(1), 1-16.

Walter, M. (2022). Images of Mountains: Touristic Consumption and Gendered Representations of Landscape and Heritage in Gilgit-Baltistan. *Visual Anthropology*, 35(3), 225-247.

WWF. (2010). Boundary delineation of Central Karakuram National Park: boundary demarcation and refortification of protected areas project. Islamabad, Pakistan

Zafar, M. U., Ahmed, M., Farooq, M. A., Akbar, M., & Hussain, A. (2010). Standardized Tree Ring Chronologies of Picea smithiana from Two New Sites of Northern Area Pakistan. *World Applied Sciences Journal*, 11(12), 1531-1536.