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Climate Change and Water Crisis in Balochistan: Causes, Effects, and Pathways to Resilience

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Abstract
This paper gives a full picture of the serious and complicated climate change and water problem that Balochistan, Pakistan's largest province, is facing. It goes into detail on the main climatic and non-climatic drivers, the terrible effects on the environment, the economy, and public health, and it lists important ways to adapt and reduce the damage. Even while Balochistan doesn't contribute much to global greenhouse gas emissions, the province is especially vulnerable to extreme weather, unpredictable rain, and rising temperatures. This climate stress is made worse by unsustainable water extraction methods, problems with the way the government works, and unfair past practices in water allocation. These problems are causing groundwater to run out and water shortages to spread. The crisis has had a huge effect on farming, people's lives, and public health. It has also caused people to move because of climate change and made political tensions worse. Recent policy efforts, including the Balochistan Integrated Water Resources Management (IWRM) Policy and FAO-supported programs, provide a strategic framework, but they will only function if they are carried out well, institutions are reformed, and resources are shared fairly. The research makes it clear that Balochistan needs integrated, multi-sectoral, and well-governed actions right away, together with a focus on climate justice, in order to create long-term resilience and make sure that the future is water-secure and sustainable.

Keywords: Climate Change, Water Crisis, Balochistan, Causes, Effects

Introduction:

Balochistan is a province that covers around 44% of Pakistan's total land area. It has a lot of land that is often hard to live on, a severe climate, and not enough water. These facts about the geography make it the province with the fewest people per square mile. Agriculture is a big part of the provincial economy and supports over 75% of the people who live there. But only 7.2% of the area can be farmed, and water is the main thing that keeps farms from being productive. The area has serious socioeconomic problems, such as widespread rural poverty caused by a lack of water and jobs outside of farming, poor access to education, and limited healthcare services. Despite Pakistan's minimal contribution to global Greenhouse Gas (GHG) emissions, with Balochistan's contribution being almost negligible, the province is disproportionately vulnerable to the adverse impacts of climate change. According to Germanwatch's Climate Risk Index, Pakistan is one of the ten countries most threatened by climate change in the world. In fact, it was the most susceptible country in 2022. Balochistan, which is already a dry area, is getting worse intense heat waves, severe water shortages, and major disruptions to people's lives. The weather in the province is very unpredictable, with droughts that come and go and terrible flash floods that

happen at the same time, like in the 2022 monsoon season. The water problem is quite bad and has many causes, including limited natural water resources, fast urbanization, uncontrolled population increase, and poor management of existing water infrastructure (Ali, 2022). Balochistan's large, dry geography is already hard to deal with, and the province's deep-seated socioeconomic problems, such high levels of poverty and restricted access to basic amenities, make it more vulnerable to the worsening consequences of climate change. Because of this pre-existing weakness, even small changes in the weather can have disproportionately bad effects. This is because the region doesn't have the basic resilience—such as strong infrastructure, a diverse economy, and good social services—to deal with these kinds of shocks. Because of this, effective solutions for Balochistan must go beyond climate-specific measures and take a more comprehensive strategy that addresses these long-standing socioeconomic and infrastructure problems at the same time. To really make the province and its people more resilient to climate change, they need to build up their basic skills and abilities instead of just reacting to climatic problems.This huge difference, where a region has very little to do with global greenhouse gas emissions but has to deal with a lot of their effects, highlights a major issue of climate justice. Pakistan's greenhouse gas emissions per person are much lower than the global average, but the country and Balochistan are nonetheless considered to be among the most vulnerable to climate change. When people don't have the same amount of responsibility and impact, it can make them feel very deprived and add to sociopolitical tensions in the province as communities deal with a crisis they didn't cause. This backdrop is very important for making policy suggestions. It shows how important it is morally and practically to get more international help, especially climate funding for adaption and resilience-building initiatives in places like Balochistan. It requires that national policies put fairness in resource distribution and development for vulnerable groups first (Khan, 2022).

Methodology

This analysis is based on a thorough look at the current literature, which includes academic research papers, policy papers, and news stories that can be trusted. The research focused on identifying and analyzing both climate-related and non-climate-related factors contributing to the water crisis in Balochistan, as well as their environmental, socioeconomic, and public health impacts. Data was synthesized to provide a holistic understanding of the crisis and to inform the proposed adaptation and mitigation strategies.

Results

The research revealed that Balochistan is grappling with a severe and interconnected climate change and water crisis, driven by both global climatic shifts and profound local non-climate factors.

Climate Change Trends: The province is experiencing significant temperature increases, more frequent and intense heatwaves (e.g., Turbat reaching 53.7°C in 2023), and erratic precipitation patterns leading to both severe droughts (e.g., 60% of the province affected between 2018-2021) and devastating flash floods (e.g., 500-700% above-normal rainfall in some districts in 2022). Snowfall has considerably decreased, and coastal areas face rising sea levels and increased cyclonic activity.

Water Crisis Manifestations: Balochistan faces acute water scarcity primarily due to rapid groundwater depletion, with the water table in Quetta plummeting by 3-5 meters annually and an

average depletion of 300 feet from 2010 to 2021. This is severely exacerbated by the uncontrolled proliferation of tube wells, which increased by 90% from 1993 to 2008. Surface water sources are unreliable, and a significant portion of the population (62%) lacks access to safe drinking water, contributing to over 58% of the province's land rapidly turning into desert.

Root Causes: The crisis stems from a combination of global climate change (driven by Greenhouse Gas emissions) and critical non-climate factors. Non-climate drivers include unsustainable water extraction practices, severe governance deficiencies and policy neglect , historical and ongoing unequal water allocation from the Indus River system (Balochistan receives a mere 3.66% of the national share), pervasive socioeconomic vulnerabilities , and extensive deforestation.

Comprehensive Effects: The crisis has devastating environmental impacts, including regular siltation of small dams, accelerated desertification, increased evaporation rates, and saltwater intrusion along the coast. Socioeconomically, it has led to the collapse of agriculture (e.g., 40% crop yield reduction in some districts in 2022) and livestock (shepherds losing half their herds), increased food insecurity, exacerbated poverty, and triggered climate-induced migration, fueling sociopolitical tensions and insurgency. Public health is severely affected by rising heat-related illnesses, rampant malnutrition (35% of child deaths in Pakistan linked to malnutrition, higher in Balochistan), and increasing waterborne diseases (e.g., 282 deaths in Dera Bugti due to contaminated water in 2022), with children's education also suffering as they drop out to help families survive, rovinces, acknowledging their unique burden in the face of a global crisis.
Climate Change Impacts and Trends in Balochistan

Balochistan is experiencing profound climatic shifts, characterized by escalating temperatures, erratic precipitation, and an increased frequency of extreme weather events, all of which underscore the province's heightened vulnerability to climate change.

Temperature Anomalies and Extreme Heatwaves
The province has experienced a marked increase in the frequency and intensity of heatwaves in recent decades, moving beyond traditional temperature norms. Summer temperatures regularly exceed 50°C (122°F) in areas such as Sibi and Turbat, with Turbat recording a scorching 53.7°C in 2023, making it one of the hottest years on record. Climate change has dramatically increased the likelihood of such severe heatwaves, which are now expected to occur every 3 years, a stark contrast to their historical frequency of once every 312 years without climate change. The number of warm days (above 40°C) has surged from a historical average of 15-20 days per year to 40-50 days per year. These scorching conditions significantly amplify evaporation rates, leading to the rapid drying out of already scarce water resources. Pakistan's projected temperature increase is anticipated to be higher than the global average, with northern parts of the country experiencing even more pronounced increases (Rahman, 2024).

Erratic Precipitation Patterns: Floods and Prolonged Droughts
The province is witnessing significant increases in the frequency and severity of extreme weather events, including unprecedented monsoon rains. This erratic precipitation leads to a dual challenge: regular siltation and overflow of small dams during intense rainfall, and prolonged droughts during dry spells. Since 2000, drought frequency in Balochistan has surged, a trend consistent with global warming's exacerbation of dry spells in semi-arid regions. The 2022

monsoon season exemplified this variability, with districts like Lasbela and Jhal Magsi recording 500-700% above-normal rainfall, resulting in devastating floods. Conversely, other areas experienced a drastic reduction, receiving only 1-2 irregular spells annually. Between 2018 and 2021, drought conditions impacted over 60% of the province, with precipitation levels falling 30-50% below normal. Since 2013, annual rainfall has often been less than 50 millimeters, which is barely one-fourth of the usual amount (200-250 mm), solidifying Balochistan's status as one of the driest regions in Pakistan. Balochistan experiences four distinct types of drought: meteorological, agricultural, hydrological, and socio-economic, each with varying intensities. The province's geographical location within a global "heat surplus zone" further amplifies its vulnerability to these extreme weather events (Jamro, 2020). The observed climatic shifts in Balochistan do not merely indicate a linear trend towards aridity or increased heat, but rather a dangerous "new normal" characterized by amplified and often contradictory extremes. Periods of intense, unexpected downpours, such as the 500-700% above-normal rainfall in 2022, are juxtaposed with prolonged droughts and drastically reduced annual precipitation. This climatic variability creates a destructive feedback loop: extended dry spells deplete soil moisture and vegetation, leaving the land highly susceptible to erosion when subsequent heavy rains occur. Instead of recharging vital groundwater reserves, these intense, short-duration rainfall events often result in rapid surface runoff and devastating flash floods, which damage infrastructure and lead to siltation of dams. This, in turn, further diminishes the province's water storage capacity, exacerbating scarcity during subsequent dry periods and perpetuating a cycle of climatic chaos. Adaptation strategies must therefore be significantly more sophisticated and robust than traditional approaches, designed to simultaneously manage both ends of the extreme weather spectrum preparing for prolonged aridity while also developing effective systems for capturing, storing, and managing sudden, intense floodwaters. This necessitates integrated water management approaches that recognize and plan for this heightened unpredictability (Naz, 2020).

Other Climatic Shifts

Snowfall has considerably decreased compared to historical records and previous years, impacting a natural source of water recharge. Balochistan has a long coastline that makes up around 70% of Pakistan's entire coastline. This makes it more vulnerable to increasing sea levels, which can cause more cyclonic activity and saltwater to seep into groundwater sources. There have been several powerful cyclones in the area, namely Gonu (2006), Yemyin (2007), and Phet (2010). The glaciers in northern Pakistan are melting, which is a major water source for Balochistan downstream. This could lead to new disasters including floods and landslides. The problems facing Balochistan go beyond local issues and show how complicated the area is interdependent. The mention of glaciers melting in northern Pakistan, which is a major water source for Balochistan downstream and could cause new disasters, shows that the province's water situation is closely connected to changes in climate that are happening hundreds of kilometers away in the upstream Indus Basin. In the same way, Balochistan's long coastline is at risk from rising sea levels and saltwater getting into groundwater. This shows how global climate events have immediate effects on the environment and people's lives, hurting fisheries and coastal ecosystems. Solutions for Balochistan cannot be confined to provincial boundaries; they demand a national, integrated water management strategy that explicitly accounts for upstream-downstream dynamics within the broader Indus River system. This also reinforces the need for international cooperation and climate finance, as some of the most significant impacts on Balochistan originate from global climate patterns and regional hydrological changes beyond its direct control (Ashraf, 2021).

Table 2.1: Key Climate Change Indicators and Observed Trends in Balochistan

Indicator	Observed Trend/Current State	Specific Data Points/Examples	Source Snippet IDs
Average Annual Temperature Anomaly	Pakistan's projected: temperature increase is expected to be higher than global average.	Northern parts expected higher increase.	
Frequency of Extreme Heat Days (>40°C)	Increased significantly.	From 15-20 days/year historically to 40-50 days/year.	
Summer High Temperatures	Regularly exceeding 50°C.	Turbat hit 53.7°C in 2023.	
Likelihood of Severe Heatwaves	Increased 100 times.	Expected every 3 years now, historically once every 312 years.	
Annual Rainfall Deviation from Normal	Highly erratic, significant variability.	500-700% above normal in Lasbela/Jhal Magsi (2022 monsoon); 1-2 irregular spells annually in other areas.	
Annual Rainfall Amount	Drastically reduced.	Less than 50 mm annually since 2013 (barely one-fourth of usual 200-250 mm).	
Drought Frequency/Severity	Surged since 2000; affecting >60% of province (2018-2021).	Four types of drought (meteorological, agricultural, hydrological, socio-economic).	
Flood Frequency/Severity	Significant increase in frequency and severity of extreme weather events.	Devastating floods in 2022 monsoon season.	
Snowfall Trends	Considerably decreased.	Compared to historical records and previous years.	
Cyclonic Activity	Increased frequency of strong cyclones.	Gonu (2006), Yemyin (2007), Phet (2010).	
Sea Level Rise along Coastline	Rising.	1.1mm annually along Karachi's coast.	

The Severity and Manifestations of Balochistan's Water Crisis

Balochistan faces an acute water crisis, characterized by rapid groundwater depletion, severe surface water scarcity, and systemic failures in water infrastructure and management.

Groundwater Depletion Rates and Specific Examples

The groundwater table in Balochistan is experiencing a daily and alarming decline, leading to a steady decrease in overall water availability across the province. Over 80% of Balochistan's water supply is derived from sources highly vulnerable to climate variability, including erratic rainfall, seasonal streams, and aquifers, which are being rapidly depleted by overuse and insufficient replenishment. Decades of excessive water extraction, primarily for agriculture, coupled with minimal natural recharge, have severely drained the province's aquifers. The proliferation of thousands of unchecked tube wells is extracting water at an unsustainable and devastating pace. In Quetta, the provincial capital, the water table is plummeting by an average of 3 meters (approximately 10 feet) annually, a rate that risks total depletion within a decade. From 2010 to 2021, Quetta experienced an average groundwater depletion of 300 feet. The number of tube wells extracting water in the province surged from 15,525 in 1993 to approximately 34,000 in 2008, representing a staggering 90% increase over 15 years. Unplanned solar tube well installations and indiscriminate pumping contribute to groundwater depletion rates exceeding 4-5 meters yearly in many areas, leading to the widespread drying of existing tube wells. The iconic Hanna Lake, a vital water body in Balochistan, has shrunk by 40% since 2000, serving as a stark symbol of the broader ecological collapse and water crisis. . Because of this depletion, people in Quetta depend on water tankers for their daily needs. About 80% of the population gets its water from a "tanker mafia" that runs about 2,000 tankers (Khan S. N., 2022). The unregulated growth of tube wells makes the already alarming rate of groundwater depletion in Balochistan much worse. For example, the water table in Quetta drops by 3 meters every year, and the rates in the rest of the province drop by 4 to 5 meters every year. The number of these wells grew exponentially, from 15,525 in 1993 to almost 34,000 in 2008. This shows that people are using a shared, limited resource in a way that can't be sustained. This is a classic example of the "tragedy of the commons," when people take water without enough rules or thought for how it would affect everyone in the long term. They do this to meet their own short-term demands for farming or living. The absence of effective governance and collective management allows for indiscriminate pumping, leading to the rapid depletion of the common groundwater pool for all users. The emergence of an informal "tanker mafia" supplying water to a significant portion of Quetta's population further highlights how this unregulated scarcity creates exploitative economies that operate outside formal governance structures. The water crisis in Balochistan is thus not merely a problem of physical scarcity; it is fundamentally a crisis of governance and resource management. Solutions must therefore move beyond technical fixes to include robust regulatory frameworks, strict enforcement mechanisms, and the promotion of community-based management models that incentivize sustainable collective action (Khan & Aslam, 2022).

Surface Water Scarcity and Reliance on Unreliable Sources

Balochistan's water supply heavily depends on erratic rainfall and dwindling groundwater reserves, given its limited natural river systems. Unlike other provinces, Balochistan lacks major canals to channel water to its arid lands, forcing farmers to rely predominantly on tube wells and highly unpredictable rainwater. Existing dam infrastructure, such as the Nari Bank Dam, Bolan Dam, and Mola Dam, has proven largely ineffective due to a combination of inadequate water control mechanisms and dilapidated infrastructure.

Access to Safe Drinking Water and Desertification Trends

A significant portion of the population, 62%, lacks access to safe drinking water, exacerbating public health risks. More than 58% of Balochistan's land is rapidly transforming into desert due to

severe water shortages, indicating widespread land degradation. The scarcity and contamination of water sources directly contribute to disease outbreaks, as evidenced by 28 deaths in Dera Bugti in 2022 attributed to contaminated water, followed by outbreaks of cholera and other epidemic diseases.

Ineffective Water Infrastructure and Management Failures

The province critically lacks the necessary infrastructure for effective water storage and comprehensive disaster management, leaving it vulnerable to both droughts and floods. The Kechi Canal project, an Rs. 80 billion initiative announced in 2013 to irrigate 713,000 acres, remains incomplete a decade later due to pervasive corruption and bureaucratic delays. Furthermore, two-thirds of its intended benefits were allocated to Punjab, and one-third of the land to retired army personnel, largely excluding the local Baloch population. Even though money was set aside for building dams in places like Dera Bugti, not a single dam has been finished in the last five years. This means that rainwater has caused damage instead of being put to good use. The province's current irrigation systems only work 45% of the time, mostly because of bad management, not enough care for water channels, and the fact that they still use old, ineffective methods like flooding. The Kechi Canal, which is still not finished, and the fact that current dams aren't working as well as they should be are just two examples of how important water infrastructure projects are failing and taking too long. Instead, they are strong signs of bigger problems that are caused by widespread corruption, bureaucratic apathy, and a basic failure of government. The fact that money set aside for building dams hasn't led to finished projects, which means that rainwater is causing damage instead of being used, shows a serious lack of planning, implementation, and oversight. Also, the unfair distribution of gains from projects like the Kechi Canal, which mostly left out the indigenous Baloch people, shows a trend of political marginalization and unfair resource distribution. These problems with infrastructure are signs of a bigger problem with accountability and political commitment. This means that building new infrastructure alone won't fix Balochistan's water situation. These kinds of investments need to go hand in hand with major changes in how the government works, strong ways to hold people accountable, and a promise to share resources fairly. The physical effects of the water crisis are profoundly based in political and administrative failings. This means that institutional transformation is necessary for any long-term solution (Makki, 2025).

Root Causes: Interplay of Climate and Non-Climate Factors

Balochistan's water crisis is a complex outcome of both global climate-related drivers and critical non-climate-related factors that collectively exacerbate the region's vulnerability.

Climate-Related Drivers

The observed global trend of climate change is evident across almost every region of Balochistan, manifesting in altered environmental processes and human activity. The primary driver is the global increase in Greenhouse Gas (GHG) emissions (carbon dioxide, methane, nitrous oxide, etc.) resulting from human activities, particularly industrial development and excessive fossil fuel consumption since the 18th century, leading to the warming of the Earth and its oceans. Rising atmospheric carbon dioxide levels contribute to increasing sea surface temperatures and disrupt global hydrological cycles, affecting precipitation patterns and coastal areas in Balochistan. Pakistan's projected temperature increase is expected to be higher than the global average, with northern parts of the country experiencing even more significant warming. Balochistan's geographical location within a global "heat surplus zone" inherently makes it more vulnerable to

extreme weather events. Projections from the IPCC Sixth Assessment Report for South Asia indicate that heatwaves and humid heat stress will become more intense and frequent, and both annual and summer monsoon rainfall will increase, albeit with greater year-to-year variation.

Non-Climate-Related Drivers

Unsustainable Water Extraction

The widespread and unchecked proliferation of tube wells, particularly solar-powered ones, is a major contributor to groundwater depletion. Unplanned installations and indiscriminate pumping have led to groundwater tables depleting at rates of more than 4-5 meters annually. The number of tube wells dramatically increased from 15,525 in 1993 to approximately 34,000 in 2008, demonstrating an unsustainable extraction trend. Historically, water has been perceived as a "free cost and vulnerable source", leading to a lack of conservation practices and regulation.

Governance Deficiencies, Policy Neglect, and Mismanagement

Poor governance is identified as the core issue hindering the implementation of effective solutions. Negligence from government bodies, law enforcement authorities, and civil society organizations is cited as a fundamental reason for water scarcity. Uncertain political timelines and a lack of policy continuity from one government to the next impede long-term water management reforms. Inadequate planning, poor institutional coordination, and the absence of effective land and water governance mechanisms contribute significantly to the crisis. Weak enforcement of existing legislation exacerbates aquifer depletion and water quality degradation. The province lags in adopting modern, climate-smart agricultural methods, unlike regions such as Punjab, which have implemented drip irrigation.

Unequal Water Allocation and Political Economy Dynamics

Balochistan, despite comprising 44% of Pakistan's land area, receives a mere 3.66% of the nation's water share from the Indus River system—the smallest allocation among all provinces, and even this meager share is often not fully provided. The extensive canal system fed by the Indus River primarily irrigates agricultural lands in Punjab and Sindh, effectively excluding Balochistan from this vital resource. Powerful "elite interests tied to water-intensive agriculture" actively resist and "stymie the reforms necessary" to address structural fault lines in the political economy of water. Pakistan's ongoing reliance on water-intensive commodities like cotton for exports keeps the problem going because they use a lot of water but don't bring in much money. This neglect of the economy and lack of political representation have led to the "water war" and a widespread "sense of deprivation" among the people of Balochistan. The Balochistan Liberation Army (BLA) and other separatist groups use the story that the central government steals the province's resources and leaves its people in poverty. Climate change makes this story even stronger. The unfair distribution of advantages from initiatives like the Kechi Canal project makes this even more clear (Magsi, 2023).

The study makes it very clear that Balochistan's water crisis isn't just caused by natural dryness or climate change; it's a problem that has been going on for a long time in the province's political economy. The clear mention of "elite interests tied to water-intensive agriculture" actively "stymie[ing] necessary reforms" shows that powerful vested interests gain from the current situation, even if it means taking too much water and making the crisis worse for most people. The "colonial Canal and Drainage Act (1873)" was written in a time when the law was unfair and out

of date, and it still affects how water is distributed today. Balochistan's disproportionately small share of national water resources (3.66% for 44% of land area), and the skewed allocation of benefits from projects like the Kechi Canal, are direct indicators of political marginalization and a lack of equitable resource distribution at the national level. This systemic neglect and perceived injustice fuel the "sense of deprivation" and provide fertile ground for separatist narratives, transforming water from a mere resource into a profound source of political grievance and potential conflict. Technical and scientific solutions alone will be insufficient if the underlying power structures, political will, and historical injustices in water allocation and governance are not fundamentally addressed. The crisis is as much about who controls and benefits from water as it is about its physical availability; sustainable solutions require a political commitment to equity and justice (Rahman & Hamza, 2024).

Socioeconomic Vulnerabilities and Lack of Awareness

The combination of poverty, limited access to education, and inadequate healthcare services significantly reduces the population's capacity to adapt to climate extremes. A heightened reliance on natural resources, coupled with limited technological capabilities and financial resources, renders communities highly susceptible to environmental degradation and poverty. . People don't know enough about water scarcity, which leads to unsustainable practices. Water problems are worse since many people don't know how to save water or how to use high-efficiency irrigation technologies. Pakistan's population is growing quickly, especially in Balochistan, which puts a lot of stress on the already limited water supply. In Balochistan, socioeconomic weaknesses and environmentally harmful behaviors feed off of each other in a negative feedback loop. The widespread problems of poverty, restricted access to education, and poor healthcare facilities are made worse by a general lack of knowledge about water shortage and how to save it. This lack of information and skills leads to actions like using too much water and letting tube wells grow out of control, which speeds up the depletion of groundwater and deforestation. This damage to the environment makes poverty worse because it destroys the natural resources that most people's jobs depend on, especially farming and raising livestock. The accompanying economic suffering makes it even harder for people and communities to invest in sustainable practices, adopt new technology, or adapt well to the growing effects of climate change. This keeps the cycle of vulnerability and environmental decline going. A truly holistic approach to the water crisis must integrate significant investments in human capital development, including widespread public awareness campaigns, environmental education, and community empowerment initiatives. Without addressing these socioeconomic root causes, which perpetuate unsustainable resource use and hinder adaptive capacity, even the most technically sound water management solutions are unlikely to achieve long-term success (Ali, 2022).

Deforestation and Environmental Degradation

Deforestation, primarily driven by illegal logging, has drastically reduced forest cover to a mere 2.5% of the province's total area, accelerating desertification and reducing the land's capacity for water retention and ecological resilience.

Table 4.1: Comparative Analysis of Water Allocation and Usage in Balochistan

Metric	Balochistan Data	Comparative Data (if available)	Source Snippet IDs

Share of National Water Allocation from Indus River System	3.66% (smallest among provinces)	Punjab, Sindh, Khyber Pakhtunkhwa combined receive larger shares.
Proportion of Pakistan's Total Land Area	~44%	Largest province by land area.
Groundwater Depletion Rate (Annual)	Quetta: 3-5 meters/year; Provincial: >4-5 meters/year.	Risks total depletion in Quetta within a decade.
Number of Active Tube Wells	15,525 (1993) to ~34,000 (2008); ~500+ solar tube wells in Washuk.	90% increase over 15 years.
Percentage of Population Lacking Safe Drinking Water	62%	-
Agricultural Sector's Share of Total Water Use	95% (Pakistan-wide figure, highly relevant for Balochistan's agriculture-dependent economy)	Household Use: 2%; Industry: 3%.
Irrigation System Efficiency	~45%	Due to poor management and traditional methods.

Comprehensive Effects of the Crisis on Balochistan

The intertwined climate change and water crisis in Balochistan has led to far-reaching and devastating environmental, socioeconomic, and public health consequences, exacting a profound human and ecological toll.

Environmental Impacts

Unprecedented monsoon rains and floods lead to regular siltation of small dams, reducing their storage capacity and effectiveness. More than 58% of Balochistan's land is rapidly undergoing desertification due to severe water shortages, indicating widespread ecological degradation. Scorching heat amplifies evaporation rates, rapidly drying out what little surface and groundwater remains. The significant shrinkage of Hanna Lake (40% since 2000) symbolizes broader ecological collapse within the province. Rising sea levels along the coastline lead to saltwater intrusion into freshwater aquifers, severely affecting coastal ecosystems, fisheries, and the livelihoods of coastal communities. Deforestation, primarily driven by illegal logging, has reduced forest cover to a mere 2.5% of the province, accelerating desertification and diminishing natural carbon sinks and water retention capabilities. The loss of vegetation coupled with a decline in animal fodder from agricultural sources has devastating effects on rangelands and livestock.

Socioeconomic Impacts

Devastation of Agriculture and Livestock

Farming, the fundamental backbone of rural livelihoods in Balochistan, is on the verge of collapse. Drought conditions in 2022 alone slashed crop yields by nearly 40% in some districts. The crisis leads to reduced agricultural production and changes in the suitability of land for crop cultivation. Livestock, a crucial pillar of the local economy and cultural identity for pastoral communities, perish in vast numbers during heatwaves and droughts due to dwindling grazing areas and scarce water. Shepherds in the province have reported losing as much as half their herds in a single season. Animals become malnourished, many perish, and others are sold at distressingly low prices, leading to significant financial losses for families. The decline in crop yields and livestock losses directly increases food insecurity, pushing families into deeper poverty. Balochistan is identified as the most vulnerable province in Pakistan in terms of water and food shortage (Naz, 2020).

Exacerbation of Poverty and Livelihood Losses

The crisis pushes families into deeper food insecurity and exacerbates existing poverty. Poverty in Balochistan is predominantly rural, directly driven by limited water resources and a severe lack of off-farm employment opportunities. Climate change poses a serious threat to poverty reduction efforts, potentially undoing decades of development gains. Many individuals and families have lost their primary livelihoods, forcing them to sell assets (like livestock) at very low prices. The crisis has also led to a significant reduction in employment opportunities, particularly in the agricultural sector. Climate-related disasters have already displaced 8 million people across Pakistan and caused an estimated $30 billion in economic losses.

Climate-Induced Migration and Sociopolitical Tensions

The severe shortage of water, coupled with food insecurity, health risks, and increasing energy demand, is projected to result in significant climate-induced migration. Such large-scale migration to adjacent provinces would create serious sociopolitical issues, potentially leading to widespread social unrest. Examples include sons moving to cities like Karachi to find work and fishermen considering abandoning their traditional livelihoods due to reduced fish stocks. Many pastoralists and rural communities have been left with no option but to migrate in search of water and pasture. As droughts and heatwaves devastate livelihoods, resentment festers among the population, potentially turning desperation into militancy. The existing insurgency and the pervasive "sense of deprivation" in Balochistan are rooted in decades of economic neglect, political marginalization, and mismanagement of development projects, all of which are amplified by the climate crisis. The environmental and resource crisis in Balochistan acts as a significant "threat multiplier," exacerbating existing sociopolitical fragilities and driving potential instability. The severe water shortages, coupled with food insecurity and health risks, are projected to induce substantial climate-induced migration, which could create serious sociopolitical issues and lead to widespread social unrest. More critically, as "droughts and heatwaves devastate livelihoods, resentment festers, turning desperation into militancy". This establishes a clear causal chain where environmental stress acts as a multiplier, amplifying existing grievances and potentially fueling conflict. The long-standing insurgency and pervasive sense of deprivation in Balochistan, rooted in decades of economic neglect and political marginalization, are profoundly amplified by the escalating climate crisis, creating a perilous feedback loop where environmental stress contributes to social instability, and instability, in turn, impedes effective environmental management. Addressing the climate and water crisis in Balochistan is not merely a development or

humanitarian imperative; it is a critical strategic necessity for national security and stability within Pakistan. Ignoring these environmental stressors risks further destabilization, internal displacement, and potentially escalating internal conflicts, with broader regional implications (Makki, 2025).

Public Health Impacts

Rising temperatures have led to a significant increase in heat-related illnesses. Heat stress is particularly dangerous for vulnerable groups, including the elderly, outdoor laborers (e.g., construction workers, farmers), and pregnant women. Malnutrition is rampant due to widespread crop failures and food shortages, compounding an already fragile public health situation. UNICEF reports that approximately 35% of child deaths in Pakistan are related to malnutrition, and about 60% are linked to poor water and sanitation conditions, with Balochistan's ratio being even higher. Water-related infectious diseases, such as malaria, dengue fever, chikungunya, typhoid, and cholera, are increasing due to climate variability affecting water resources and quality. Contaminated water sources directly lead to disease outbreaks, as tragically demonstrated by 28 deaths in Dera Bugti in 2022 due to contaminated water. Children are forced to drop out of school to help their families cope with survival, sacrificing their future prospects to the ongoing crisis.

A profound intergenerational injustice is unfolding in Balochistan, as the current climate and water crisis directly erodes the future potential of its population. The tragic reality of children dropping out of school to assist their families in the struggle for survival means their futures are being sacrificed to a crisis they did not create. This not only means losing people, but it also keeps poverty and underdevelopment going from one generation to the next. The crisis is also hurting the health of vulnerable groups, especially women and children, more than others. This shows how the crisis is hurting the basic foundations of future societal well-being and productivity. The current use of unsustainable resource extraction effectively "borrows" from future generations, making their lives worse and giving them less chances. Long-term planning must be a big part of sustainable solutions that actively protect the future of the population. This means making big, long-term investments in education, health care, and a wide range of jobs that are robust to climate change. Balochistan is in danger of being stuck in a never-ending state of catastrophe, where each generation has to deal, and has fewer possibilities than the last more difficult than the last (Jamro, 2020).

Table 5.1: Quantifiable Socio-Economic and Health Impacts of the Crisis

Impact Area	Specific Metric/Observation	Quantifiable Data	Source Snippet IDs
Agriculture	Crop Yield Reduction	Nearly 40% crop yield slashed in some districts (2022 drought).	
Livestock	Livestock Mortality Rate	Shepherds lost half their herds in a single season. Animals malnourished, many perished.	
Food Security	Food Insecurity Incidence	Increased due to declining crop yields and livestock losses. Balochistan most vulnerable province for food shortage.	

Poverty/Livelihoods	Exacerbation of Poverty	Rural poverty driven by limited water resources. Loss of primary livelihoods, assets sold at low prices.
Public Health	% Population Lacking Safe Drinking Water	62% of population lacks access to safe drinking water.
Public Health	Child Mortality (Water/Malnutrition Related)	35% of child deaths in Pakistan related to malnutrition; 60% linked to poor water/sanitation (Balochistan ratio higher).
Public Health	Heat-Related Illness Incidence	Significant increase in heat-related illnesses.
Public Health	Disease Outbreaks	28 deaths in Dera Bugti (2022) due to contaminated water, followed by cholera outbreaks.
Migration/ Displacement	Number of Displaced Persons (Pakistan-wide)	8 million people displaced by climate-related disasters.
Economic Losses (Pakistan-wide)	Economic Losses from Climate Disasters	$30 billion in economic losses.

Adaptation Strategies, Mitigation Efforts, and Policy Recommendations

To solve Balochistan's complicated climate and water crisis, we need to use a variety of methods, including present programs, new ideas, and long-term changes to policy.

Current Initiatives

Balochistan Integrated Water Resources Management (IWRM) Policy

The Balochistan government has officially announced the IWRM initiative, which was made possible with important technical help from the Food and Agriculture Organization (FAO) of the United Nations. The World Bank is giving money to this project as part of the Balochistan Integrated Water Resources Management and Development Project. The new IWRM policy and the Balochistan Water Resources Management bill together create an important legal framework that will improve the capacity of institutions, combine surface and groundwater management, and encourage gender-inclusive water governance. It aspires for a comprehensive approach to solving difficult problems with water governance, which is a big step forward for sustainable and inclusive water governance. The policy is based on the idea that water is a limited and fragile resource that is especially vulnerable to the effects of climate change. It supports the main ideas of sustainability, fairness, and integration. It calls for immediate action to stop groundwater depletion, deal with saltwater intrusion in irrigated regions, and use nature-based alternatives for managing water. The policy gives local communities and institutions the power to take an active role in water governance, using their deep understanding of local water resources and needs. This is in line with the concepts of subsidiarity and decentralization. It stresses adaptive management and ongoing

learning, encouraging a flexible and iterative approach to implementation that lets changes be made quickly in response to changing situations and new problems. The policy looks at all the different things that affect water supplies, such as climate change, population increase, agricultural needs, industrial and mining needs, and environmental concerns. It emphasizes how important it is for everyone to work together, recognizing water as a basic human right and working to make sure that everyone has fair access to it (Rahman M. U., 2024).

The recent announcement of the Balochistan Integrated Water Resources Management (IWRM) Policy, which was created with help from the FAO, is an important "roadmap" and "milestone" for sustainable water governance. However, its ultimate effectiveness depends on how well it is put into action. The policy paper itself says, "Policies are only as good as their implementation." This remark hits home with the problems of "poor governance" and "lack of policy continuity" that have long plagued development efforts in Balochistan. The ongoing delays and failures of major infrastructure projects, like the unfinished Kechi Canal, are strong reminders that even the best plans can be thrown off course by deep-rooted systemic problems, such as powerful elite interests that may resist reforms and weak enforcement of laws. So, the problem isn't only coming up with all-encompassing answers; it's also getting past the deep political, bureaucratic, and social-economic barriers that stand in the way of making them happen. The IWRM Policy and other efforts will be more successful if they can find a way around and break down these long-standing problems than if they are well-designed. Future efforts must prioritize robust implementation mechanisms, including strong accountability frameworks, transparent resource allocation, and a concerted effort to overcome political resistance and bureaucratic inertia (Jamro, 2020).

FAO-Supported Projects

Beyond the IWRM project, the FAO has launched the Building Resilience and Addressing Vulnerabilities to Emergencies (BRAVE) initiative, simultaneously implemented in Sindh, Balochistan, and Punjab. BRAVE is funded by the UK's Foreign, Commonwealth and Development Office (FCDO) and is implemented through a collaborative partnership involving IOM, FAO, UNICEF, CARE International, ACTED, and Islamic Relief. The initiative is projected to benefit 60 villages across three districts, reaching approximately 9,000 households per district. An Extended Technical Working Group has been established under BRAVE to drive climate-resilient interventions across a diverse range of sectors, including agriculture, livestock, rangelands, forestry, renewable energy, and aquaculture.

Proposed Strategies

Sustainable Water Management Practices

Rainwater harvesting is identified as crucial for agricultural development, especially in rain-fed areas where water scarcity is a major problem. This involves capturing intense, brief rainfalls that often lead to runoff and soil loss, to provide supplementary irrigation during dry seasons. There is an urgent need for everyone to become "water conscious" and act quickly to conserve water. Desalination plants are proposed as potential "game-changers" for water supply, particularly in coastal areas. Promoting and scaling up efficient irrigation methods like drip irrigation, which has shown success in boosting water efficiency in other regions, is essential. Sustainable utilization of recycled wastewater for cleaning, washing, and other non-potable uses can significantly decrease the demand for potable water. Lining water channels with bricks, as successfully initiated in Punjab, can substantially reduce water wastage. Implementing policies to shift from low-value,

high-water-demanding crops (e.g., sugarcane) to high-value, low-water-demanding crops (e.g., sunflowers) is also recommended. Exploring and improving direct air capture technology for greenhouse gas mitigation is crucial to address the root cause of climate change.

Infrastructure Development and Modernization

Prioritizing the completion of stalled projects like the Kechi Canal and building new dams, reservoirs, and canals to effectively harness rainwater and surface runoff is critical. Increasing upstream storage capacity through the construction of both large and mini dams is also necessary. Developing more green spaces, heat-resistant infrastructure, and early warning systems for extreme weather events will enhance resilience. Ensuring robust infrastructure and effective governance are in place to manage water resources efficiently is paramount. Augmenting public funding for critical water infrastructure development is also a key recommendation.

Strengthening Governance, Institutional Capacity, and Legal Frameworks

The government needs to make smart and useful choices about how to manage water. The Balochistan Water Resources Management law is a key aspect of the IWRM framework that will help set up a good legal framework. It is important to make the current plans for managing water, treating it, and running the government better. It is suggested that Pakistan create a long-term water sector development strategy (WSDS) or a comprehensive "Water Vision" to help with long-term management of water resources. It is also important to make changes to the constitution and encourage cooperation between the public and commercial sectors at the federal, provincial, and local levels. It is vital to go back and change old laws, such the colonial Canal and Drainage Act (1873), to make sure that everyone pays the same amount of tax on the water they use. It's really important to set up clear policies and trustworthy ways to govern. Better water management will also come from making institutions stronger and fixing problems with the current laws.

Community Engagement, Public Awareness, and Capacity Building

It's vital to start big public awareness efforts, educational programs, and research projects about water scarcity and conservation. It is also a good idea to encourage people to get involved in their communities and set up forums for sharing knowledge to spread best practices. It will be helpful to use big media campaigns and village-to-village extension services to get new irrigation methods and technologies to farmers. To stop farmers from wasting water when it is scarce, it is important to teach them through awareness campaigns and demonstrations. It is also important to make farm households more adaptable so they can deal with the effects of climate change. Helping the people in the area become more resilient and less affected by droughts would also help the overall resilience.

Inter-Provincial Water Allocation Reforms and Climate Justice Advocacy

Making sure that Balochistan gets its fair share of water from the Indus River system is very important. We also need to fix how water is used inefficiently and how it is unevenly distributed between provinces to stop social and political unrest and cut down on water waste. It is very important to do a full evaluation to make sure that all users get a fair share of water, especially for irrigation. It is also necessary to seek and make use of international collaboration and help to lessen the effects of climate change and make sure that water is safe for long-term growth. Setting up cooperative research centers, maybe with nations like China, to come up with crops and irrigation methods that use less water is another way to help (Naz, 2020).

Because Balochistan's climate and water situation is so complicated, we need to find solutions that involve many different sectors and work together. The IWRM policy's broad framework and the BRAVE initiative's focus on "climate-resilient interventions across agriculture, livestock, rangelands, forestry, renewable energy, and aquaculture" show that the problem can't be solved by only looking at one part of it. The crisis has profound connections to the environment, society, economy, and politics. This means that actions taken in one area will always have impacts on other areas. A fragmented or compartmentalized approach, like only building dams and without dealing with groundwater depletion or governance difficulties, is not likely to work in the long term. This broad vision shows how important it is to have a "whole of government" and "whole of nation" strategy that encourages deep collaboration and coordination across sectors. In this case, we shouldn't think of water security as a separate issue. Instead, it should be seen as a key part of long-term stability and sustainable development.

Table 6.1: Key Policy Recommendations and Responsible Stakeholders for Implementation

Policy Area/ Recommendation	Specific Action/Strategy	Key Stakeholders	Expected Outcome/Impact	Source Snippet IDs
Water Governance Reform	Full implementation of IWRM Policy & Balochistan Water Resources Management bill.	Federal Government (Ministry of Water Resources, Ministry of Climate Change), Provincial Government of Balochistan (Irrigation Dept., PDMA), FAO, World Bank, Local Communities.	Enhanced Water Security, Integrated Surface & Groundwater Management, Gender-Inclusive Governance, Reduced Corruption.	
Sustainable Water Management Practices	Promotion of Rainwater Harvesting, Drip Irrigation, Wastewater Recycling, Desalination.	Provincial Government (Irrigation Dept.), Farmers, Local Communities, Academia, Private Sector.	Increased Water Efficiency, Reduced Water Waste, Diversified Water Sources, Sustainable Agriculture.	
Infrastructure Development & Modernization	Completion of Kechi Canal, Building new dams/reservoirs, Heat-resistant infrastructure.	Federal & Provincial Governments, World Bank, International Lenders.	Increased Water Storage Capacity, Reduced Flood Damage, Improved Irrigation, Climate-Resilient Urban Planning.	

Community Capacity Building	Public Awareness Campaigns, Environmental Education, Farmer Training on Modern Techniques.	Provincial Government (PDMA), NGOs (CARE, ACTED, Islamic Relief), Academia, Local Communities, Farmers.	Increased Adaptive Capacity, Reduced Unsustainable Practices, Improved Livelihoods, Enhanced Community Resilience.
Inter-Provincial Water Equity & Climate Justice	Reform of Water Allocation Laws (e.g., Indus River System),Advocacy for	Federal Government (Ministry of Water Resources), Provincial	Equitable Resource Distribution, Reduced Sociopolitical
Policy Area/ Recommendation	Specific Action/Strategy	Key Stakeholders	Expected Outcome/Impact
	Equitable Share for Balochistan.	Governments, International Community.	Tensions, Enhanced National Cohesion.
Livelihood Diversification & Food Security	Climate-resilient interventions in agriculture, livestock, rangelands, forestry, aquaculture.	FAO, UK FCDO, IOM, UNICEF, CARE International, ACTED, Islamic Relief, Local Communities.	Improved Food Resilience, Diversified Livelihoods, Reduced Poverty, Decreased Climate-Induced Migration.

Conclusion:

The analysis presented underscores the profound urgency and multi-faceted nature of the climate change and water crisis in Balochistan. The province doesn't add much to global greenhouse gas emissions, but it is disproportionately affected by rising temperatures, unpredictable rainfall, and severe weather events. This stress on the climate is made worse by deep-seated non-climate variables such unsustainable groundwater exploitation, systemic flaws in governance, and unfair historical water allocation. The combination of these factors has caused terrible damage to the environment, the end of conventional ways of making a living, worsening poverty, and serious public health concerns, all of which have forced people to move because of climate change and made political tensions worse. The problems are big and hard to solve, but the report's ideas for developing long-term resilience and making sure the province has enough water are realistic and fair. The recent announcement of the Balochistan Integrated Water Resources Management (IWRM) Policy and the start of FAO-supported projects like BRAVE are important steps ahead since they give people a plan and a legal basis for action. However, the success of these programs depends on how well they are put into action, which means getting beyond long-standing political, bureaucratic, and social-economic problems. To make Balochistan's water supply safe and strong, there has to be ongoing political will, strong accountability systems, and a basic commitment to

fair resource distribution at both the provincial and national levels. It needs a change in thinking toward integrated water management that takes into account how environmental, social, economic, and political factors are all connected. Also, to promote sustainable behaviors and build adaptive skills from the ground up, we need to make big investments in developing human capital, such as raising public awareness, teaching people about the environment, and giving communities greater authority. The crisis is scary, but it also gives us a chance to make big changes. Balochistan may advance toward a more stable, prosperous, and sustainable future for its vulnerable people by taking decisive and well-governed initiatives now.

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