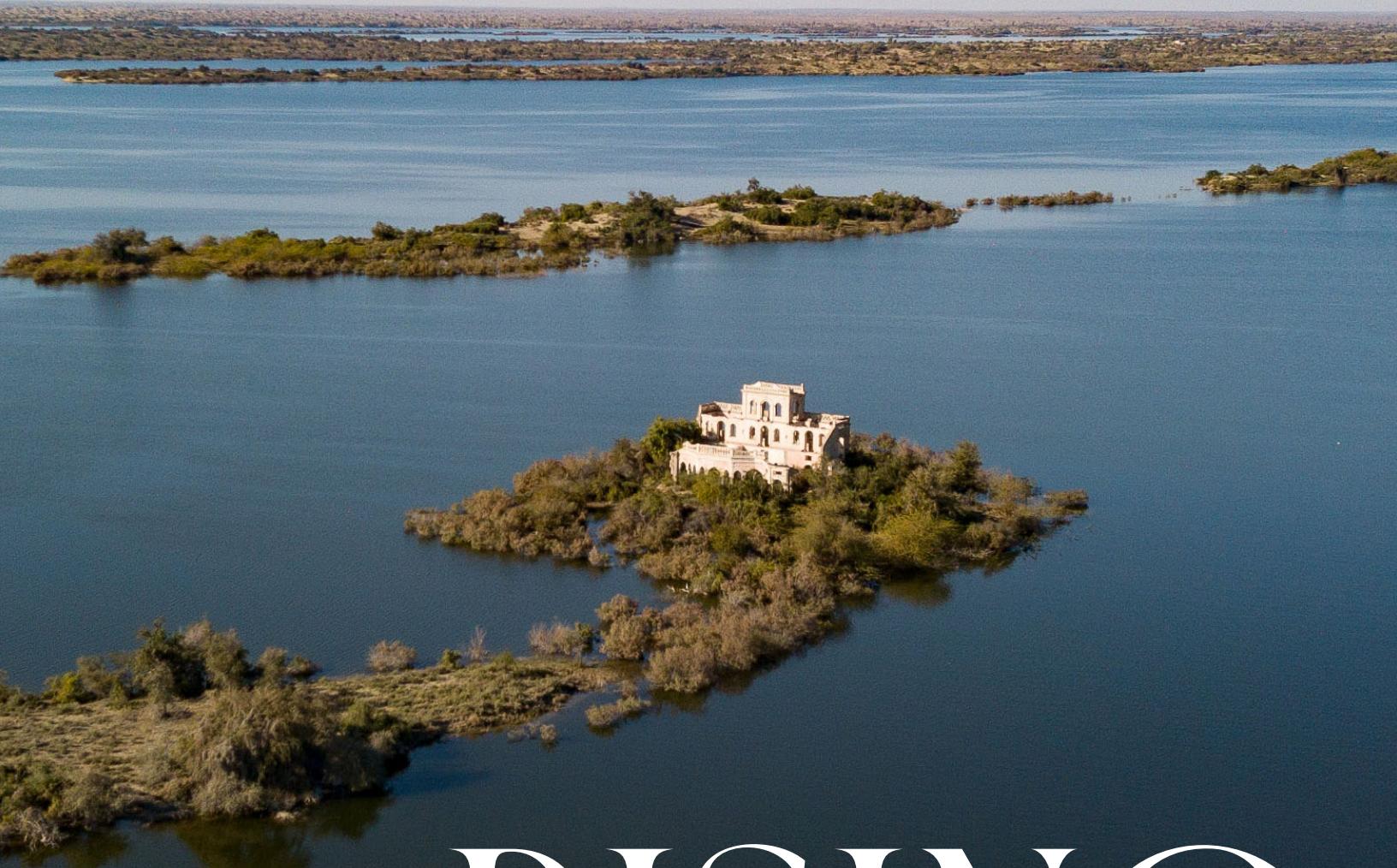




# Natura

A quarterly magazine of WWF-Pakistan

Vol 51, issue 4, 2025



RISING  
ABOVE THE RISK

# EDITORIAL



Pakistan's landscapes, from the towering peaks in the north to the fertile plains in the south, have always shaped the lives of its people. This year, they have also reminded us, with stark clarity, of the mounting challenges of a changing climate. Floods, glacial lake outbursts, droughts, and extreme heat have tested communities, infrastructure, and ecosystems alike. Yet, amid the devastation, there remains a persistent thread of hope: the knowledge that solutions exist, and that action can make a difference.

In this edition of *Natura*, *Rising Above the Risk*, we explore Pakistan's climate realities, the science behind disaster risk, and the pathways to resilience. From analytical perspectives on the 2025 monsoon floods to forward-looking strategies like nature-based solutions, community-led adaptation, and climate-smart governance, this issue reflects the urgent need to prepare, not just respond. We feature the *Pakistan Climate Crises Charter*, outlining actionable steps for building resilience, alongside in-depth insights from experts on water, forests, wildlife, and air quality.

While the year has brought undeniable loss, it has also underscored our capacity to rise above risk when knowledge, planning, and community action converge. Every policy refined, forest restored, river protected, and community empowered is a reminder that resilience is possible. As we turn the page to a new year, the message is clear: preparation, foresight, and collaboration with nature are our strongest allies in facing the climate challenges ahead.

*By Shahgan Hummayoun Butt, Coordinator - Digital and Brand, WWF-Pakistan*



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# CLIMATE EXTREMES AND THE 2025 MONSOON FLOODS IN PAKISTAN IMPACTS, CHALLENGES, AND THE PATH TO RESILIENCE



*By Dr Imran Azam*  
*Manager Community Water Stewardship and Replenishment,*  
*WWF-Pakistan*



Climate change, driven largely by greenhouse gas emissions and human activities, has become one of Pakistan's most pressing challenges. Shifts in climate patterns are now evident across the country, with rising temperatures and changing rainfall regimes contributing both to prolonged droughts and increasingly severe flooding events. Recent climate modeling further shows that warming at global and regional scales is disrupting moisture dynamics, resulting in extended dry spells as well as more intense monsoon rainfall.

These changes are particularly severe in Pakistan's arid and semi-arid regions such as Balochistan, Sindh, and southern Punjab, where increased evapotranspiration and reduced soil moisture have escalated the frequency and severity of droughts.

***Morphing from meteorological into hydrological, and then into agricultural droughts, this phenomenon threatens agricultural productivity, biodiversity, and groundwater sustainability, especially within the lower Indus basin.***

At the same time, Pakistan continues to experience a rise in extreme precipitation events, which trigger flash floods, soil erosion, and land degradation, particularly in northern regions and within the upper Indus basin. This increasing climate variability poses significant risks to water governance, food security, and sustainable development, placing Pakistan among the world's most climate-vulnerable countries.

The year 2025 offered another stark reminder. Eastern Punjab experienced catastrophic flooding, largely due to unusually high monsoon rainfall between August and early September across Indian Punjab and Pakistani Punjab. Torrential rains overwhelmed vast areas of Punjab, Khyber Pakhtunkhwa (KP), Sindh, Balochistan, and Azad Jammu and Kashmir.

On 26 August 2025, rainfall reached extreme levels - 538 mm in Udhampur, 310 mm in the Jammu and Samba districts of Kashmir, and 362.3 mm in Sialkot, Pakistan. Additionally, heavy precipitation in Himachal Pradesh forming the upper catchments of the Chenab, Ravi, and Sutlej rivers contributed significantly to downstream flooding.

***This year, the Pakistan Meteorological Department (PMD) and the National Disaster Management Authority (NDMA) issued multiple alerts for riverine floods and glacial lake outburst floods (GLOFs), particularly in the upper catchments of the Indus and Chenab rivers.***

Experts attribute these recurrent flood events to the accelerated hydrological cycle driven by climate change, which is increasing the frequency and intensity of extreme precipitation and monsoon variability across South Asia.

Punjab bore the brunt of the disaster, with around two million individuals affected, primarily due to direct rainfall and upstream reservoir discharges. According to a damage assessment by the provincial disaster management authority, more than 2.5 million acres of land was inundated. In KP, heavy rainfall in mid-August triggered flash floods and landslides in mountainous districts such as Swat and Buner, resulting in substantial human and infrastructural losses

The scale of devastation recorded in the Intersector Coordination Group's Situation Report (2025) underscores the severity of Pakistan's climate vulnerabilities. Monsoon floods wreaked havoc across Punjab, KP, and Gilgit-Baltistan; submerging around 1.2 million acres of agricultural land in Punjab alone—spanning Sialkot, Narowal, Hafizabad, Gujrat, Chiniot, Jhang, Alipur, and Jalapur Peerwala. With rice, cotton, and sugarcane fields destroyed at the height of the Rabi crop preparation season, the impacts on food security are expected to reverberate for months.

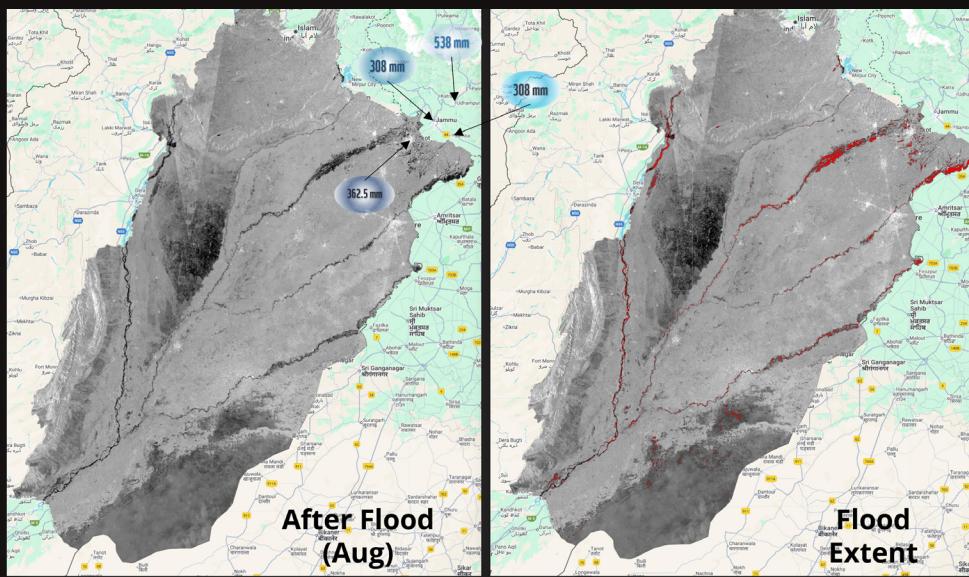


## **The economic toll on agriculture has already been estimated at USD 2 billion.**

Livestock losses, along with the destruction of fodder reserves, triggered distress sales and widespread disease outbreaks, intensifying pressure on farming communities and necessitating urgent vaccination drives. Beyond the agricultural sector, the floods damaged or destroyed over 229,760 homes, while schools and health facilities were rendered non-functional due to thick mud and contaminated water. Broken or polluted water pumps further curtailed access to safe drinking water, compounding public health risks. Displacement became widespread, with thousands forced to sleep outdoors with limited shelter.

***Stagnant floodwaters spurred outbreaks of cholera, diarrhea, typhoid, malaria, and dengue. Although mobile health units were deployed, damaged roads and disrupted connectivity restricted their reach.***

With food and fodder stocks washed away or contaminated, humanitarian food rations became the primary source of survival for many. This cascading chain of impacts highlights not only the scale of the 2025 monsoon disaster but also the urgent need for long-term resilience planning, improved disaster preparedness, and climate-smart governance across Pakistan.



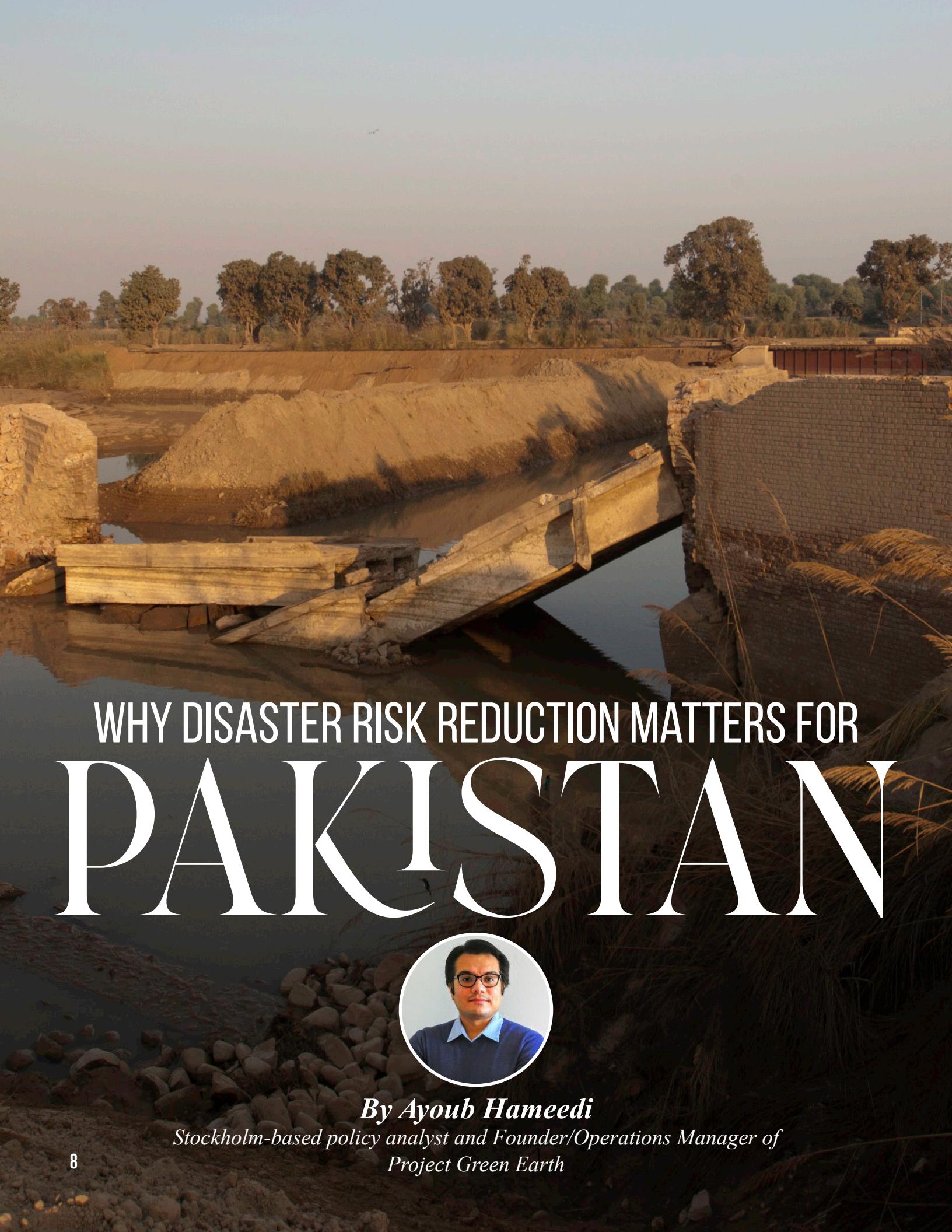
Red highlighted area along Ravi and Chenab river is showing the inundation due to the overflowing of nallah DEG; AIK; PALKU (District Sialkot), and BASSANTER, BEIAN (District Narowal) (credits: Usama Maqsood GIS Specialist WWF-Pakistan)



Building resilience to future climate-induced disasters will require Pakistan to rethink how it plans, manages, and safeguards its natural and built environments. As extreme weather events become more frequent and severe, long-term preparedness- not just emergency response- must guide national and provincial decision-making. The following strategic actions need urgent attention:

- Mainstreaming climate adaptation into national and provincial development plans, ensuring that ongoing and future projects are aligned with the National Climate Change Policy (2021) and National Adaptation Plan (2023). Also, implementing the National Water Policy (2018) by promoting water-efficient agriculture, encouraging rainwater harvesting, and supporting groundwater recharge initiatives. Further, enforcing the Floodplain Zoning Act to prevent new settlements and infrastructure in high-risk flood zones, drawing on successful global models such as the 'Room for the River' approach to help reduce exposure to flood hazards.
- Restoring wetlands, riverine forests, and natural flood buffers, especially through Nature-based Solutions (NbS) in urban and semi-urban areas to reduce runoff and enhance water retention. Scaling up afforestation efforts and integrating NbS/EbA into watershed management to improve soil stability, reduce erosion and support healthier ecosystems.
- Introducing and expanding crop insurance schemes, particularly in the most climate-vulnerable districts, as climate projections show that severe floods and droughts are likely to become more frequent and more disruptive. At the same time, promoting climate-smart agriculture and crop zoning to reduce vulnerability.
- Investing in multi-purpose water storages/reservoirs and improved drainage systems to manage excess water during heavy rainfall events.
- Building the capacity of District Disaster Management Authorities and local governments to ensure stronger, more decentralized preparedness and response and engaging communities in risk mapping, planning and post-disaster recovery efforts. Establishing community based early warning systems and conducting regular simulation exercises will also be crucial.
- Fostering public-private partnerships to scale up investment in climate adaptation and disaster risk reduction.





# WHY DISASTER RISK REDUCTION MATTERS FOR PAKISTAN



*By Ayoub Hameedi*

*Stockholm-based policy analyst and Founder/Operations Manager of  
Project Green Earth*

Pakistan has repeatedly faced the harsh realities of climate change. Since the turn of the 21st century, the nation has witnessed two catastrophic floods, first in 2010 and then in 2022. Both events swept across the country, leaving devastation in their wake, erasing years of development, and weakening the social fabric of our society. These disasters not only caused enormous financial losses but also damaged critical infrastructure, leaving Pakistan even more vulnerable to future crises.

The 2010 floods alone inflicted a staggering USD 9.7 billion in damage, according to the World Bank Group, double the cost of the 2005 earthquake. During the first decade of this century, natural disasters collectively caused over USD 14 billion in losses. The floods in 2010 added another USD 3.7 billion to the tally. Then came 2022, a year marked by Pakistan's worst flooding in history. GermanWatch reports that these floods caused USD 15 billion in damages, claimed 1,700 lives, and affected over 33 million people. On top of this, the nation required an additional USD 16 billion for reconstruction once the waters receded.

***Pakistan cannot afford to lose more precious lives, reverse development gains, or remain unprepared in the face of climate-induced disasters. We must learn from these events and take proactive measures to reduce the impact of future floods.***

One key step is constructing small, medium, and large-scale dams across the country. These would help harvest rainwater, increase surface water availability, and reduce the intensity of floods. Such infrastructure aligns with the goals of the SENDAI Framework, enabling better flood management, lowering the number of people affected, and reducing mortality rates. Improved water management would also protect critical infrastructure, boost industrial growth, increase agricultural productivity, enhance per capita water availability, and mitigate water scarcity. In urban areas, artificial lakes could help capture flash floods during the monsoon season, minimizing infrastructural damage.



The World Bank Group warns that by 2050, extreme climate events, environmental degradation, and air pollution could slice off 18–20 per cent of Pakistan's GDP each year. With 1 per cent of GDP equivalent to USD 1 billion, this translates to annual losses of USD 18–20 billion, or USD 36–40 billion if 1 per cent GDP equals USD 2 billion. Clearly, investing in disaster risk reduction is far more cost-effective than facing the consequences of inaction.

The WWF-Pakistan led 'Pakistan Climate Crises Charter 2022' emphasizes the urgent need for effective communication and coordination among federal, provincial, and district governments. Strengthening local governments is critical, as they are the frontline defenders against natural and climate-induced disasters. Nature-based solutions, such as wetland rehabilitation, reforestation, soil conservation, and floodwater management, must become integral to our infrastructure and development projects.

A climate-resilient Pakistan will require collective action—from national, regional, and local governments to each citizen. We are accountable to our children and future generations.

***The choice is ours: prepare proactively or face mounting losses. By acting now, we can build a Pakistan resilient enough to meet today's and tomorrow's climate challenges.***



# Reframing Flood Resilience

## Learning from the Past, Acting for the Future

Pakistan's growing vulnerability to floods is not only a result of changing climate patterns- it is also the outcome of years of unsustainable development choices. As cities expanded, natural drainage paths were built over, with little consideration for where water would go. Encroachments on floodplains, coupled with deforestation and the degradation of natural vegetation, have stripped away the country's natural flood defenses.

At the same time, poorly planned infrastructure has ignored the impact of the development of natural water flows, habitats, and entire ecosystems. This unbalanced approach to growth has led to long-term environmental harm- amplifying the effects of extreme weather events and leaving communities increasingly exposed to disasters.



# Charting a Way Forward

In the aftermath of the devastating floods of 2022, WWF-Pakistan reaffirmed its commitment to climate resilience through the launch of the Climate Crises Charter, a call for urgent, coordinated action at every level. The Charter outlines key priorities that Pakistan must collectively advance to prepare for future crises:



- Advocate internationally for loss and damage financing, ensuring that the most affected countries receive fair compensation and support for rebuilding.
- Strengthen institutional governance, with clearer coordination and communication between federal, provincial and district agencies.
- Reinforce local government systems, empowering them to manage climate induced disasters effectively.
- Map climate risks and vulnerabilities, particularly those related to infrastructure and its ability to withstand extreme weather.
- Mainstream local-level adaptation and integrate nature-based solutions within the national development paradigm.
- Prioritize disadvantaged and at-risk communities, ensuring inclusive and equitable resilience-building.
- Embed crisis response at the community level, strengthening preparedness and awareness.
- Address population management concerns, recognizing their link to urban sprawl, land degradation and environmental strain.



Scan the QR code to read the  
Pakistan Climate Crises Charter.

Since 1950, Pakistan has witnessed 19 major floods causing over 10,600 deaths and USD 30 billion in damages.



# 1992

## Northern Floods

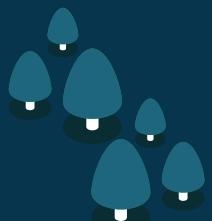
- 1,500 deaths
- USD 1 billion damages

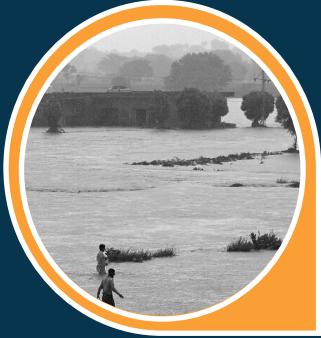


# 2010

## Super Flood

- 20 million affected
- 2,000 deaths
- 160,000 km<sup>2</sup> inundated
- USD 9.7 billion damages





# 2011

## Sindh Floods

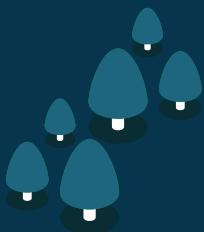
- 9.3 million affected
- 516 deaths
- Severe impact in Sindh's flat plains



# 2014

## Jhelum-Chenab Floods

- 2.5 million affected
- 300 deaths



# 2022

## Catastrophic Floods

- 33 million affected nationwide
- 1,700+ deaths
- USD 14.9 billion damages and USD 15.2 billion losses

# 2025

## Monsoon Floods



700+ deaths



Thousands displaced



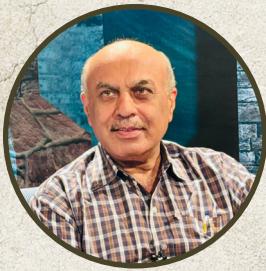
Severe damage in KP (Buner, Swat, Bajaur, Battagram, Mansehra, Shangla) & Gilgit-Baltistan



Roads, power lines, and infrastructure destroyed



# RETHINKING DISASTERS



## By Naseer Memon

Civil society professional

A stark reality that is grossly denied is that no disaster is purely natural. Even a cursory chiseling of any disaster event will reveal human hand below it. Rain falls from the sky but human interventions convert it into a disastrous flood. Earthquakes shake the earth but buildings kill people. Unless disasters are recognised as a result of human interference, the right remedies will remain elusive.

Pakistan experienced yet another calamitous monsoon this year. Malicious weather events in Gilgit Baltistan, Khyber Pakhtunkhwa and Punjab killed over 1,000 people and caused enormous damage to infrastructure, cropland and the assets of people. Local communities in the disaster areas attribute this catastrophe to a medley of human induced causes.

The mountains of Gilgit Baltistan and Buner have been deprived of their green cover through a brazen deforestation spread over decades. Consequently, any abnormal rain on mountains becomes a flash flood.

*With the removal of natural barrier to retard its pace, these flash floods have become horrendous as they roll down tons of boulders and massive rocky debris.*



The Forest Resources Assessment (FRA) 2020, categorised Pakistan as a low forest cover country with barely 4.7 per cent of its total land area under forest. Ironically, the annual rate of deforestation is reported to be between 0.7 per cent and 2 per cent, which is the highest in Asia. This vanishing forest cover has imperiled mountainous communities by exposing them to raging flows descending with enormous velocity. The flood affected areas of Gilgit Baltistan, Kashmir and Khyber Pakhtunkhwa are among the hot spots of worst deforestation areas of Pakistan. Research based on variations in forest cover maps in 2023 concluded that GB lost over 1,700 square kilometres of forest cover in two decades.

*The research revealed that Chilas subdivision witnessed the highest rate of deforestation when over 8,600 acres of forest vanished from the map between 2000 and 2010. Darel/Tangir and Astore ranked second and third. These areas faced the impact of the recent devastation.*

Another factor that aggravates the floods is our large population base and its unbridled growth. Pakistan's population has increased from 33 million at the time of its creation to near 250 million today. This tremendous population increase not only causes ever increasing emissions, but it also exerts stress on water, forests and other natural resources of the country. According to some estimates, Pakistan has a deficit of 1.2 million houses. With about 45 per cent of the population living below the poverty line, affording a house has become a nightmare for a large number of people.

*This constrains people to construct shabby structures near or inside rain nullahs, natural streams and floodplains. These communities often become victims of unanticipated flows revisiting their flow path that remained parched for several years.*



***Riverine communities traditionally lived in harmony with annually recurring floods. People living within flood plains (locally called katcha area) practiced seasonal post-flood agriculture at a subsistence scale.***

These communities would migrate to elevated places, e.g. such as embankments with the onset of monsoon season without any administrative campaigns for evacuation.

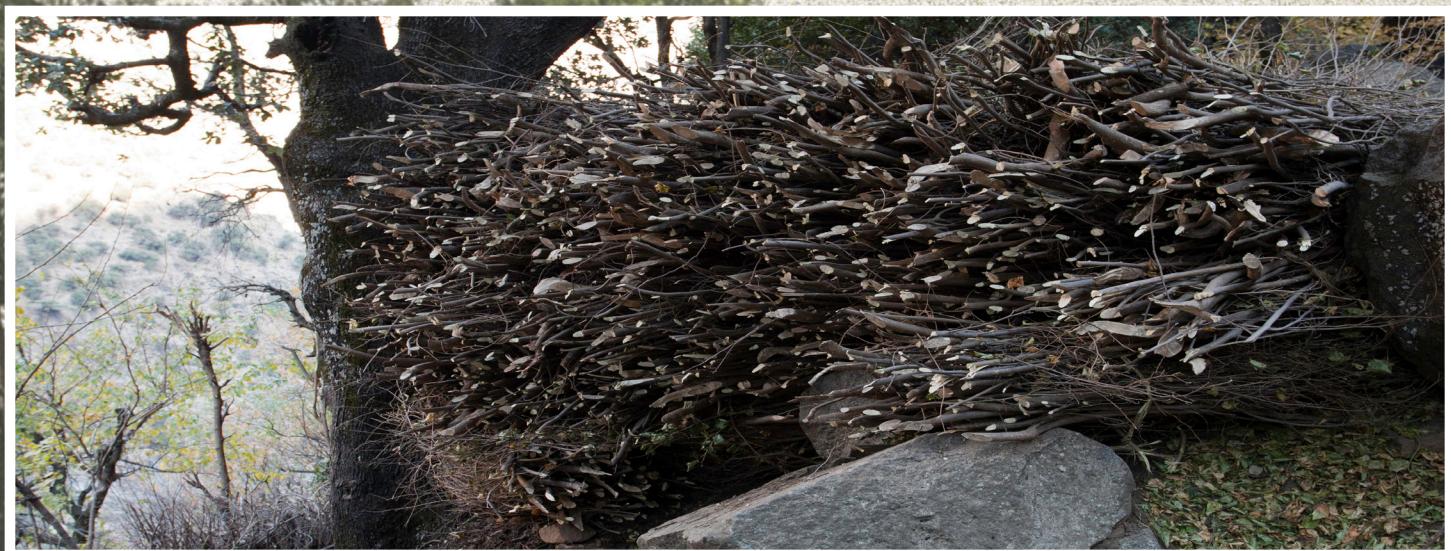
However, katcha has gone through a sea change over a recent decade. Subsistence agriculture is dwarfed by several times bigger commercial farming inside the riverbed. Huge embankments have been erected to protect vast cropped areas from river flows. This scale of agriculture has created new settlements of peasant communities that gradually extend to proper villages. The political clout has favored these flood plain communities with roads, electricity and other public infrastructure. Numerous such settlements have now encroached floodplains that have tempered with the river regime. These embankments, locally called zamindara bund succumb to heavy monsoon flows and result in displacement of thousands of families particularly when the water crosses high flood marks. In the tourist areas of GB and KP, multi-floor hotels, restaurants and guesthouses protrude into the river belly.

These structures are washed away by strong currents of summer flows. This year, parts of GB including Hunza witnessed tragic incidents involving several tourists who ignored weather warnings and could not be saved due to inadequate rescue services in a challenging terrain.

Most of the roads, housing societies, drainage schemes and agriculture land have been developed in a complete disregard of natural drainage created by natural flows over hundreds of thousands of years. Building infrastructure in such a reckless manner has blocked the gravity passage of rainwater causing urban flooding. Towns have been allowed to expand in all directions without any analysis of hydrologic data. These cities get inundated mainly due to the absence of land use planning and proper zoning.

Every disaster is a teacher. If we lack learning aptitude, it is our fault. Climate change is an irrefutable reality. However, using it as a shield to justify disasters will only heap more disasters on us. A rational approach demands careful analysis of such cataclysm.

***Constructing concrete structures will not fix our problems. Steel cannot replace natural green cover. Our flawed development paradigm merits honest introspection and corrective action that can restore natural balance. Tampering with nature will only cause disasters.***



# FLOOD RISK IN PAKISTAN: WHY FORESTS MATTER

Pakistan's forests remain under pressure from deforestation and degradation. Natural forest degradation, deforestation and land-cover transitions contribute to flood risk and damages. Satellite-based Global Forest Watch reports approximately 9,000–10,000 hectares of tree cover loss between 2001–2023, with recent years showing fire as an increasing driver. This is significant for Pakistan, given its low baseline forest cover.

## Main drivers of degradation:

fuelwood demand, illegal timber harvesting, overgrazing, expansion of agriculture, infrastructure projects, forest fires; accompanied by inappropriate and weak management planning and implementation with insufficient community participation.

Global and regional reviews show correlations between deforestation and increased flood frequency and magnitude, especially in steep, developing-country watersheds. Mechanisms include:



Increased surface runoff and peak discharges



Greater incidents of shallow landslides and debris flows



Sediment loads choking river channels

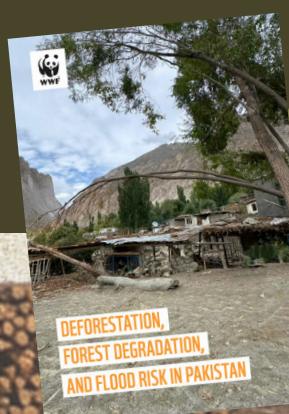


Loss of slope stability and water regulation functions

Deforestation plays a major role in increasing Pakistan's flood risks, but it isn't the only factor. The 2010, 2022 and 2025 floods, while primarily driven by extreme monsoon events, were amplified by land-use changes, sedimentation, and weakened watershed resilience. Climate change, absence of early-warning systems and vulnerability mapping, ill-preparedness, wrong development priorities, poorly planned infrastructure and the obstruction of natural waterways have also amplified the scale of disasters in recent years.

What's urgently needed is precautionary and science-based management of natural forest ecosystems in mountain headwaters. These forests play a vital role in protecting downstream communities, safeguarding fragile watersheds, and sustaining long-term ecosystem services.

Strengthening conservation and sustainable management, especially natural forests, requires empowering local communities, reducing poverty-driven dependence on forests, and improving management practices. This includes preparing and implementing modern working plans and management plans, supported by independent third-party validation and monitoring. Only through such combined efforts can we conserve forests while also minimizing the risks of devastating floods.



Scan the QR code to read  
WWF-Pakistan's report  
on Deforestation, Forest  
Degradation, and Flood Risk  
in Pakistan.

# BETWEEN FLOODS AND FORGETTING



*By Tariq Alexander Qaiser*  
*Published first in the Daily Times Pakistan*



## HISTORIES:

Some fifty million years ago tectonic plates crashed and the Himalayas were pushed upwards. The seabed transformed into still rising mountains. Ocean currents started circulating anew, and wind patterns changed. Warming waters caused increased moisture evaporation, with it precipitation of rain and snow. Glaciers formed. The Indus River System was born. The geography and climate of the subcontinent started evolving into the form we see today. This was about ten million years ago. Monsoons and the resulting flooding are an ancient phenomenon. Over millennia, climate systems have adjusted slowly, but a few times the change has been sudden, and catastrophic. Change is the only constant.

Our geologic era is called the Anthropocene. This is a period of massive, human escalated disruptions to Earth's climate and biodiversity. In the billion years of our planet's presence, this is the 6th episode of mass extinction. We live in an "existential crisis". The weight of these often used words needs to be deeply understood. These are profound times. The questions to be asked are: Will we as a species, people, respond to the impact of climate change appropriately? Is proportionate response even possible? The why and what, is also a critical query. The answers lie in working together in harmony with these powerful, natural forces, not in fighting them. But we humans seem focused on increasing the differences between ourselves.

We fight and are now starting to fight over water.

## HIS-STORIES:

Waters have been bureaucratised, commoditised, politicised, and weaponised. Dams have been built to collect, reserve or even deny water. It has been released in acts of preservation, or destruction. Historically men have poisoned wells. Today glacial melt, falling rain, mix with toxic effluent from human industry and callousness. In floods, the Delta at the end of the Indus receives these poisons in a form that is diluted. When the dry season arrives, untreated waste concentrates into a pungent, corrosive, toxic soup. It ends up as poison in the sea. We poison our own wells. Inland it is often allowed to leach, or in the case of water bottling plants, even pumped back into groundwaters and aquifers.

Some of these histories are recorded, most escape notice. Many pollutants persist. Synthetic, industrial, agricultural, chemical products, and agents tend to do so. But this was not always so. Histories are rewritten and stories are created. Markers of our destructive human presence and devastating environmental footprint are ignored; many are hidden.

## HER-STORIES:

Our cultures have had their origins in the once pure flow of these waters. Stories and legends have been told; mostly of strong women and some of men. Legends written of principle, of stance, of love, all are connected to these rivers. These waterways have carried our histories, our ancestral pain of passion. They carry now flows tainted by ourselves. All returns to where our mother river, the Indus, rests. This delta is where it returns to its roots. To where its journey begins once again.



## WEFT, WARP and the WOVEN:

Poetic words, perhaps obtuse, but in what manner should one describe the lifeline, the life blood of our very existence. This river has connected those high mountains, the productive plateaus, the fertile plains, and this alluvial delta. It was those silver threads, unraveled once, that spun together. They created the ancient Indus Valley Civilization. That weft and warp still connect us all. This is still an incredible woven tapestry.

### This is OUR home.

Will this fabric of us tear? Will the threads unravel? Will these rivers with or without waters eventually divide us? If the rivers die, do we? What shape will the future cultures born from these waters take? What form has our presence taken today? What will we create for tomorrow? And what will those who come after us make up what we leave behind? What form will the future cultures born off these waters take? What form has our present presence taken? What will those that come make of us? Histories of consequence and inequities are being witnessed nowadays. Will we hear His-stories, Her-stories or Histories? Can we write our own true story? I pray for and still do believe in that rudder and sail of self-determination. But only if held firmly by us will they help navigate today's turbid fluid flows.

It is important to understand where we came from. It is critical to question where we are heading. It is paramount to recognise the difference between the woven and the spun. What is the difference between a history and his-story? Our river assimilates, gathers all into a mainstream, into the once and still now, incredible Indus. This is our *rag-e-gar-dan* (jugular vein). It has been our people's home for thousands of years. It does divide, disintegrate, but only when it prepares to dissipate into the embrace of its mother, and the warmth of its ocean.





© Naveed Qamar

## THE WAY OF WATER:

There should be no doubt that our futures are deeply linked to the fate of these waters. Global warming will continue to cause glaciers to melt, seasonal rainfall to intensify, floods to occur regularly, and droughts to escalate. This is known, it is predictable and is currently inevitable. The river's gift has been the distribution and sharing of its waters. This is no longer a given. The land's gifts are these riverbeds, flood plains, fertile ground, and self-charging aquifers. These are treasures. Who should they be protected from? What is a given is that the water cycle will continue. Evaporation from the sea, precipitation patterns, and the formation of ice and snow will continue, but this will change. In Pakistan it will be to the immediate detriment of our communities. How many of us will be forced, or choose to move away?

What will visibly remain are the channels formed by nature. The laws of physics will still cause fluid to flow downhill. When the volume and velocity of flow is great, it will overflow into floodplains. If there is an obstruction that it can't move, it will redirect and erode whatever it can. This is the way of water.

If our constructions do not work with, and respect the elemental forces of nature, they will be damaged or destroyed. We are witnessing this. If some manmade concrete washes away, what of that? But if lives within suffer the pain of profound loss? Then there is much—much to object to—vociferously.

In the words of our national treasure Architect Arif Hassan sahib; from his article Reporting on floods: "The mapping of waterways is necessary" ... "Much of the floods have been the result of encroachments on waterways that have popped up on the paths of rivers and streams, thus blocking the natural flows" ... "...it becomes necessary to protect the land between the river and its floodplains, and develop forest, scrub, and alternative agriculture on it. This will reduce land available for real estate development. But this is what we require to create a happier and healthier, physical and social environment." Needless to say, we all must agree that a happier, healthier environment is a necessity.



## REAL ESTATE IN THE WAY OF WATER:

Keeping in mind the national interest, one of the least productive, least desirable, sub-optimal uses of land or water is for elite housing colonies. Residential development on arable lands is simply absurd. On floodplains, the sale of housing properties is an outright criminal act. And this is consistently being done. We need to respect the path water takes. It will flow in the channels it has created. That is a given fact of geography and gravity. This is a historical fact. These old waterways can be seen clearly in aerial photographs and satellite imagery. They are visible even in Martian topography. If this can be seen, then why build on riverbeds? Why build in our cities naaras (storm water channels)? Why do buyers purchase properties that are known to flood?

The developers and the marketing specialists don't suffer. The last buyer of that 'file' suffers. The people who aspire to live or work in these homes do suffer. Why do professional specialists, city planners, architects, engineers and developers believe so vehemently in "draining the swamp?" Lands that flood will keep flooding...

## HISTORY - SCIENCE and the NOT AS YET UNDERSTOOD:

The absolute truth is in the fact that human engineering still cannot subdue the greater forces of nature. The big question is: Should we as a species aspire to do so? Constructions, machines, pumps, work when the surge, and the quantum of control required, is limited and manageable. Our constructs can be effective only if we work with the laws of known and understood science. When our engineering interventions don't fight, but ride the wave of elemental surges of nature, only then can they be successful in the long term. I would like to mention a few interventions:



### 1- DAMS - Do they work?

Yes, only if the circumstances are correct. Three sides of high ground, a narrow, tall aperture; an opening that is dam-able. The water flow through turbines do generate power. The dam does create a reservoir, a storage of badly needed water. But for how long? How soon does the flooded valley silt up? This is not a rhetorical question. Our Tarbela Dam is a prime example of silting.



### 2- RECHARGE WELLS - Are they fashionable?

No. Do they work? Yes. Is the capital investment high? No. Are they installed quickly? Yes. Do they silt up quickly? No. Do they need sediment filtration? Yes. Are they high maintenance? No. Is this a long term solution? Yes. Is this the prime solution? No. Are they viable in flood plains? Absolutely YES. Are they a ridiculous alternative? Absolutely NO.



### 3- ANCIENT METHODS - Are they still in use?

Yes. Historical evidence of living and farming with reoccurring floods is present in our history—Mohenjodaro. The placing of villages and towns on higher ground is common sense and visible. Flood plain agriculture, rain cycle: Kharif and Rabi plantation is still practised. Karez, water distribution systems (subterranean water canals) existed but are dying out. They remain an incredible method of handling aquifer water in arid regions. Learning from indigenous knowledge of living sustainably is critical.

## **CUSTODIANS or COLONISERS:**

Our population growth requires us to be cognizant of the need for custodianship of Earth. This is especially true of land where we were born. Even if we do not live there anymore. Pakistan, obviously cannot bear the weight of the world. We do seem to regularly bear the brunt of so much of the fallout. However, a burden is a lesson. I would venture that this would depend on how one reacts and what one plans towards. We need to look after the asset that has spawned our ancient presence on this land. It is incumbent that we ensure the correct usage of its natural resources. This needs to be in the nations interest, not just to the benefit of institutions, corporations, groups or individuals.

To protect everyone's long term future, progress, productivity and development has to proceed without destroying ecosystems that sustain us. We have to add value to human lives. Uplifting of all, needs a long term view. We have to use land and resources wisely, judiciously, sustainably, creatively, and equitably. Without this, a praiseworthy culture cannot be created. As the population grows, we have to be sensitive to the fact that home grown resources will be required. Food security and trade-able industrial production require self-sufficiency in energy, raw materials and skilled human resource. Pakistan is still blessed with potential. I firmly believe this. But will we squander this window, this opportunity? The future requires knowledge (science) driven, nature-based solutions. The challenge is exciting.

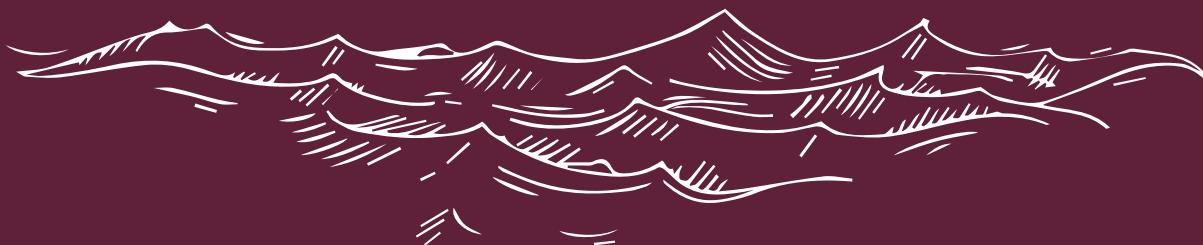
## **KNOWLEDGE, SCIENCE and and its QUEST:**

Richard Feynman the nuclear physicist who worked on the atomic bomb, defined science in a lecture to his students: "Science is the acceptable philosophy of ignorance". That is, the acceptance of not knowing enough about the laws of nature, of science, becomes a starting point. The not known guides the all important questions for understanding. This is a philosophical statement in the search for the truth ... I find the profoundness and humility of his words inspiring.

There is so much we still don't understand. But without the presence of questions and the availability of human minds trained and educated to seek answers, we might as well abdicate from determining our own future. Are we walking on this path of abdication? Education, seeking of knowledge, questioning, is paramount. To make informed decisions, then, this is how it has to be. The reminders to think, reflect, and contemplate are very frequent even in the Holy Quran. And then there is the injunction to walk gently on the Earth, to be custodians. And then there is the profound command of 'Iqra'- to read, learn, and seek knowledge.

Harmony with our ecosystem, balance with and understanding of the way of nature (science) is the only way forward. We must walk this path firmly, decisively, with humility, and with considerate gentle steps. This is true, not only in our relationship with nature but also in the way we treat all that is alive. Especially our own species.

Let us not forget the histories—written or spoken—of nature or of humankind. Will we? Can we? Or is there even a choice?



# BEYOND CONCRETE

A CONVERSATION WITH HAIDER RAZA,  
DIRECTOR NORTH AND NATURE-BASED SOLUTIONS  
AT WWF-PAKISTAN





## **Northern regions are both ecologically vital and highly vulnerable to floods. How would you describe the scale and nature of flood-related challenges in the areas?**

Northern Pakistan — including Gilgit-Baltistan (GB), Azad Jammu and Kashmir, and Khyber Pakhtunkhwa's (KP) mountain districts — faces severe flood risks driven by ecological fragility, climate extremes, and socioeconomic vulnerability. Over 40 per cent of Pakistan's population lives in flood-prone zones, with dense rural settlements along rivers.

Situated within the Hindu Kush-Karakoram-Himalaya (HKK) range, the region feeds major rivers like the Indus, Swat, and Jhelum, where glacial melt and intense monsoons cause recurrent flooding. Over 50 high-risk GLOF sites exist in GB, with recent outbursts in Hunza, Ghizer, and Chitral destroying infrastructure and displacing communities. Deforestation, unplanned urbanization, and encroachment on floodplains further reduce natural resilience, as seen in the 2025 Thak Niyat valley floods. Weak infrastructure and institutional gaps compound the threat. Without urgent reforms and better watershed management, escalating climate impacts will continue to endanger lives, livelihoods, and these ecologically vital mountain systems.

## **For decades, flood protection in Pakistan has largely relied on hard infrastructure. Why is there now a growing emphasis on Nature-based Solutions, and what advantages do they offer compared to traditional methods?**

Pakistan's growing focus on Nature-based Solutions (NbS) reflects a shift from relying solely on 'grey infrastructure' like dams and levees, which have proved inadequate under intensifying climate impacts such as the 2022 floods that displaced 33 million people.

NbS work with natural systems to enhance resilience, restore ecosystems, and support communities. They are adaptive, cost-effective, and multifunctional — for example, mangrove restoration protects coastal areas at a lower cost than seawalls while boosting fisheries and biodiversity. In the north, conserving Himalayan forests improves watershed health, reduces erosion, and curbs downstream flooding. Beyond flood control, NbS store carbon, create green jobs, and support livelihoods through practices like agroforestry in floodplains. By combining ecological restoration with community well-being, they offer a sustainable, long-term approach to flood management in Pakistan.

## How can natural systems, such as forests, wetlands, and floodplains, act as protective buffers against floods? What makes them more sustainable in the long run?

Natural systems like forests, wetlands, and floodplains act as natural buffers by absorbing, storing, and slowing floodwaters — functions that make them more adaptive and sustainable than rigid infrastructure. Forests enhance soil infiltration through their roots, stabilize riverbanks, and reduce surface runoff, while upland forests delay water flow, lessening downstream flooding. Wetlands function as sponges, storing excess rain and stormwater; peatlands slow water velocity and trap sediments; and coastal wetlands such as mangroves and salt marshes dissipate wave energy, protecting shorelines.

Unlike engineered structures, these ecosystems adapt and regenerate over time. Wetlands can rise with increasing water levels, forests naturally regrow, and all these systems improve water quality through natural filtration. Their ability to evolve with climate change and deliver multiple co-benefits makes them a long-term, cost-effective solution for flood resilience.

## What kind of scientific understanding or data is needed to design and implement effective NbS for flood risk reduction, especially in mountainous regions like Gilgit-Baltistan?

Designing effective NbS for flood risk reduction in mountainous regions like GB requires a multidisciplinary scientific approach that addresses complex environmental and socio-climatic dynamics. Key data include:

- **Hydrology and meteorology:** Historical and real-time river flows, peak discharges, sediment transport, snowpack accumulation, and glacial retreat.
- **Topography and geology:** Satellite-derived slope maps to identify landslide-prone areas, and soil characteristics (infiltration, texture, erodibility) for interventions like check dams or terracing.
- **Land use and ecosystems:** Landcover mapping to prioritize reforestation or protect natural buffers, ecological and biodiversity baselines, and ecosystem service assessments.
- **Climate and risk modelling:** Climate projections and flood simulations to anticipate extreme events and identify vulnerable communities.

Integrating these data ensures NbS are strategically placed, ecologically sustainable, and effective at reducing flood risks.

## What have been some flagship initiatives of WWF-Pakistan demonstrating how NbS can strengthen disaster resilience?

WWF-Pakistan has implemented flagship NbS in GB that demonstrate how ecological restoration can strengthen disaster resilience.

This includes the restoration of natural drainage pathways in Astak valley. This initiative benefits communities in Shanu, Rejing, and Tukla, who rely on agriculture and livestock. Between 2007 and 2023, frequent floods caused annual household losses of around PKR 150,000 by inundating crops, orchards, and social forestry. The 2010 floods alone claimed 1,700 lives in KP and displaced 20 million people, while recurring floods and landslides continue to damage over 50,000 homes annually. WWF cleared boulder-filled drainage pathways and built stone diversion walls at vulnerable points, effectively channeling floods into the main nullah. This intervention protected agricultural fields, orchards, and households while also resolving a long-standing social conflict between Rejing and Shanu over village boundaries.

Similarly, an erosion control structure on the Shyroke riverbank in Kharkoo addressed severe riverbank erosion that had destroyed thousands of hectares of social forestry and farmland. WWF constructed a protective stone wall and replanted indigenous species to restore ecosystem integrity and safeguard livelihoods. This NbS reclaimed 26.6 hectares and protected 30 hectares of land, enabling communities to resume cultivation and securing food and livelihood resources.

These initiatives illustrate how NbS can combine disaster risk reduction, ecosystem restoration and community resilience.

## Under the Water Resource Accountability in Pakistan programme, WWF-Pakistan and FCDO have implemented water and resilience-focused interventions. Could you share how these efforts have contributed to improved water management and community preparedness in the region?

Under the WRAP programme, WWF-Pakistan and FCDO have implemented a range of water and climate-resilience interventions across Gilgit-Baltistan and Khyber Pakhtunkhwa, significantly improving community preparedness and water management in both regions.

Across GB and KP, the programme supported the rehabilitation of traditional irrigation channels, construction and repair of silt traps, installation of drinking-water pipe networks, and the establishment of gravel-based filtration units for schools and community clusters. These improvements strengthened water security, reduced contamination risks, and enhanced irrigation efficiency for farming households.

To ensure sustainability, Water User Groups (WUGs) were formed and capacitated in multiple communities, enabling equitable water distribution, transparent decision-making, and better dispute resolution. This has reduced long-standing tensions around water use and improved overall governance at the local level.

In many areas, such as Marapi village in Gilgit, where damaged channels previously caused acute water shortages, crop loss, and repeated conflicts, rehabilitation efforts, including stone pitching and protective bunds, restored consistent water flow and revived agricultural productivity. Together, these interventions have increased resilience, improved access to safe water, and empowered communities across GB and KP to manage their water resources more effectively.

## **Beyond reducing disaster risk, how do NbS approaches benefit local communities in terms of livelihoods, water security, and ecosystem restoration?**

Nature-based Solutions (NbS) provide local communities with multiple benefits beyond disaster risk reduction, including livelihoods, water security, and ecosystem restoration.

NbS create jobs through reforestation, wetland rehabilitation, agroforestry, eco-tourism, and fisheries. Resilient agricultural practices, like conservation agriculture and agroforestry, improve crop yields, soil fertility, and climate resilience. Community-led projects such as urban gardens and rainwater harvesting empower marginalized groups through skill development and inclusive decision-making.

Forests and wetlands act as natural reservoirs, regulating hydrological cycles, reducing sedimentation, and enhancing groundwater recharge. Restored floodplains and rainwater harvesting capture excess rainfall and store it for dry periods, stabilizing freshwater access. Riparian buffers and constructed wetlands also improve water quality by filtering pollutants.

NbS revive habitats like mangroves, coral reefs, and grasslands, supporting native species and ecological balance. Agroecological practices combat erosion and desertification, while large-scale afforestation and peatland restoration enhance carbon sinks, improve air quality, and regulate microclimates.

## **What steps are needed to scale up NbS at a national level? How can policies and planning frameworks better reflect the role of ecosystems in disaster management?**

Scaling up NbS nationally and integrating ecosystems into disaster management requires coordinated action across policy, planning, finance, and communities. This begins with explicit national frameworks—supported by quantitative targets such as restoring 20 per cent of degraded ecosystems by 2030—and mandatory inclusion of NbS in urban, agricultural, and forestry plans. Disaster risk reduction policies must also be updated to treat mangroves, forests, and wetlands as critical infrastructure, with corresponding revisions to building codes and land-use regulations.

Alignment across national, provincial, and local governments is essential. This includes training planners and policymakers in NbS design, monitoring, and integration, and establishing national repositories to share best practices.

Financing must follow suit: redirecting infrastructure budgets, mobilizing climate finance, and offering tax incentives for private-sector investment, with funding tied to measurable outcomes such as biodiversity improvements or reduced flood losses.

Finally, NbS should be paired with traditional infrastructure for cost-effective resilience, grounded in meaningful participation of local and marginalized communities, and strengthened through partnerships with academia, government, and civil society. Geospatial tools can further support planning by mapping ecosystems and modelling their disaster-mitigation benefits.

# ALCHORI STANDS STRONG

## NATURE-BASED SOLUTIONS IN ACTION

*By Shahgan Hummayoun Butt  
Coordinator Communications, WWF-Pakistan*

This year, floods once again swept through Alchori in Shigar district, Gilgit-Baltistan, but the story was different from the past. Around 100 kanal of land were affected, one hotel sustained damage, and 50 trees were lost. By and large, the community was able to withstand the floods with minimal disruption to their lives and livelihoods.

Back in 2020, however, the floods were devastating. Two households were completely lost, 220 kanal of land were damaged, one water storage tank destroyed, ten cattle sheds swept away, 1,200 ft of water channels washed out, and 2,500 trees uprooted. The scale of destruction highlighted the urgent need for sustainable, long-term solutions to protect Alchori from recurring flood risks.

The turning point came with the construction of a gabion protection bund, completed on 31 March 2024. This simple yet highly effective wall of stones and wire mesh became the community's shield against floods. By slowing down the water flow, reducing soil erosion, and diverting excess water, the gabion bund protected both lives and land. During the 2025 floods, floodwaters were contained, and the land immediately behind the protected area remained completely unaffected. This example is a clear demonstration of the power of Nature-based Solutions (NbS). By working with natural systems rather than against them, communities can build resilience, safeguard resources, and reduce disaster risks. When we invest in nature, nature invests in us.

Alchori's story is one of hope and learning. Even in the face of extreme events, a simple, well-planned intervention like the gabion bund can make all the difference, protecting forests, farmland, and livelihoods while showing that sustainable solutions are not just possible but also essential.



See restoration in action



# UNSEEN VICTIMS



## WILDLIFE IN THE SHADOW OF PAKISTAN'S FLOODS



*By Dr Uzma Khan*

*Global River Dolphin Rivers Initiative - Asia Lead, WWF*



This year's floods unfolded differently from the previous disasters, marked by a sudden and faster escalation, record breaking rainfall, and a stronger imprint of climate change. Punjab faced the heaviest blow, ~5.1 million affected, 1.9 million evacuated; while Sindh struggled with expanding urban flooding.

***The drivers were multiple and interlinked: intense short bursts of rain, accelerated glacial melt from the north, and large-scale dam releases magnified downstream flooding.***

While earlier floods were very catastrophic, this year's event has been more complex in cause; swifter in onset, and wider in reach, pushing millions into crisis across Punjab and Sindh.

Beyond the human tragedy lies a quieter crisis for wildlife. Endangered species were swept up in the waters. The Punjab Forest, Wildlife and Fisheries Department has a newly formed wildlife force of 552 rangers, and as a woman I am extremely proud to mention it comprises 123 women, leading rescue efforts.

***This team of rangers have saved over 50 animals; hog deer, sambar deer, pangolins, blue bulls, pythons, and other displaced animals, some of which came through the transboundary waterflows from India; even rescued lions from the private facilities near the Ravi.***



We can be certain that many burrowing wildlife species such as snakes and small mammals, and feral dogs and cats remain unaccounted for, likely lost to the floods. The Indus river dolphin faces particular peril, as rising waters drive them into irrigation canals where they get stranded as the water level drops.

***The Sindh Wildlife Department leads the rescue efforts of these stranded dolphins when the water recedes.***

We will know the exact numbers of strandings when the floods pass and dry season begins- that is when it is easier to locate the dolphins.

***Past experiences, such as in 2010, show that eight dolphins were rescued from the water channels within the agricultural fields, and following the flood, 48 Indus river dolphin carcasses were found. This is a huge number considering that the entire population of the species is only about 2,000!***

It reminds us that the impacts on wildlife often surface long after the floods subside, through habitat loss, shifts in livelihoods such as increased reliance on fishing when crops and livestock are destroyed.

While climate change is making floods increasingly unpredictable and destructive, it is important to remember that natural flood cycles also play a vital role in renewal. Seasonal flooding recharges wetlands, sustains riverine forests, and replenishes habitats for species such as hog deer, freshwater turtles, and migratory waterfowl. Floodwater also brings nutrients to our mangroves and supports fisheries that many communities depend on. The real challenge is balancing risk with resilience.

***While Pakistan's National Disaster Management Authority has already projected 22 per cent higher rainfall in 2026, there is still time to act.***

Protecting floodplains and riverine forests from encroachment and restoring natural connections between rivers and their lakes are powerful, nature-based solutions that avoid the heavy costs of engineered flood defenses. These natural buffers absorb shocks, store water for communities, and at the same time provide lifelines for turtles, waterfowl, and countless freshwater species.

***Encroachments, whether through illegal settlements or sanctioned leases around wetlands and forests urgently need to be rethought. Riverine forests are not empty land; they are natural shields, buffering communities against flash floods and cloudbursts that are only intensifying under climate change.***





A strong example comes from China's Yangtze river, home to the critically endangered Yangtze finless porpoise. By restoring the oxbow lakes, such as Poyang and Dongting lakes, China created safe floodwater spillways that is a thriving habitat. In the 2022 survey, the porpoise population stood at 1,249, with 492 individuals living in Poyang and 162 in Dongting. There are more porpoises in these two lakes combined than the Yangtze river mainstream.

***Depending on water levels, Poyang lake expands from 500 to 4,000 square kilometres, illustrating how floodplain restoration can simultaneously protect people and revive ecosystems.***

In urban areas, however, rivers have been reduced to open drains, choked with untreated domestic sewage and industrial waste. In Karachi, the Lyari and Malir rivers have carried the heaviest loads of rubbish in the recent floods. Instead of restoring these rivers, there is a perception that floods flush these 'drains', sadly they are not even referred to as rivers anymore. Ironically, this 'flushing' carries solid waste and toxins near a 'Marine Protected Area' and pollutes the turtle nesting beaches. Therefore, urgent efforts are required to clean the beaches. Industrial effluents from the Korangi industrial area further polluted the outflow, turning seasonal floods into environmental hazards as the impact of pollutants are slow to develop and need monitoring.

Equally important is tackling the cascading health risks: stagnant waters breed disease vectors and flood-borne pathogens can spread rapidly between livestock and wildlife. Some deadly viruses and bacteria can survive after too. For example the anthrax bacterium can form spores and survive, while the hand, foot and mouth virus can survive for weeks in water which provides a vehicle for local spread, especially if animals drink from or wade through it.

***Vigilant monitoring, vaccination programmes, and cross-sector preparedness will be essential to protect both people and ecosystems.***

# AIR POLLUTION IS PAKISTAN'S PRIMARY DISASTER



*By Abid Omar*  
*Founder of the Pakistan Air Quality Initiative (PAQI)*





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The smog 'calamity' is the visible symptom of a permanent, systemic failure. A resilient, climate-adapted Pakistan is not possible without breathable air. Air quality must be treated as the primary, measurable outcome of national urban, transport, and climate policies.

In late 2024, as hazardous smog enveloped Punjab, the Provincial Disaster Management Authority (PDMA) took an extraordinary step: it officially declared smog a 'calamity'. By invoking a 1958 Act designed for floods and famines, the state formally categorised air pollution as an acute disaster, a direct response to a spiraling public health emergency.

While the diagnosis as a 'disaster' is correct, the response remains superficial. The state's response has been dominated by 'smog theatre': interventions as optically impressive as they are scientifically unsound. The deployment of water-spraying 'anti-smog guns' for instance, is particularly egregious. Far from cleaning the air, research shows that spraying roads with water can actually increase fine particle (PM2.5) concentrations as dissolved solids become airborne upon evaporation.

Optical solutions are a dangerous distraction. Air pollution is not a standalone crisis. It is the measurable outcome of decades of flawed policy in urban, transport, and energy sectors. It is not just a seasonal calamity; it is a systemic disaster and, more critically, a threat multiplier for Pakistan's other environmental risks.

To view air quality as a standalone problem is a policy failure. It must be integrated with and reframed as the central challenge in Pakistan's Disaster Risk Reduction (DRR) strategy.

## The Permanent Disaster

First, the seasonal narrative must be dispensed with. The crisis is year-round. In 2024, Lahore's average pollution level was 108 ug/m<sup>3</sup>. This level of toxic exposure is well above the WHO safe limit of 5ug/m<sup>3</sup>, and reduces the average resident's life expectancy by seven years. This makes air pollution the country's single greatest public health threat, responsible for an estimated 128,000 premature deaths annually.

The seasonal 'calamity' is merely a visible symptom of this year-round failure. This chronic disaster, once normalised, is now the accelerator for the acute disasters in the headlines.

## Heat, Injustice, and Smog

The first interlinkage is the toxic synergy between air pollution and extreme heat. Both are outcomes of flawed urban design and fossil fuel dependency. The 'urban heat island effect' is well-documented, but research increasingly shows that co-exposure to extreme heat and high levels of particulate matter has a synergistic effect on mortality, with the combined risk being greater than the sum of their individual impacts. This flawed urban fabric of concrete and car-centric transport generates and traps both heat and pollutants, forcing the most vulnerable—often in dense, informal settlements lacking green cover—to contend with a dual assault of thermal stress and respiratory toxicity.

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## From Urban Soot to Glacial Floods

The second interlinkage connects Pakistan's smog-choked plains directly to its melting cryosphere. A key component of the PM2.5 pollution from diesel fleets, brick kilns, and crop burning is black carbon (BC). These microscopic soot particles are transported hundreds of kilometres, eventually settling upon the glaciers of the Hindu Kush, Karakoram, and Himalayan ranges. This is not a benign deposit. As the 2019 Hindu Kush Himalaya assessment by International Centre for Integrated Mountain Development (ICIMOD) identified, black carbon from South Asian plains is a critical factor in accelerating glacial melt. It drastically reduces the ice's 'albedo' (reflectivity). Darkened by soot, the glaciers absorb more solar radiation, accelerating their melt rate. This mechanism directly contributes to two of Pakistan's existential climate threats: a higher risk of Glacial Lake Outburst Floods (GLOFs) and the addition of significant meltwater to monsoon-swollen rivers.

**The diesel truck idling in Lahore is, in effect, helping to melt the glacier in Hunza.**



## Designing for Disaster

Smog, extreme heat, and amplified flooding are not disparate problems. They are concurrent symptoms of a single root cause: an urban planning paradigm antithetical to human health.

For decades, as the planner Arif Hasan has documented, official planning has focused on elite, car-centric 'schemes' like signal-free corridors. This model ignores the majority and actively designs out walkability and public space.

This failure is compounded by a failure of architecture, as Kamil Khan Mumtaz has argued- we abandoned indigenous, climate-adapted design for sealed, concrete-and-glass boxes. These structures are unsuited to our climate, requiring massive energy inputs for air conditioning and feeding the emissions cycle. This dual failure has engineered an urban landscape that maximises emissions and traps heat.



## Evidence-Based Solutions

If the problem is integrated, the solutions must be as well. A genuine DRR strategy must pivot from spectacle to substance. This begins with foundational data, as it is impossible to regulate what is not measured. From there, sectoral regulation must be enforced. The successful conversion of over 11,000 brick kilns in Punjab to cleaner 'zigzag' technology, which can cut black carbon emissions by 60 per cent, serves as a powerful template. This model of regulation, industry partnership, and technical support should be applied to enforce cleaner fuel standards like Euro-VI and to shift agriculture away from crop burning; not through punitive measures, but through a systemic transition to regenerative agriculture that restores soil health.

Finally, funds wasted on 'smog theatre' must be redirected to integrated urban solutions. Investing in public transit fails without coupling it with Transit-Oriented Development (TOD) models; the dense, walkable communities Hasan's work champions, and the climate-appropriate building codes Mumtaz's arguments call for.

The PDMA was correct to declare smog a calamity. Now, we must treat it as one, not with seasonal gestures, but with a systemic overhaul. A resilient, climate-adapted Pakistan is not possible without breathable air. If the air is clean, it means our cities are walkable, our transport is efficient, and our buildings are sustainable. If the air remains toxic, it means we have failed.

The work of disaster risk reduction begins, and will be measured, in our skies.



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## Pakistan's Air Pollution: By the Numbers

**7.5**  
YEARS

The potential reduction in life expectancy for a resident of Lahore due to long-term exposure to particulate pollution.

**128,  
000**

Estimated premature deaths in Pakistan annually attributable to air pollution-related illnesses.

**3<sup>RD</sup>**

Pakistan's rank among the world's most polluted countries in 2024.

**21%**

The increased mortality risk on days when extreme heat and extreme particulate pollution occur simultaneously, a risk greater than the sum of their individual effects.



# REBUILDING THE ARCHITECTURE OF RESILIENCE

FROM FLOOD CONTROL TO RISK GOVERNANCE



**By Muhammad Fawad Hayat**  
*Senior Director Recharge Pakistan, WWF-Pakistan*

Every monsoon, we are reminded that floods are part of nature's rhythm; inevitable, but not always catastrophic. In 2025, record monsoon rains once again tested Pakistan's defenses: embankments cracked under pressure, canals overflowed, and floodplains long sealed by development failed to hold back the surge. Entire districts were inundated; more than four million people were displaced and over 1,037 lives were lost. According to the Planning Commission's preliminary assessment, the floods caused an estimated PKR 822 billion (USD 2.9 billion) in damages, with agriculture and infrastructure bearing the greatest toll.

***These are not the costs of a natural disaster alone, but of choices made in how we build, govern, and neglect the landscapes meant to protect us. To escape this cycle, Pakistan must move from reactive flood control to strategic resilience grounded in nature, data, and incentives.***

## Diagnosing the Failure

Our prevailing flood management paradigm is undermined by systemic flaws. Infrastructure across the Indus basin often works at or near design limits, built under historical hydrology assumptions that no longer apply. Fragmented mandates across water, irrigation, disaster management, and planning mean that upstream decisions are seldom assessed for their downstream impacts.

***The loss of ecological buffers, drained wetlands, encroached floodplains, and cleared riparian forests, further turn manageable rainfall into destructive floods. The geographic pattern of the 2025 flood losses reveals the depth of systemic exposure: Punjab alone accounted for 76.8 per cent of total damages. This concentration of loss highlights how structural vulnerability and unplanned development have outpaced preparedness across the Indus basin.***

These structural gaps share a common root: perverse incentives. Agencies are rewarded for new infrastructure, not avoided losses; data systems remain weak because monitoring is not mandated; and nature-based solutions struggle to compete economically against concrete-built alternatives, which are easier to quantify and fund.





## Ecosystem-Based Adaptation as Infrastructure

If floods result from human and system failures, then so must the solution. Ecosystem-based adaptation (EbA) treats ecosystems as active parts of flood-risk management: restored wetlands and floodplains store water and absorb peak flows, easing pressure downstream; reconnected side channels and re-vegetated levee zones provide safe overflow routes; while soil conservation, afforestation, and micro-catchment work uphill to slow runoff and sediment, improving the performance of both natural and engineered systems.

*The 2025 floods vividly demonstrated what infrastructure is at stake: 2,811 kilometers of roads, 2,267 education facilities, 243 health units, and 866 water infrastructures were damaged or destroyed. These are precisely the types of downstream assets that well-managed wetlands, floodplains, and forested buffers can help protect through natural flood attenuation.*

# Incentivizing EbA: From Concept to Catalysts

Around the world, hybrid approaches have begun to show promise. In the Netherlands, the 'Room for the River' programme intentionally widened floodplains to give rivers space to safely flood. In Vietnam, floodplain restoration combined with dyke sets reduced damage by diverting surges into controlled zones. In Latin America, watershed Payment for Ecosystem Services (PES) schemes linked finance to performance by rewarding upstream communities for protecting ecosystems that provide flood attenuation, sediment control, and water regulation for downstream users. These are models, not perfect analogies, but they show that nature and engineering can co-exist in a resilient system. Though experimental, these models illustrate how finance is evolving to reward resilience, not just construction.

For ecosystem-based adaptation (EbA) to succeed, it must be built into the financial logic of disaster risk reduction. Mechanisms such as PES and outcome-based contracts connect performance to finance. The latter goes a step further by tying payments to verified outcomes, such as reduced flood discharge or avoided damage.

*With agriculture alone losing PKR 430 billion in the 2025 floods, aligning financial flows with ecosystem protection is no longer aspirational; it is fiscal necessity. Redirecting even a small share of reconstruction budgets toward such mechanisms could yield exponentially greater savings in avoided losses.*

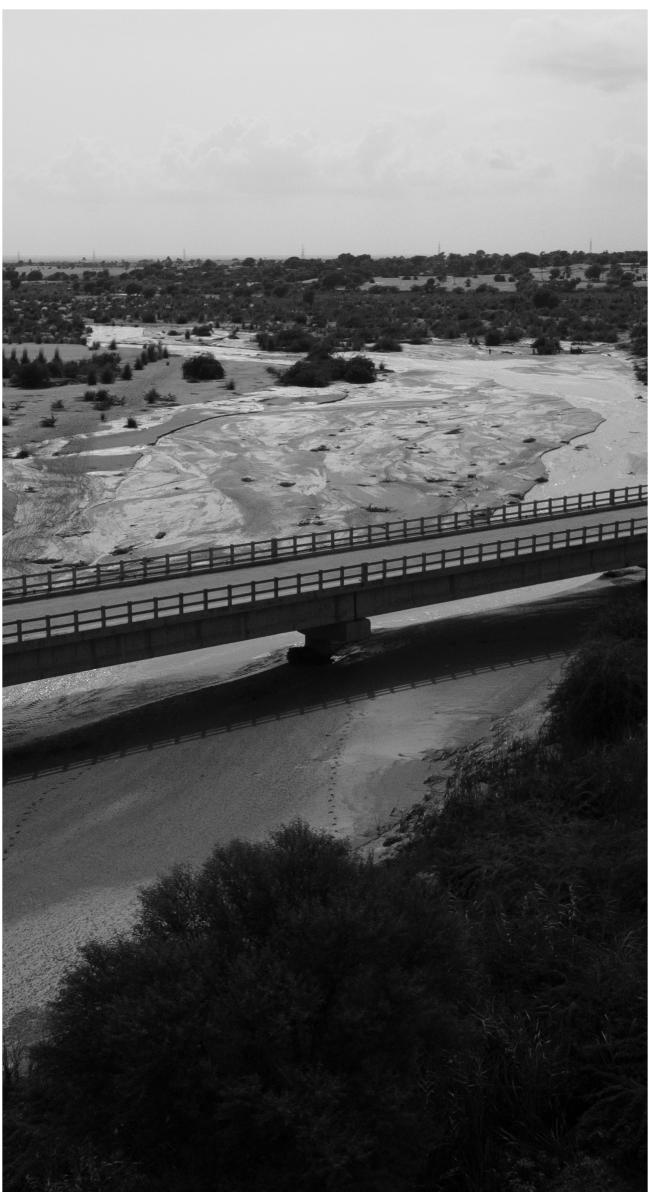
## Resetting the Disaster Risk Reduction Architecture through Recharge Pakistan

Recharge Pakistan is not just another project, it is a node in a system change. Rather than rushing into field works, it anchors its strategy in credible risk modelling, cross-agency stakeholder buy-in, and transparent landscape prioritization. The project's pilot landscapes are selected to expose both flood and drought risk gradients, making it possible to track performance across climate extremes. The devastation left behind by the recent and previous floods highlights why such modelling-led, ecosystem-based interventions are not a luxury but a prerequisite for national resilience.

Through rigorous baselining and scenario analysis, Recharge Pakistan is laying the empirical groundwork that becomes essential to scale. The value is in valid counterfactuals: measuring what would have happened without intervention, then comparing to what does occur. That comparative evidence is the entry point for policy makers and financiers to adopt new incentive structures.

*Over time, project success will provide the empirical license for organizations and governments to introduce incentives such as PES and outcome-linked payments in Pakistan's DRR programmes, but that in no way means that the applicability of these mechanisms should not already be a national priority.*

Crucially, Recharge Pakistan's design is not static; it is adaptive. As data streams and monitoring mature, interventions can be refined. For example, by moving from single floodplain reconnections to a calibrated network of wetland 'mosaics' designed to store water longer in some cells and release it earlier in others. The project thus remains a dynamic and evolving initiative, guided by evidence and adaptive learning.



## Alignment of Policy, Finance, and Institutions

To transform flood resilience in Pakistan requires more than pilot success. A new enabling environment must emerge:

- Flood planning regulations should require ecosystem-based options as part of infrastructure approval.
- Budgeting systems should allow multi-year funding for ecosystems, not only for built projects.
- Line agencies need to be co-accountable: when infrastructure amplifies risk downstream, agencies upstream must share liability or benefits.
- Public–private partnerships could channel resilience credits or green bond instruments into EbA investments.
- A national or provincial PES registry and monitoring system could institutionalize payments and performance tracking.

The monsoon floods of 2025 were the result of design, policy, and institutional choices that neglected the pace at which nature is responding to climate change.



*Recharge Pakistan is one instrument in that shift, but the real work must be to align incentives, integrate governance, and scale adaptation. Embedding performance-linked financing into such systems could allow agencies to contract for measurable outcomes. If these elements align, then each monsoon becomes a stress test rather than a crisis.*

While the overall 2025 losses were lower than the catastrophic floods of 2022, the pattern of destruction was more concentrated and hydrologically volatile, signaling that the risk is evolving faster than our response systems. The challenge ahead is not to outbuild nature, but to learn to work with it, so that future monsoons become tests of preparedness, not episodes of loss.

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