

Environmental Hazards in Afghanistan

Risk Assessment, Impacts, and National Preparedness



Seismic Risk



Floods



Drought



Landslides



Avalanches

Is really the Nature our enemy?

"A careless captain sinks his own ship." *Proverb*

- 👉 Environmental hazards are actually the consequence of usual natural processes sometime intensified by human activities.
- ❖ Environmental hazards are defined as extreme events or substances in the Earth and its ecological system that may cause adverse effects to humans and things they value (NRC 1996).

"The time to dig a well is not when your house is on fire." *Logical saying*



Afghanistan: The Heart of Asia is at risk!

- ❖ Afghanistan is among the countries most exposed to environmental hazards in Asia due to its complex topography, sensitive seismo-tectonic position, fragile ecosystems, and limited institutional capacity for disaster risk management.



Earthquakes

Shallow, high-magnitude events along active plate boundaries



Floods

Snowmelt & flash floods affecting 25+ provinces annually



Droughts

Multi-year droughts eroding rain-fed agriculture



Landslides

Slope failures on steep, deforested terrain



Avalanches

Seasonal snow hazards in high-altitude passes

- ❖ The country frequently experiences earthquakes, floods, landslides, droughts, with significant consequences for lives, infrastructure, agriculture, and long-term socio-economic stability
- ❖ So we are going to discuss major environmental hazards in Afghanistan assess major risks, their spatial scale and socio-economic impacts, and Afghanistan's current level of preparedness

Afghanistan: A Landlocked, Mountainous Crossroads



- A land-locked mountainous country with 652,860 km² area and about 45 million population
- Beyond the natural hazards, Afghanistan has been facing political, social and economic challenges

Geographic drivers of hazard exposure



Hindu Kush and Pamir ranges — steep, seismically active, avalanche- and landslide-prone



Five major river basins dependent on snowmelt — flood- and drought-sensitive



Semi-arid to arid climate; average temperature raising 1.8°C since 1950



Widespread non-engineered mud-brick and timber construction

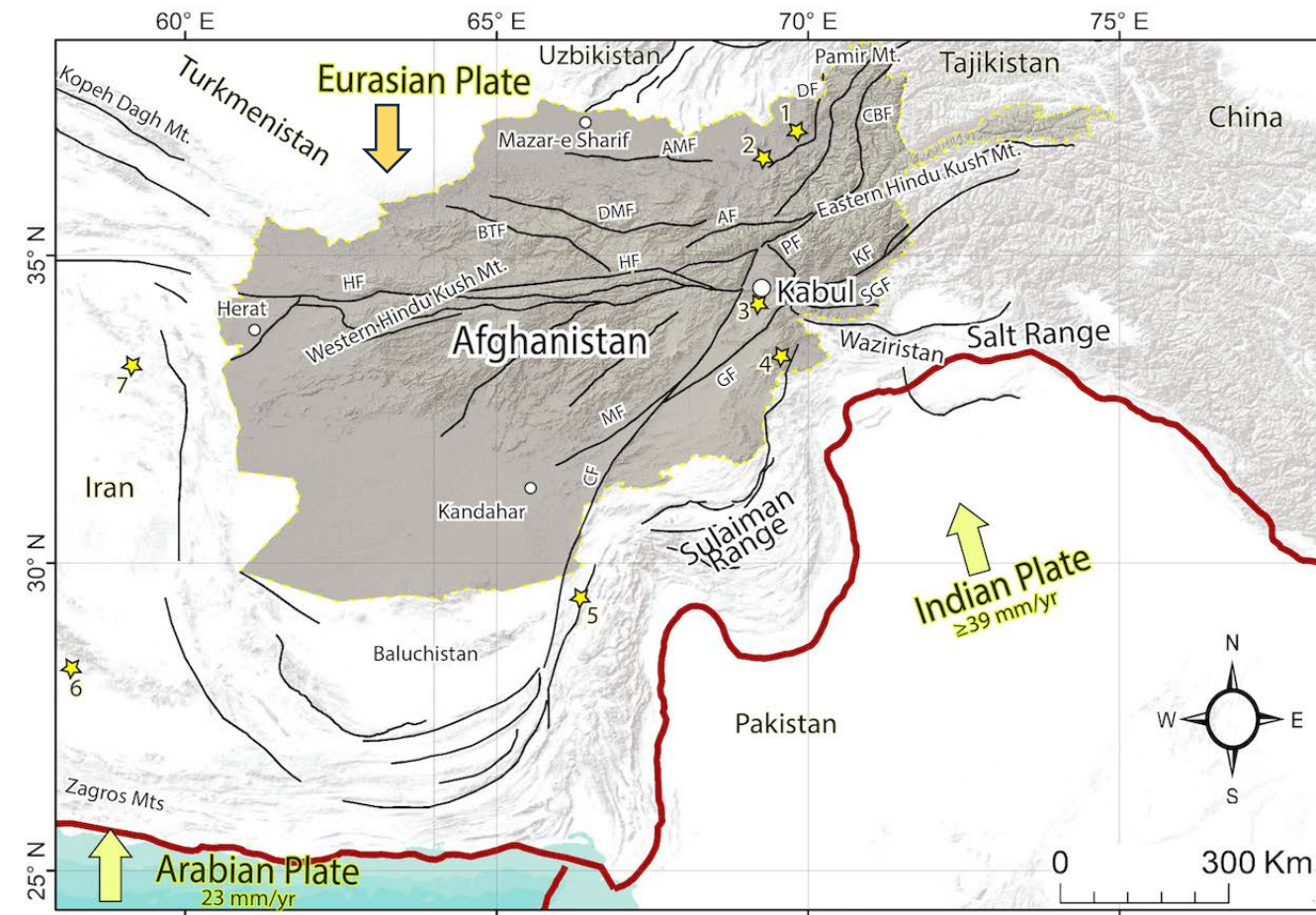
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SECTION ONE

Seismic Hazards

Afghanistan sits astride the Indian–Eurasian plate boundary, producing frequent, often shallow and highly destructive earthquakes.

Tectonic Setting: A Collision Zone

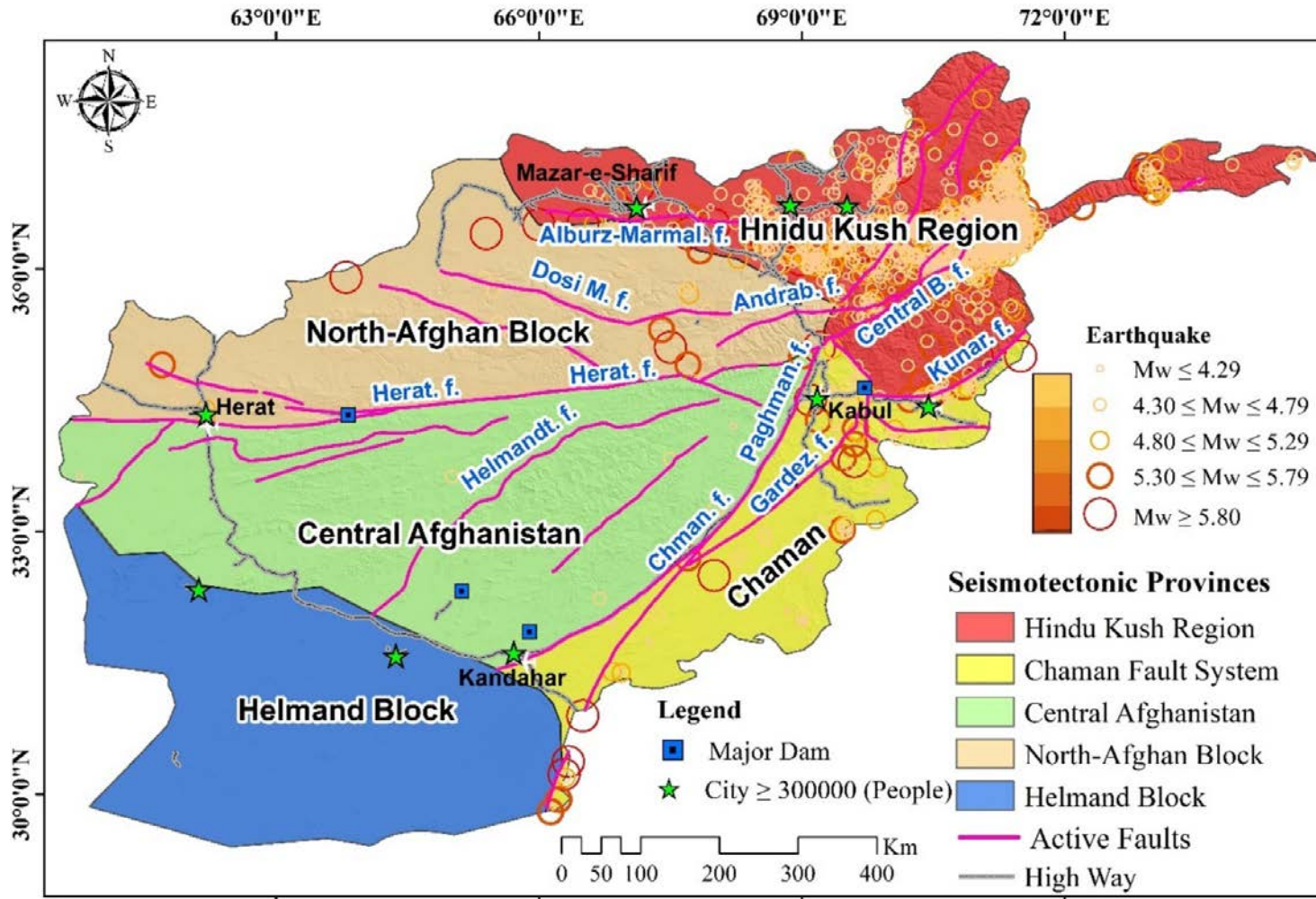


- ❖ Afghanistan lies within the Alpine–Himalayan orogenic belt, inside an active continental collision
- ❖ **The Eurasian Plate:** This massive continental plate forms the basement under northern Afghanistan, 13 mm/yr
- ❖ **The Indian Plate:** This plate is moving northward at a rapid rate of roughly **30 to 40 mm per year**, pushing directly into Eurasia.
- ❖ **The Arabian Plate:** Situated to the west, this plate pushes northeastward, indirectly squeezing western Afghanistan against Eurasia.

Plate Convergence Rates

Indian Plate (east)	~39–43 mm/yr
Arabian Plate (west)	23–33 mm/yr
Chaman Fault slip	8 - 33 mm/yr
Historical events $\geq M4.5$ (since 1964)	12,700+

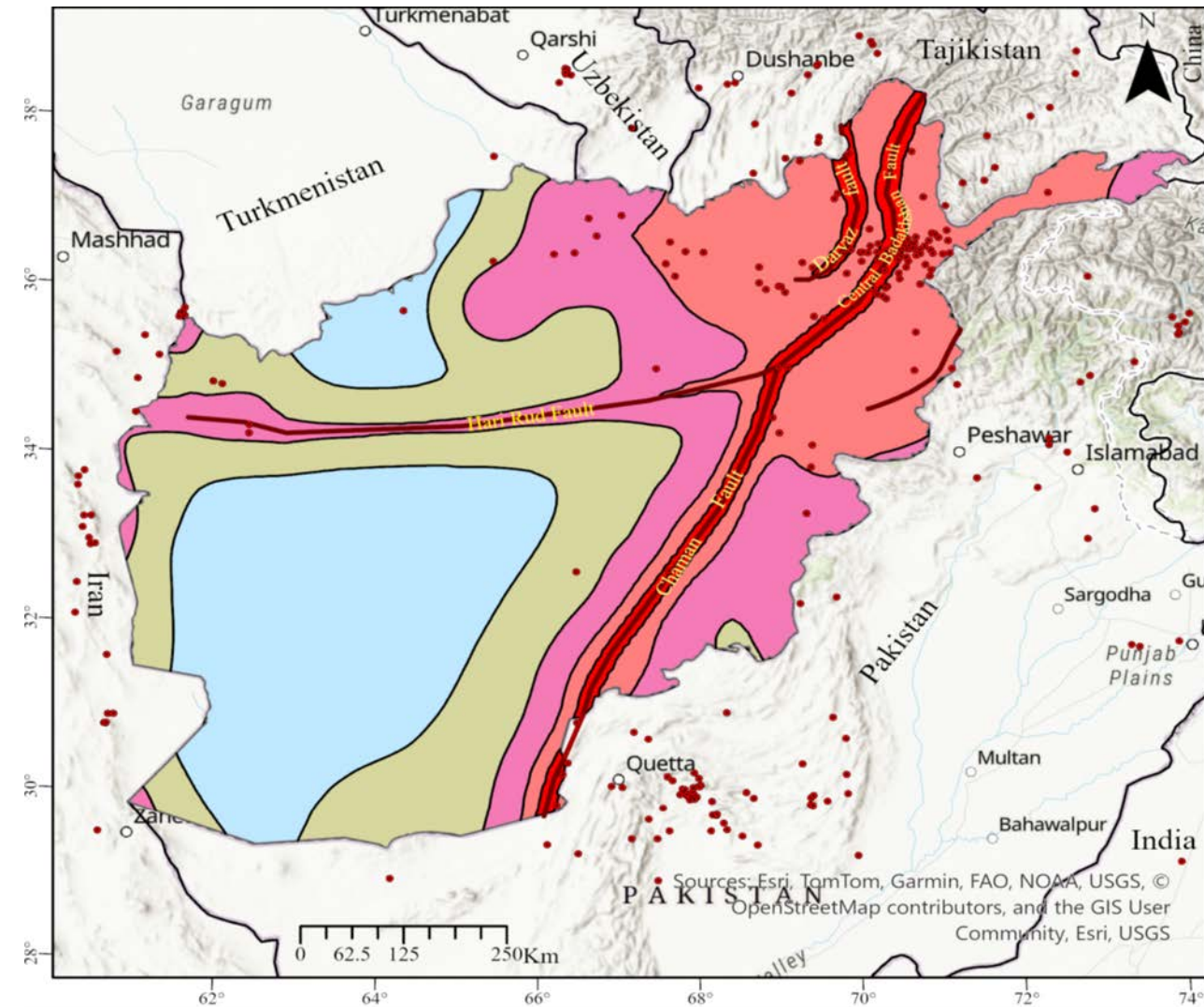
Seismotectonic Provinces of Afghanistan



Province Characteristics

- ❑ Hindu Kush: crustal thickness 65–80 km; deep seismicity to ~300 km; active subduction signature
- ❑ Chaman Block: shallow seismicity; left-lateral slip 8–33 mm/yr
- ❑ North-Afghan Block: moderate–shallow seismicity in thick sedimentary basins (to 16 km)
- ❑ Helmand Block: seismically stable; consistent crustal thickness (40–45 km)
- ❑ Central Afghanistan: sparse seismicity despite complex fault networks

Seismic hazards zonation



- Earthquakes (734–2004)
- Faults

Seismic Regions

- Mild: Hanging objects sway; windows rattle; no damage.
- Moderate: Objects sway; some items fall; negligible damage.
- Strong: People may lose balance; furniture shifts; slight structural damage.
- Very Strong: Objects fall; slight to moderate structural damage.
- Severe: Furniture overturns; moderate to heavy structural damage.
- Violent: People thrown down; monuments fall; heavy to very heavy structural damage.

A Rising Toll of Destructive Earthquakes

7,000+

Deaths from earthquakes
in Afghanistan over the
past decade

560

Average annual earthquake
deaths over the past
decade

12

M7.0+ earthquakes in NE
Afghanistan since 1900

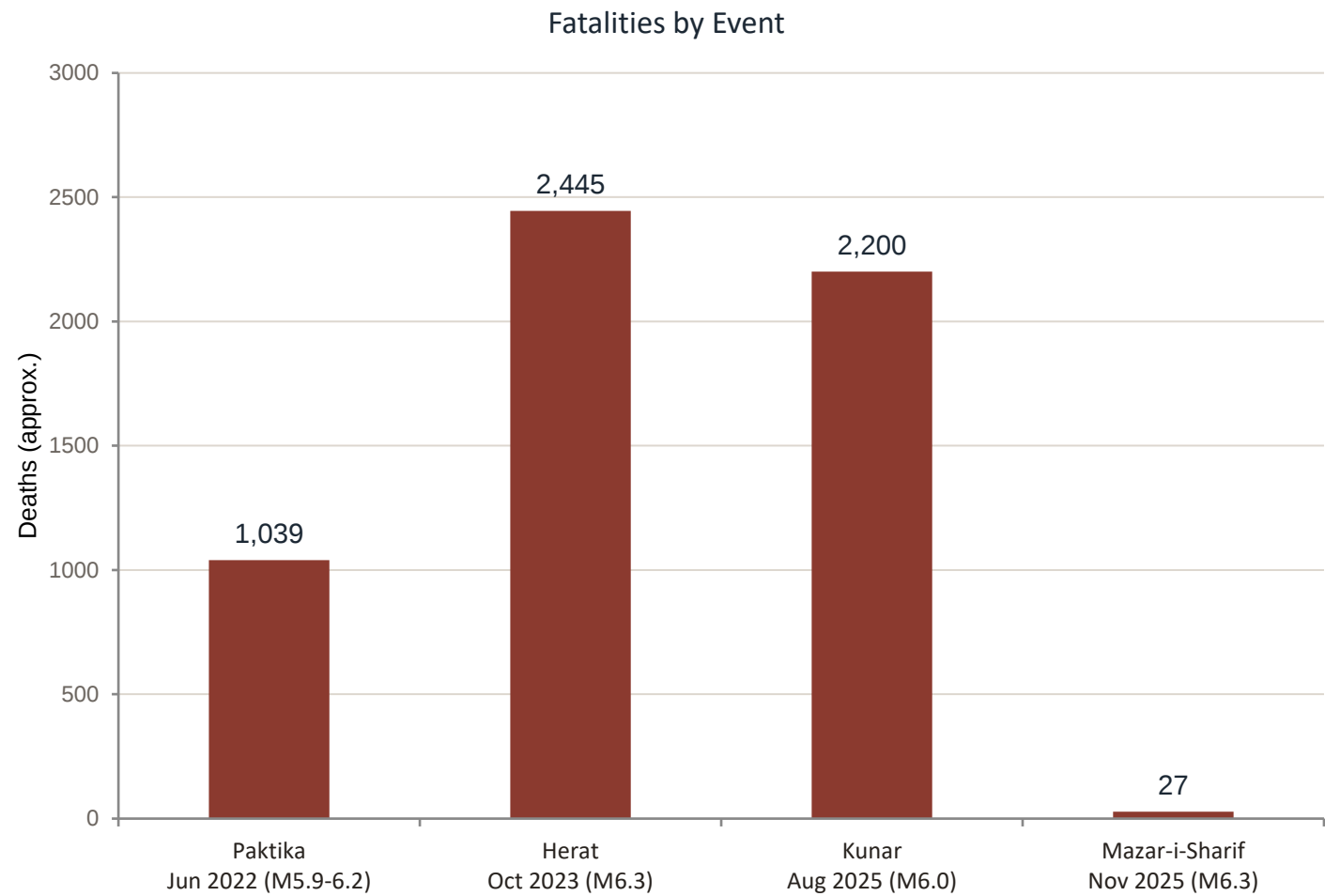
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Major deadly earthquakes
since the 2021 political
transition

Four major earthquakes, 2022–2025

Jun 2022	Paktika	M 5.9–6.2	~1,039+ deaths
Oct 2023	Herat (Zindajan)	M 6.3 (×4 events)	~2,445 deaths
Aug 2025	Kunar	M 6.0	2,200+ deaths
Nov 2025	Mazar-i-Sharif (Balkh)	M 6.3	Dozens of deaths

Comparing the Four Major Earthquakes (2022–2025)



Why moderate-magnitude earthquakes turn catastrophic

- Shallow focal depths (8–10 km) concentrate energy at the surface
- Non-engineered mud-brick and timber housing collapses even under moderate shaking
- Nighttime timing traps sleeping residents indoors
- Steep terrain triggers co-seismic landslides that seal off access routes
- Weak institutional capacity delays search-and-rescue and relief delivery



Housing Vulnerability: The Multiplier Effect

- The large majority of rural Afghan housing is built from unreinforced mud-brick (Clay), rammed earth, and timber, materials with negligible tensile strength under seismic loading
- Heavy earthen roofs, common for insulation, are a leading cause of fatal collapse onto occupants
- Construction is frequently sited on steep, unstable valley slopes with minimal siting or engineering oversight
- No nationally enforced seismic building code exists for rural or informal construction



Retrofitting public buildings to modern seismic standards could reduce fatalities by an estimated 90% and economic losses by 60%



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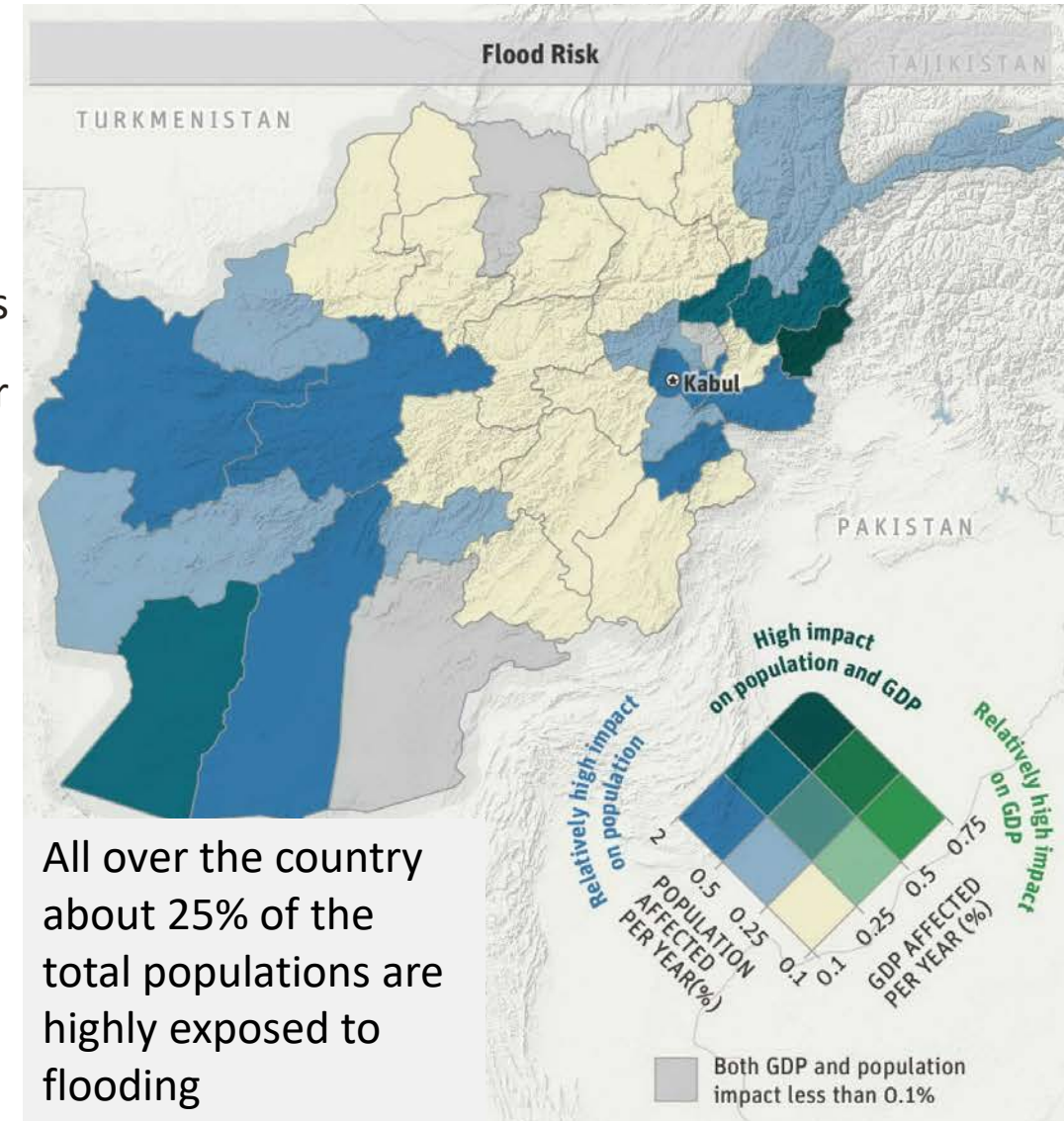
SECTION TWO

Floods and Droughts

The most widespread hazards in Afghanistan — flooding is the most common natural disaster, while multi-year drought has undermined food security since 2021.

Floods: Afghanistan's Most Frequent Hazard

- ❑ Driven by extreme rainfall events (linked to El Niño and climate change) combined with rapid snowmelt across five major river basins
- ❑ Aridification from prior drought years hardens soil and reduces water absorption, increasing dangerous runoff and flash-flood intensity
- ❑ Flash floods are frequently accompanied by mudslides, destroying homes, roads, bridges, irrigation systems, and standing crops
- ❑ Northeastern (Badakhshan, Baghlan, Takhar) and western (Herat, Ghor, Badghis, Faryab) regions are recurrently the hardest hit



All over the country about 25% of the total populations are highly exposed to flooding

The Rising Flooding Events

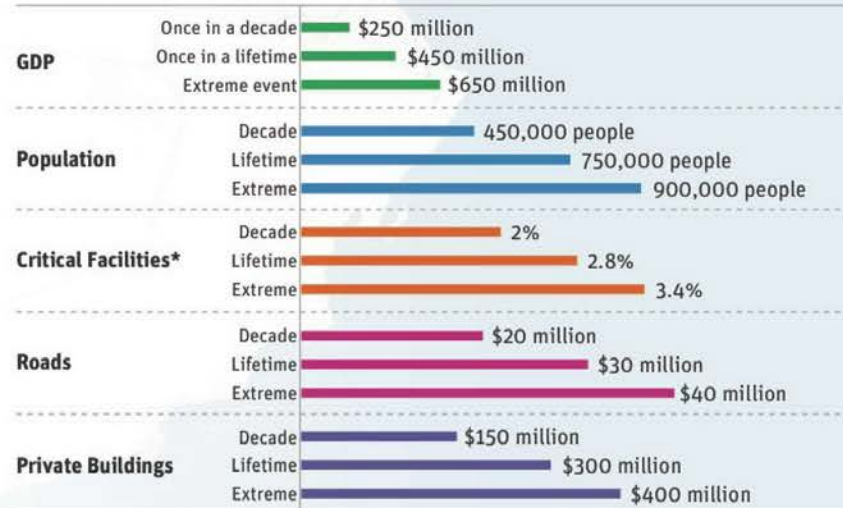
Date	Location(s)	Event & impacts
July 2026	Nuristan (especially Parun) and eastern Afghanistan	Flash floods killed at least 23 people , injured about 125 , 100 missing , and damaged homes, roads, markets, and services.
May–June 2026	Samangan, Baghlan, Badakhshan, Kunduz, Takhar	Heavy rains caused flash floods affecting about 682 families ; 11 deaths and 4 injuries were reported.
March–April 2026	31 provinces across Afghanistan	Widespread floods, landslides, and heavy rain affected more than 73,300 people , causing 93 deaths, 181 injuries , and thousands of damaged homes.
May 2024	Baghlan, Badakhshan, Takhar and other northern areas	Severe flooding killed more than 300 people nationwide, with major destruction of homes and farmland.



Flooding Impacts in country

Modeled Flood Impacts

Reference Situation (2010)



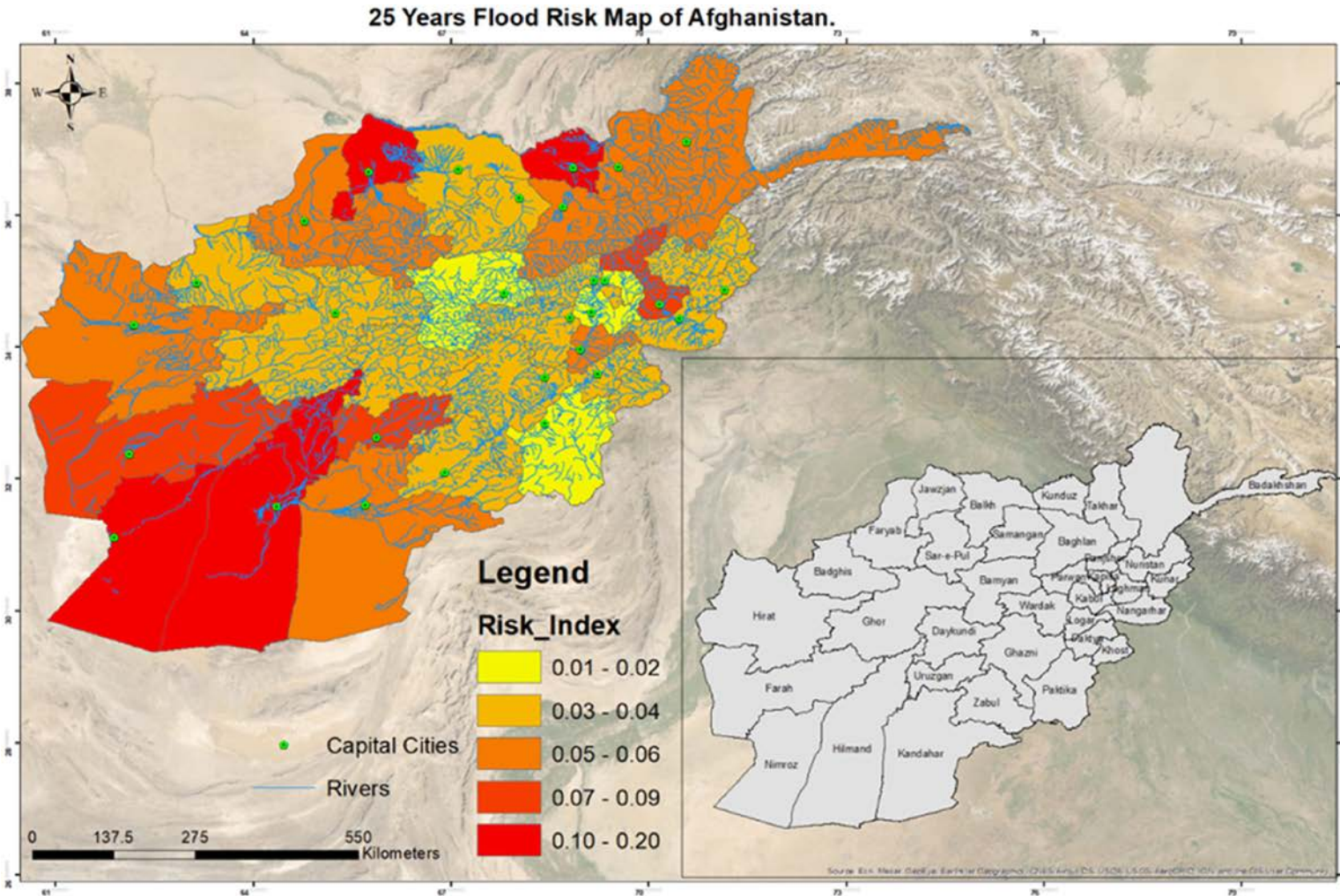
*(Healthcare, Education and Energy)



Sectoral Impacts

-  Tens of thousands of **acres of agricultural land destroyed**; thousands of livestock killed
-  **Roads, bridges** (dozens destroyed) and **irrigation canals** severely damaged, isolating whole districts
-  Public schools and at least 40+ health facilities damaged, disrupting essential services
-  **Women and children** over-represented among casualties and among those most affected by service disruption

Risk assessment of Flood



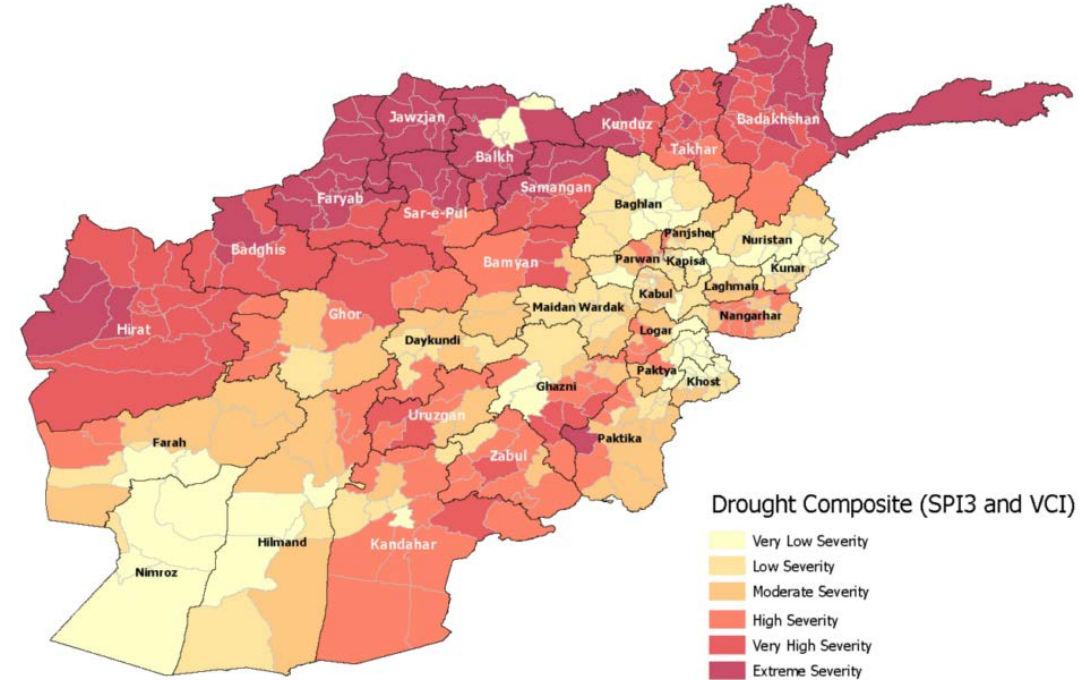
When combining hazard, exposure, and vulnerability, the provinces facing the **highest overall flood risk are Nimroz and Helmand** in the southern region, and **Jawzjan and Kunduz** in the northern and northeastern regions. Provinces with the least overall risk include Bamyan, Kabul, Kapisa, and Paktika

Drought Crisis

- ❑ Drought is the most frequent and devastating natural hazard in Afghanistan, now occurring in shorter cycles due to climate change.

Types of Drought Observed:

- ❑ **Meteorological Drought:** Driven by La Niña patterns causing below-average snowpack in the **Hindu Kush mountains** (the country's primary water tower).
- ❑ **Hydrological Drought:** Manifests as depleted aquifers and reduced river flows. Groundwater levels in critical basins (like Kabul and Helmand) have dropped significantly due to unregulated extraction.
- ❑ **Agricultural Drought:** Soil moisture deficits that directly kill rain-fed wheat (*lalmi*) and reduce pasture quality for livestock.
- ❑ At least 60% of the population depends on rain-fed agriculture, making livelihoods acutely sensitive to shifting precipitation patterns



Climate Change - Drought

- ❑ According to a [report](#) by ACAPS, the country **has endured eight major droughts** since 1969, including catastrophic events in 2018 and 2021 that affected over 11 million people.
- ❑ Climate change is a significant driver of these worsening conditions. Temperatures in Afghanistan have risen by nearly **1.8 °C since 1950**, leading to reduced snowfall in the Himalayas and diminished river flows. With precipitation trending lower, seasonal droughts are both more frequent and more severe.
- ❑ Experts [indicate](#) that agriculture, which sustains **roughly 30 % of** Afghanistan's GDP, bears the brunt of the crisis.



13.1M

people in high-rate food insecurity, Oct 2023 (IPC 3+)

2.3M

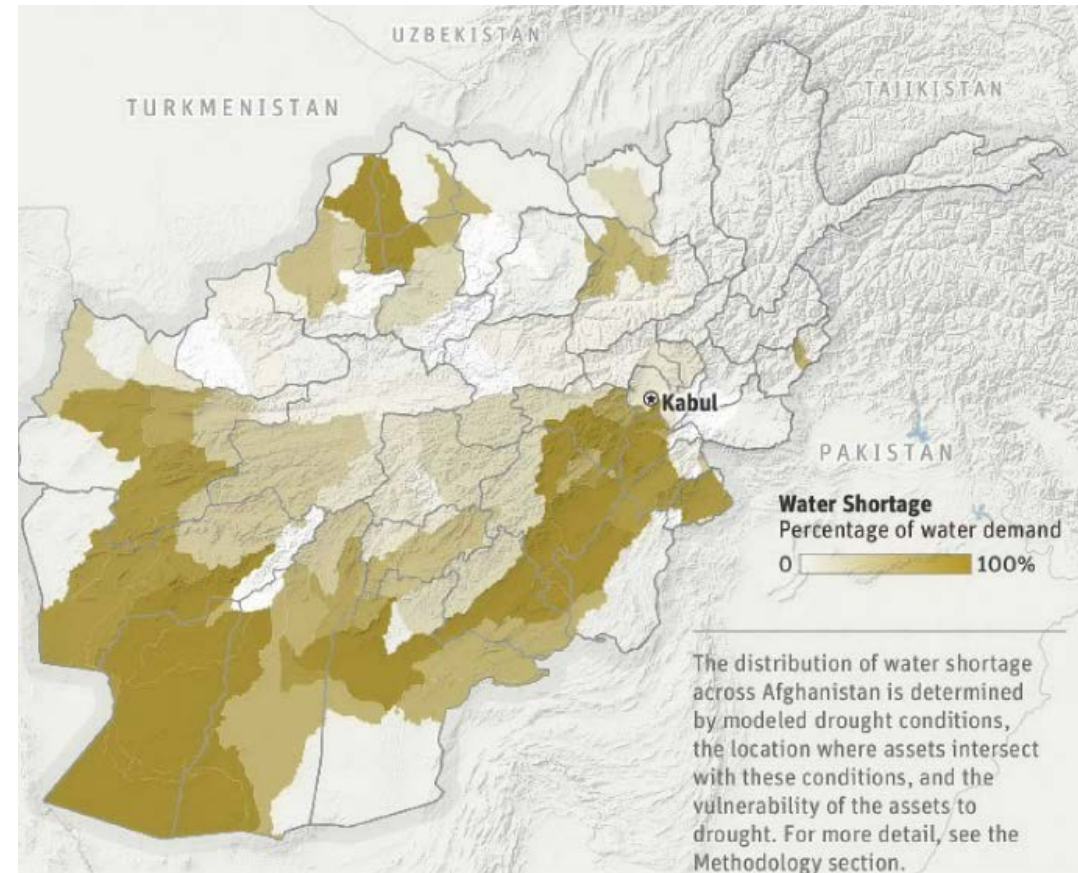
people displaced by drought since 2021

1.8°C

national temperature rise since 1950

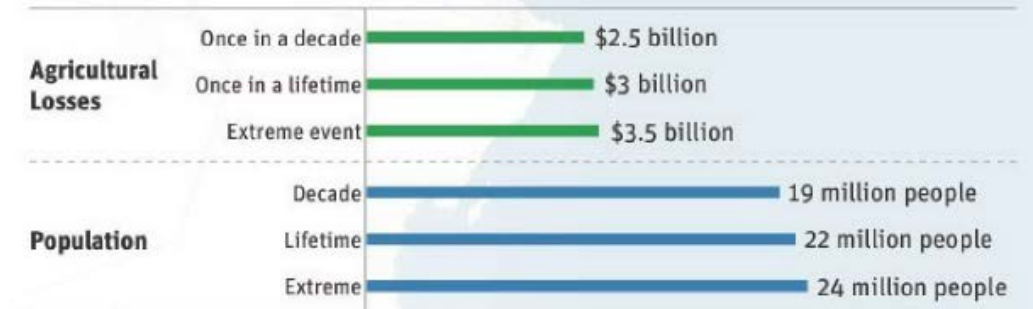
Drought Crisis to future ...

- ❑ According to recent research notable drought years—1985, 1999–2002, 2004, 2008, 2011, 2018, and 2021–2022—were consistently identified
- ❑ Spatial analysis revealed pronounced drying trends in the **Southwestern, Northern, Northwestern, and Western zones**, which are already identified as drought hotspots.
- ❑ Seasonal analysis further revealed a shift from isolated seasonal droughts toward persistent, multi-seasonal drought conditions. This shift suggests a transition toward more prolonged and recurrent drought regimes, heightening risks to food security, ecosystem health, and rural livelihoods.



Modeled Drought Impacts

Reference Situation (2010)



Drinking Water Crisis due to Drought

Drinking water crisis	Millions of Afghans face shortages of safe drinking water due to drought, conflict, poor infrastructure, and contamination.
Groundwater depletion	Over-pumping, reduced rainfall, and climate change are lowering groundwater levels; from 30- 100 m , many wells are drying, especially in cities like Kabul and Kandahar.
Main impacts	Water insecurity, higher costs, health risks, and pressure on vulnerable communities.



Kabul's groundwater could run dry by 2030. Urgent infrastructure projects and international support are needed to prevent mass displacement.

Reported By south Asian Desk Agency

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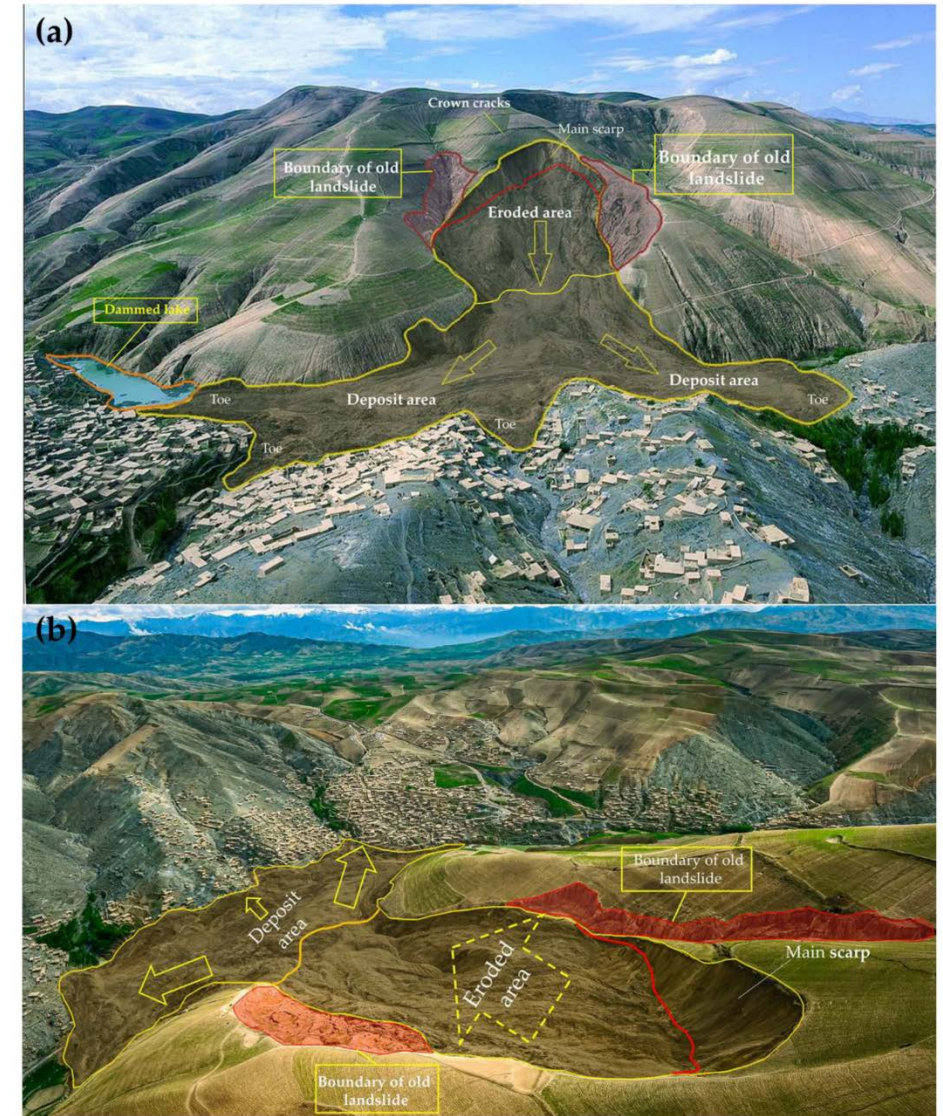
SECTION THREE

Landslides

Steep, deforested, and seismically active terrain makes slope failure a recurring seasonal threat across the highlands.

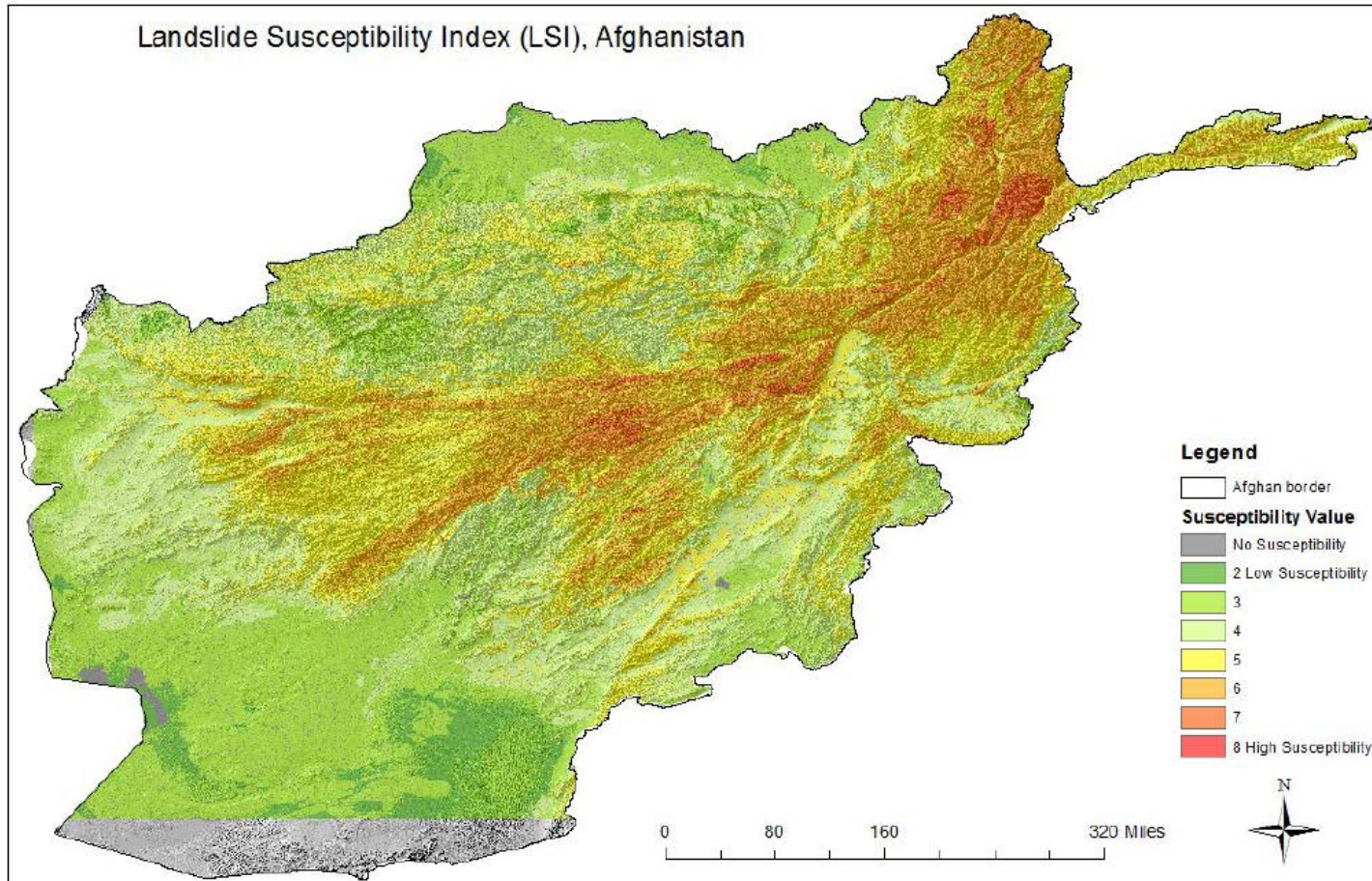
Landslides: A Threat on Unstable Slopes

- ❑ Over **60% of Afghanistan's terrain** is mountainous, and landslide susceptibility is classified as high across much of the country
- ❑ **Triggers** include heavy or prolonged rainfall, rapid snowmelt, and earthquake shaking — often in combination
- ❑ The number of people affected by landslides is projected to **double by 2050** as population growth pushes settlement into marginal, unstable terrain
- ❑ Deforestation and unregulated slope-side construction remove natural stabilizers and increase exposure



Abe Barek landslide, happened in the morning of May 2, 2014, in Badakhshan Province, buried 86 houses and took the lives of almost 2700 people.

Slope movements hazard



HAZARD RISK ASSESSMENT MATRIX

	Hazard Categories			
	1	2	3	4
Frequency of Occurrence	Catastrophic	Critical	Serious	Minor
(A) Frequent	1A	2A	3A	4A
(B) Probable	1B	2B	3B	4B
(C) Occasional	1C	2C	3C	4C
(D) Remote	1D	2D	3D	4D
(E) Improbable	1E	2E	3E	4E

Unacceptable High Medium Low

According to the level of causing factors, susceptibility and history of slope movements events, hazard level in:

- north-eastern and central areas of the country has been approximated **high-medium**,
- northern areas **medium-high**,
- southeastern and southern areas **low – medium**
- western and southwestern areas **low**.

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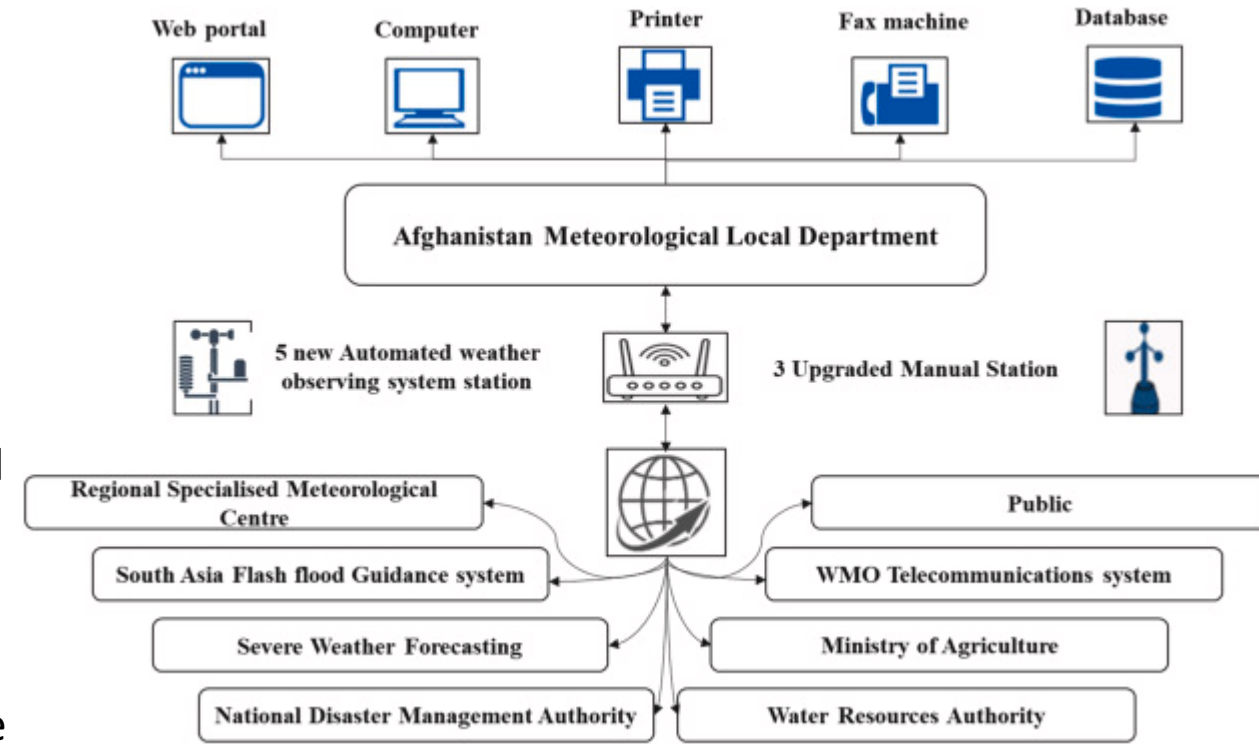
SECTION FIVE

National Preparedness

Institutional capacity has improved incrementally over decades, but remains constrained by instability, funding gaps, and weak risk-reduction planning.

Disaster Management Authority

- **ANDMA (Afghanistan National Disaster Management Authority):** The central state entity tasked with **assessing immediate damage, identifying high-risk corridors, and coordinating local search and rescue teams** during emergencies.
- **The Afghan Red Crescent Society (ARCS):** Acts as the country's frontline humanitarian network, deploying local volunteers for immediate first aid, evacuation support, and emergency distributions.
- **Provincial Disaster Management Committees (PDMCs):** Decentralized regional bodies tasked with reporting landslide or flash-flood data from remote areas back to the capital.
- **National and limited International NGOs**



The comparison indicates moderate scores i.e. India (Score: 3.695), Bangladesh (Score: 3.317), and Pakistan (Score: 3.15), excluding **Afghanistan (Score: 2.378049)** highlights that Afghanistan need to improve the flooding warning system.

Where National Preparedness Falls Short



Incomplete Hazard Mapping

Detailed, updated hazard and risk maps remain limited outside donor-funded pilot assessments (e.g., the 2017 World Bank/GFDRR study)



Weak Early Warning Systems

Real-time seismic, flood, and avalanche monitoring networks are rare, especially in remote mountainous districts



Fragmented Risk-Reduction Planning

Community-level disaster management plans exist only in a subset of donor-supported districts, not nationwide



Constrained International Support

Diplomatic isolation since 2021 has slowed access to international rescue teams, technical assistance, and financing



Non-Resilient Building Codes

Seismic and flood-resistant construction standards are not enforced for the large informal/rural housing stock



Data & Funding Shortfalls

Humanitarian response plans are chronically underfunded (as low as ~23% in 2023), limiting both response and risk-reduction investment

The Cost of International Isolation

- ❖ Following the August 2021 political transition, most donors froze or withdrew large-scale cooperations with the Afghan state
- ❖ No foreign search-and-rescue teams were deployed after the August 2025 Kunar earthquake — a marked **contrast with international responses to comparable disasters elsewhere**
- ❖ Approximately \$9 billion in Afghan Central Bank foreign reserves has remained frozen, constraining the state's fiscal capacity to invest in resilience
- ❖ United Nations University Institute for Water, Environment and Health (UNU-INWEH) researchers directly link Afghanistan's elevated disaster death tolls to this combination of **isolation, aid contraction, and weakened governance capacity**

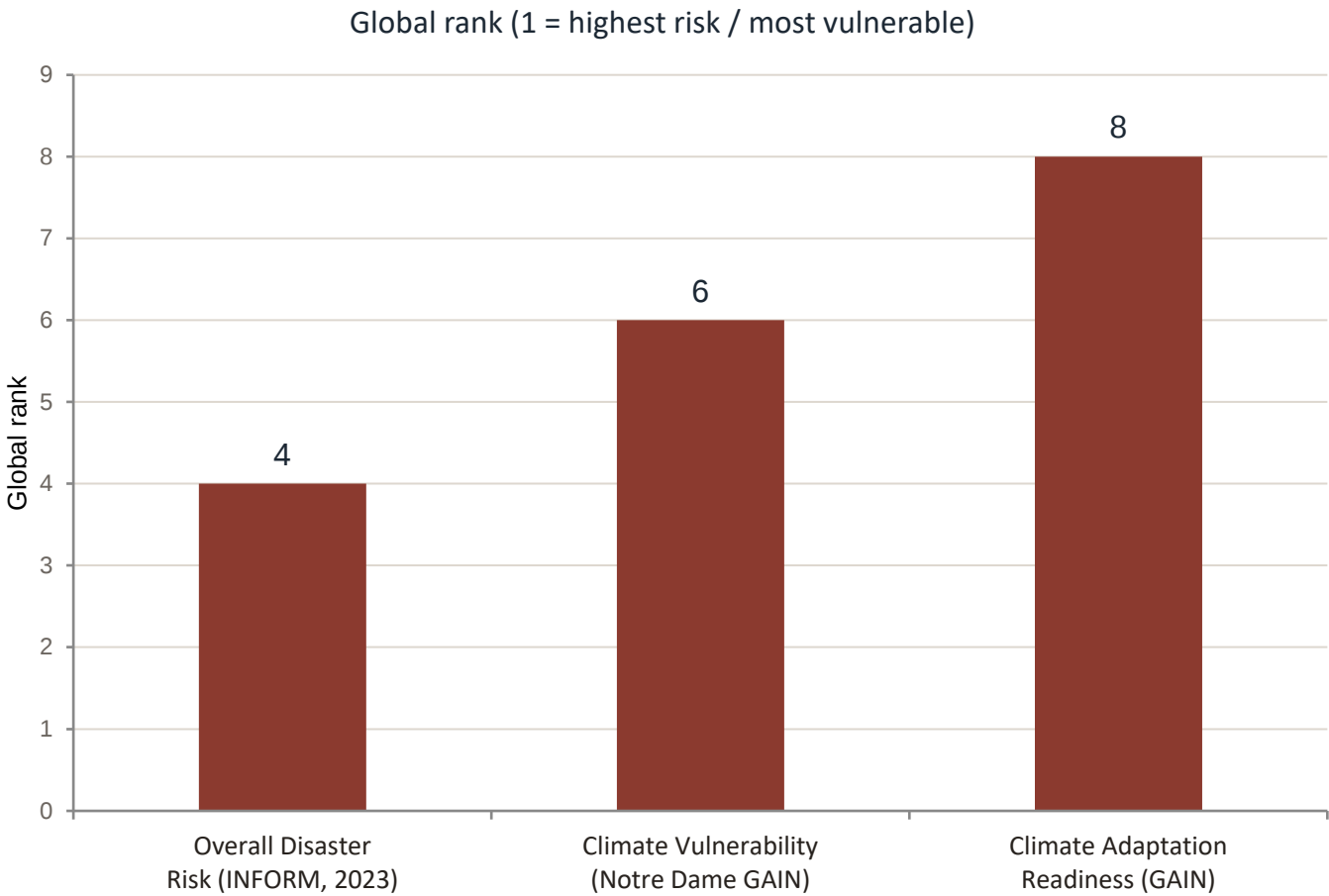
\$9B

in frozen Afghan Central Bank
Assets since 2021

0

foreign search-and-rescue teams
deployed after the Aug 2025 Kunar
earthquake

How Afghanistan Ranks Globally



Sources: INFORM Risk Index (2023); ND-GAIN Country Index (latest available edition)

- ❖ Afghanistan consistently places among the 10 highest-risk, most climate-vulnerable, and least-prepared-to-adapt nations worldwide
- ❖ a convergence of physical hazard exposure with limited institutional and financial capacity to respond.

Priorities for Integrated Hazard Management

- ❖ **Complete National Hazard Mapping:** Expand nationwide hazard mapping for earthquakes, floods, landslides, and avalanches to improve disaster preparedness.
- ❖ **Promote Resilient Construction:** Encourage affordable earthquake- and flood-resistant construction and retrofitting of vulnerable homes. *Some Possible with local resources*
- ❖ **Invest in Early Warning Systems:** Strengthen seismic and weather monitoring systems to provide timely warnings, especially in high-risk areas.
- ❖ **Strengthen ANDMA Capacity:** Rebuild the technical capacity, equipment, and coordination of ANDMA to improve disaster risk management.
- ❖ **Sustain Humanitarian Engagement:** Maintain international humanitarian support to ensure effective disaster preparedness and emergency response.
- ❖ **water management:** can reduce the shortage of water and climate change effects
- ❖ **Accepting Risk-Informed Planning:** Incorporate disaster and climate risk assessments into infrastructure, urban planning, and development policies.



Protection from Environmental hazards is a humanitarian issues, so it is recommended to not politicized the Risk Reduction affairs.

Thank You

Questions & Discussion
