

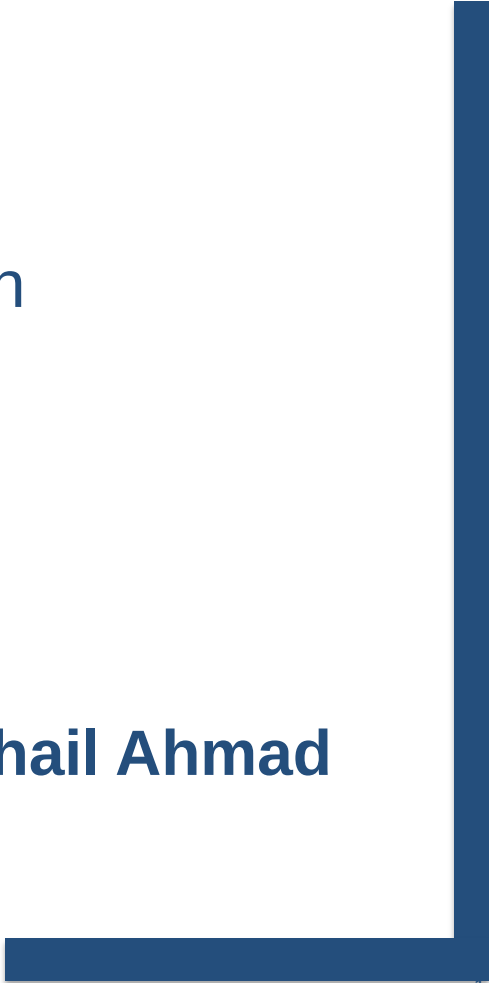


HUM 117

Pakistan Studies

Climatic Regions of Pakistan

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Learning Outcomes

- Identify Pakistan's major climatic regions.
- Explain the roles of latitude, altitude, distance from the sea, monsoon circulation and western disturbances.
- Relate climate to agriculture, water resources, settlements and economic activity.
- Assess climate risks and adaptation priorities for Pakistan.

Section 1

What is climate and why Pakistan has climatic diversity

Weather, climate, geography and atmospheric systems

Weather and Climate

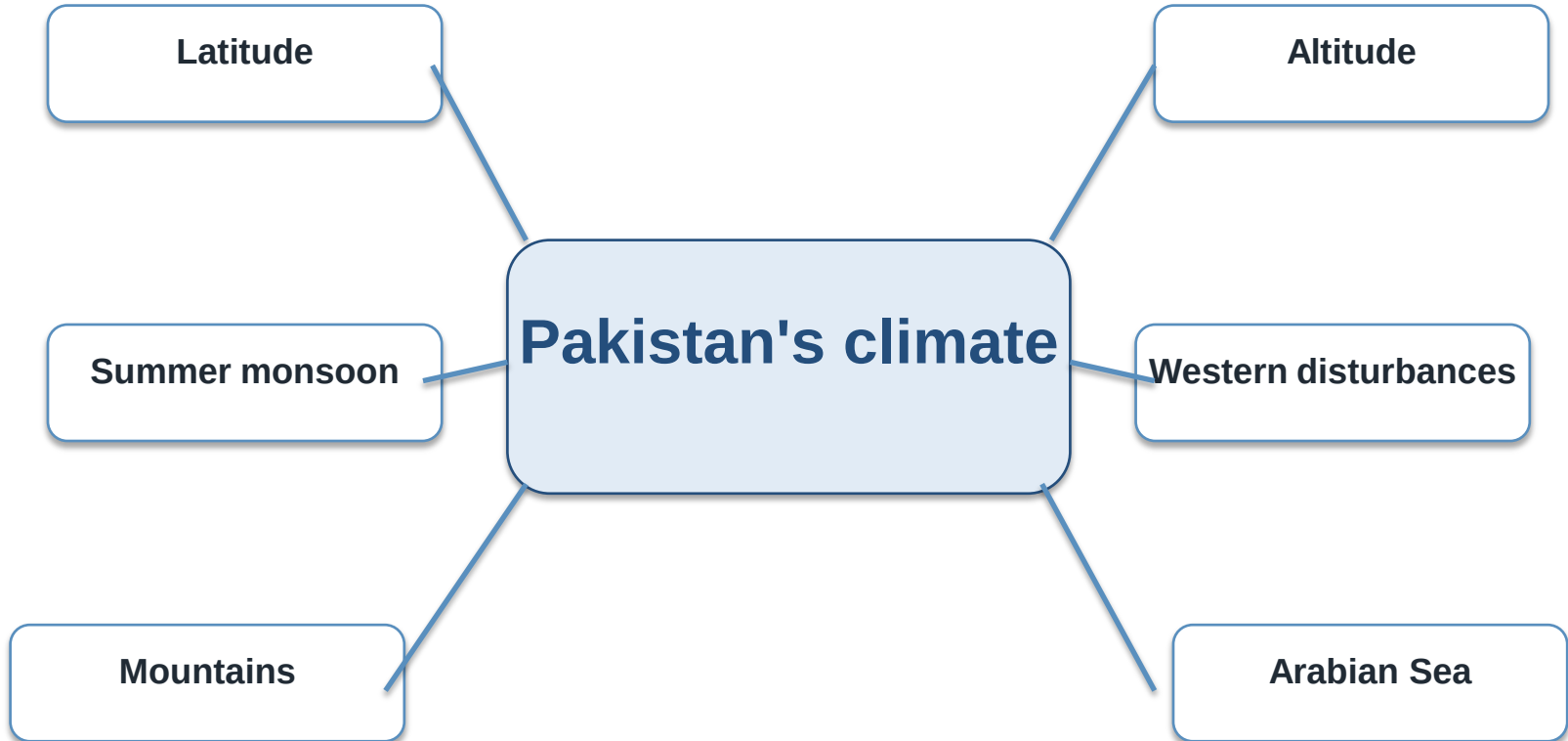
Weather

- Short-term atmospheric conditions.
- Changes over hours, days or weeks.
- Examples include a heatwave, rainfall event or cold spell.

Climate

- Longer-term patterns of temperature and precipitation.
- Shapes ecosystems, agriculture and settlement.
- Explains recurring seasonal and regional differences.

The main controls of Pakistan's climate



Pakistan's seasonal cycle

- Cold season: November to February.
- Pre-monsoon hot season: March to mid-June.
- Monsoon season: mid-June to mid-September.
- Post-monsoon season: mid-September to October.
- Most of the country is arid to semi-arid, with strong regional variation.

Section 1: Key Takeaways

- Pakistan has no single uniform climate.
- Mountains create strong temperature and precipitation contrasts.
- The summer monsoon and winter western disturbances affect different parts of the country.
- The Arabian Sea moderates the southern coastal belt.
- Climate diversity shapes agriculture, settlement and water demand.

Section 2

Mountain and northern climates

Elevation, snow, glaciers and the Indus water system

Northern Pakistan: major mountain systems

- Hindu Kush in the north-west.
- Karakoram in the north, including K2.
- Himalayan ranges in the north-east.
- Climate varies sharply with elevation, aspect and local topography.
- Valley floors often have milder conditions than surrounding high elevations.

Altitude and climate

At high elevation

- Lower temperatures.
- Longer periods of snow and ice.
- Shorter growing seasons.
- Greater dependence on seasonal access.

In lower valleys

- Milder local conditions.
- Orchards and agriculture.
- Larger settlements.
- Tourism and transport activity.

Snow, glaciers and the Indus system

- Snow and glacier melt contribute to the perennial flow of major rivers.
- The Greater Himalayan region above 35°N receives substantial winter precipitation as snow and ice.
- The timing of snowmelt affects downstream water availability.
- Changes in temperature and glacier stability create risks for water management.
- Mountain water resources matter to agriculture and hydropower far downstream.

Northern climate: economic and social links

Agriculture

Orchards, livestock and valley farming depend on seasonal water and temperature.

Tourism

Weather and seasonal accessibility shape tourism activity.

Hydropower

River flows depend on precipitation, snow and glacier dynamics.

Hazards

Glacial lake outburst floods and landslides threaten exposed settlements and infrastructure.

Section 2: Key Takeaways

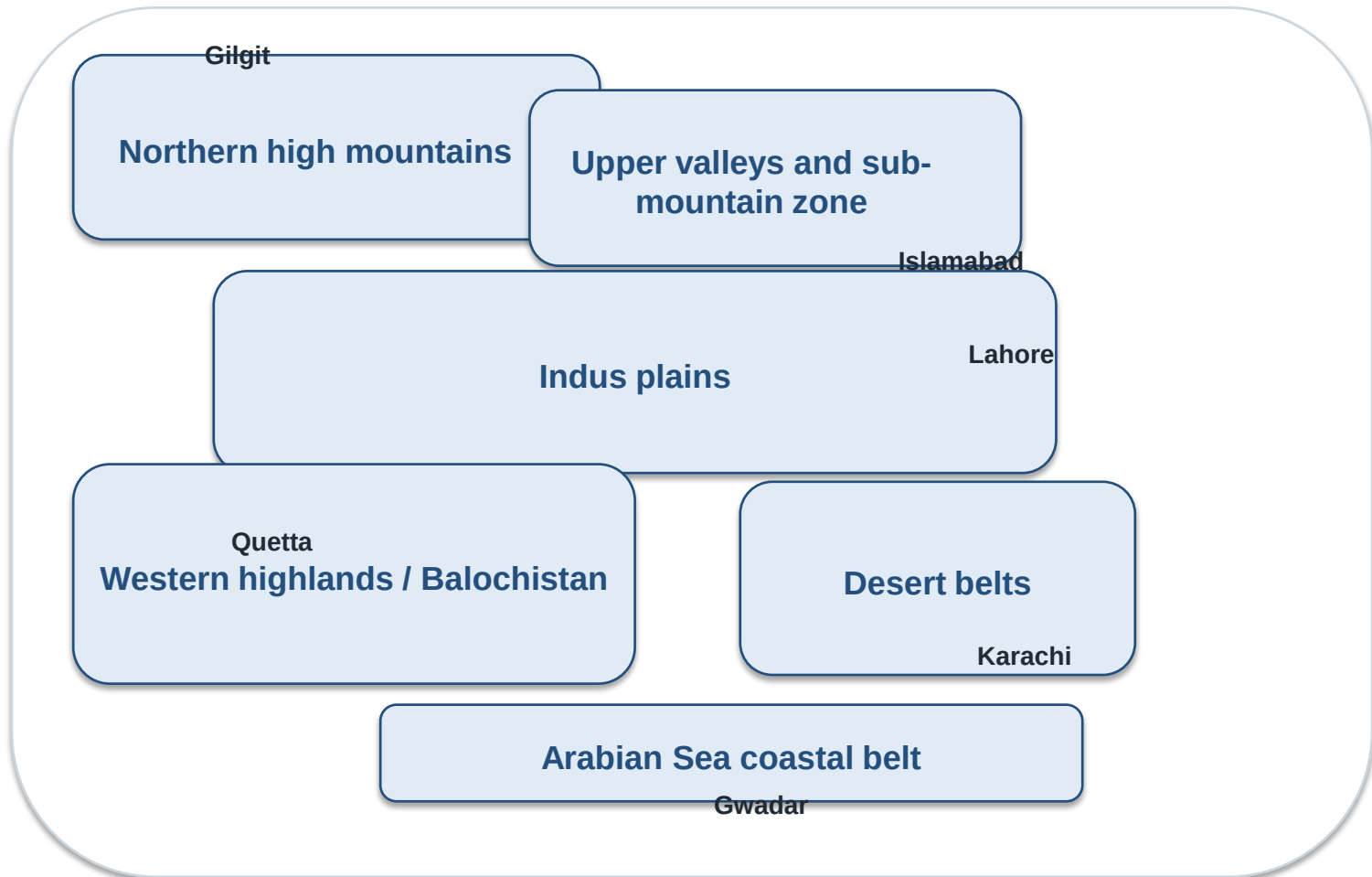
- Northern climates change sharply with elevation.
- Snow and glacier systems are part of Pakistan's national water security.
- Climate risks in the mountains have downstream consequences.
- Adaptation requires early warning, resilient infrastructure and sound water management.

Section 3

Indus plains, arid zones and deserts

Agriculture, irrigation and water variability

The Indus plains and major dry zones



Schematic regional map, not to scale. Regional boundaries are simplified for teaching.

The Indus plains

- Punjab and Sindh contain major agricultural areas within a generally dry to semi-arid climatic setting.
- Irrigation is central to intensive agriculture.
- The Indus Basin Irrigation System supports large populations and extensive cropping.
- Monsoon rainfall supplements irrigation but varies from place to place and year to year.

Punjab and Sindh: different climatic settings

Punjab

- Strong seasonal temperature variation.
- Monsoon rainfall is important but variable.
- Canal irrigation supports high agricultural productivity.
- Central and southern areas are broadly dry semi-arid.

Sindh

- Generally warmer and drier.
- Large contrast between irrigated Indus corridor, Thar and coast.
- Water demand is high in irrigated areas.
- Coastal conditions differ from inland desert environments.

Pakistan's major desert environments

- Thar Desert in Sindh and adjoining areas.
- Cholistan Desert in southern Punjab.
- Kharan Desert in Balochistan.
- Desert environments support pastoralism, livestock and drought-resistant livelihoods.
- Water availability and variability are the central constraints.

Climate, irrigation and food security

- Heat increases crop water requirements.
- Rainfall variability affects sowing, yields and flood risk.
- Efficient irrigation reduces pressure on scarce water resources.
- Crop selection, water storage and climate information support food security.
- Climate is one factor among several influencing crop choices.

Section 3: Key Takeaways

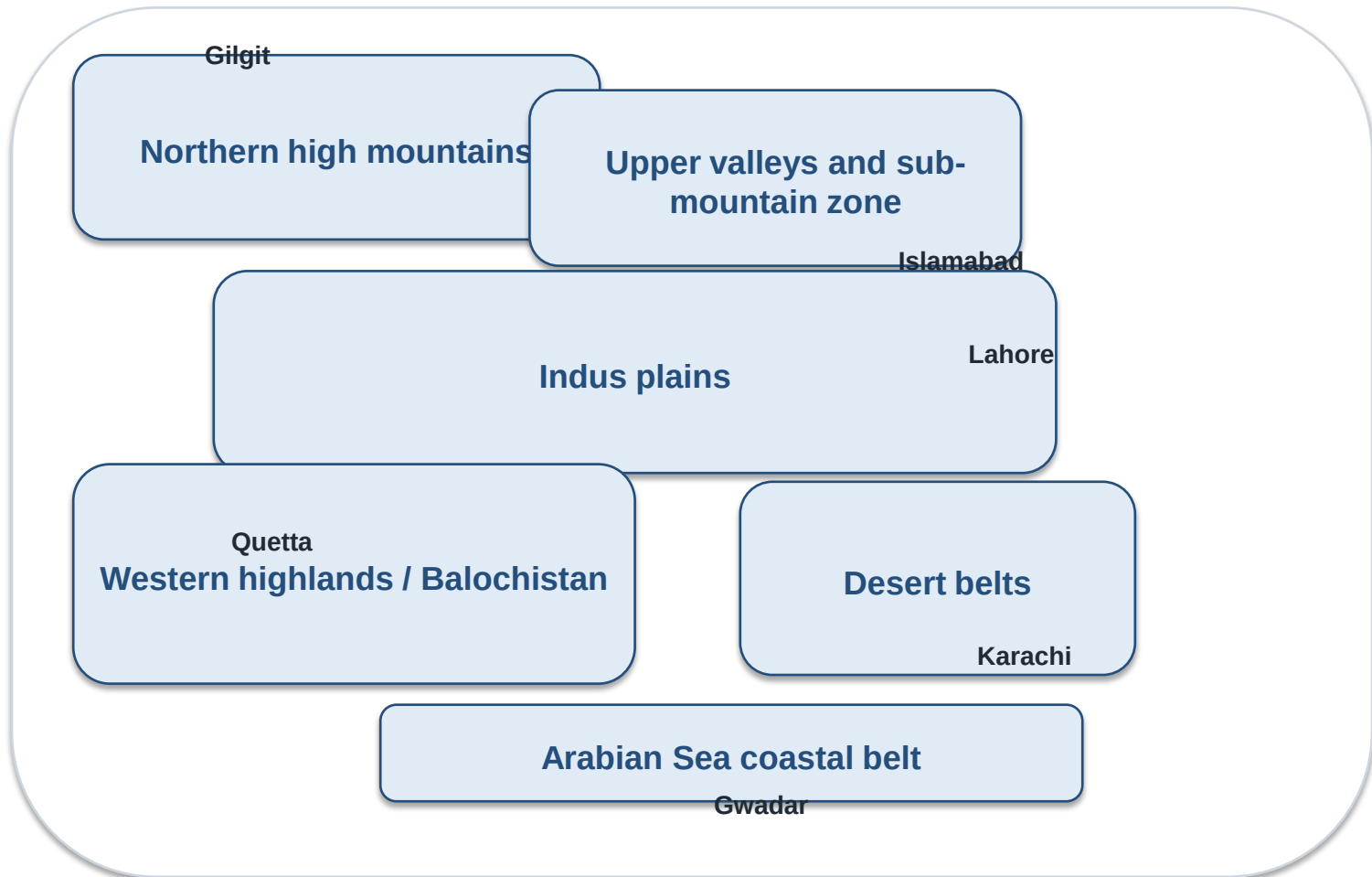
- Pakistan's agricultural strength is closely linked to irrigation.
- The Indus plains combine productive agriculture with a generally dry climate.
- Punjab, Sindh and desert environments have distinct climatic and water conditions.
- Future food security depends on better water management and climate-resilient agriculture.

Section 4

Balochistan and coastal climates

Aridity, maritime influence and water scarcity

Balochistan and the Arabian Sea coast



Schematic regional map, not to scale. Regional boundaries are simplified for teaching.

Balochistan: climate contrasts

Inland plateau

- Predominantly arid conditions.
- Highland basins and dry valleys.
- Quetta has colder winters because of elevation.
- Groundwater is important.

Coastal belt

- Arabian Sea moderates temperature extremes.
- Humidity and sea breezes influence local conditions.
- Karachi and Gwadar have maritime characteristics.
- Coastal rainfall differs from inland desert patterns.

Rainfall and aridity in Balochistan

- Balochistan is identified as the driest major region.
- The climate indicators give an average provincial rainfall of about 210 mm.
- Local conditions vary substantially, so the provincial average does not describe every district.
- Aridity influences settlement density, agriculture, rangelands and infrastructure planning.

Water scarcity as a development issue

- Groundwater supports communities and agriculture in many parts of Balochistan.
- Excessive extraction creates depletion risks.
- Rainwater harvesting and watershed management help retain scarce water.
- Small dams and efficient irrigation support local water security.
- Drought-resilient livelihoods reduce vulnerability.

Section 4: Key Takeaways

- Balochistan's aridity is a defining feature of its settlement and economic geography.
- Altitude creates colder inland conditions around places such as Quetta.
- The coast has a distinct maritime influence.
- Climate policy needs to reflect local ecological and water conditions.

Section 5

Climate change, economic effects and adaptation

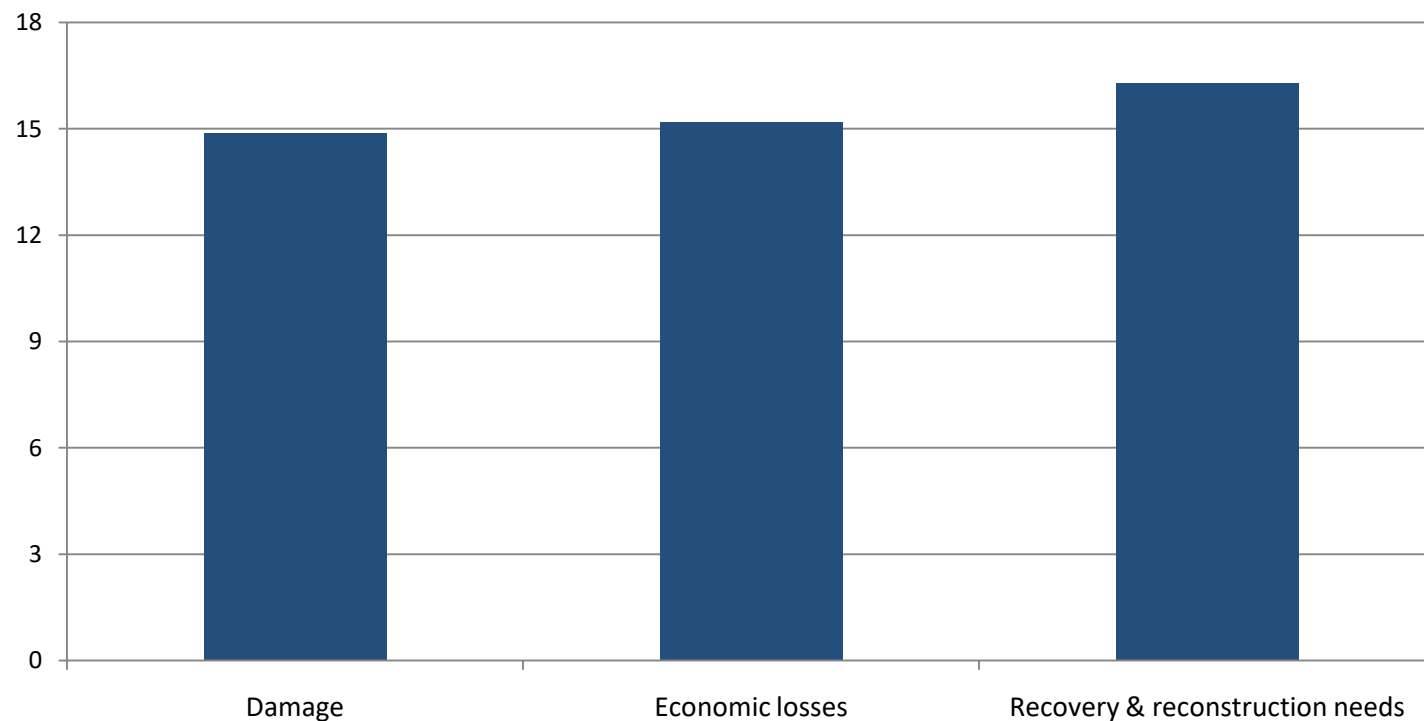
From climate hazards to development resilience

Pakistan's climate risk profile

- Heatwaves and extreme heat.
- Floods and intense rainfall.
- Drought and water stress.
- Changing snow and glacier dynamics.
- Sea-level and coastal risks.
- Ecosystem and livelihood stress.

The economic scale of the 2022 floods

US\$ billions



2022 flood assessment: damages US\$14.9bn; economic losses US\$15.2bn; recovery and reconstruction needs US\$16.3bn.

Human and economic impacts of the 2022 floods

- About 33 million people were affected.
- More than 1,700 people died.
- Total damages were estimated at US\$14.9 billion.
- Economic losses were estimated at US\$15.2 billion.
- Recovery and reconstruction needs were estimated at US\$16.3 billion.
- Housing, agriculture and livestock, and transport and communications were among the most heavily affected sectors.

From climate hazard to development impact

Climate hazard

Heat, flood, drought, rainfall variability or glacier-related hazard.

Physical damage

Homes, roads, crops, livestock, schools and other assets are damaged.

Livelihood loss

Households lose income, productive assets and access to services.

Development setback

Public finances, poverty reduction and long-term development face additional pressure.

Climate adaptation priorities

Adaptation

- Climate-resilient agriculture.
- Efficient irrigation and water storage.
- Urban drainage and heat action plans.
- Mangrove and watershed protection.

Preparedness & resilience

- Early warning systems.
- Resilient roads, schools and public infrastructure.
- Disaster-risk planning.
- Stronger local and national institutions.

Pakistan's climate policy: a balanced approach

- Adaptation is essential because Pakistan is highly exposed to climate hazards.
- Efficient water use supports agriculture, cities and ecosystems.
- Resilient infrastructure protects development gains.
- Clean energy and lower-carbon development remain relevant national objectives.
- Climate resilience is linked to water, food, health, economic and national security.

Final Synthesis

- Pakistan's climate ranges from high-mountain environments to arid plateaus, irrigated plains, deserts and coastal zones.
- Geography interacts with monsoon circulation, western disturbances, altitude and the Arabian Sea.
- Water connects the climatic regions: snow and glaciers feed rivers, while irrigation sustains the plains.
- Climate change increases pressure on agriculture, water, infrastructure and public finances.
- Climate-resilient development is therefore a national development priority.

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