Natural Resources: Water, Forests, Minerals and Fish

Water supply, dams, barrages and the Indus Waters Treaty; forests and deforestation; mineral resources; and the fishing industry.

Water

Dams and barrages

Name	River	Notes
Tarbela Dam	**Indus** (Khyber Pakhtunkhwa)	the **largest earth-filled dam** in the world; completed in **1976**; irrigation, **hydroelectricity** and flood control
Mangla Dam	**Jhelum** (Azad Kashmir)	completed in **1967**; built as part of the **Indus Basin Project** to replace the eastern rivers; irrigation and power
Warsak Dam	**Kabul River** (near Peshawar)	built in the **1950s**; irrigation and electricity

Barrages (low dams with gates that raise water levels to send water into canals): **Sukkur**, **Guddu** and **Kotri** on the Indus in Sindh; **Taunsa**; **Chashma** (the **Chashma–Jhelum Link Canal**); and **Trimmu** on the Chenab. **Link canals** carry water between rivers, **distribution canals** and **field channels** take it to farms.

Water as a resource

- **Irrigation:** about **90%** of water use is for **agriculture**. The **Indus Basin Irrigation System** is one of the world's largest.
- **Industrial:** textiles, fertilisers, sugar and leather need large amounts; **domestic:** drinking and washing.
- **Power: hydroelectricity** from dams.
- **Sources: rivers** (glacier and snowmelt, and rain), **groundwater** through **tubewells** and wells; **rainwater** harvesting.
- **Control:** dams, barrages and canals store and distribute water; **embankments** protect from floods.

The Indus Waters Treaty (1960)

Signed by India and Pakistan (President Ayub Khan and Prime Minister Nehru) with the **World Bank** as mediator, after the dispute that began in **1948**:

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- **India** was given the **eastern rivers**: **Ravi, Beas and Sutlej**.
- **Pakistan** was given the **western rivers**: **Indus, Jhelum and Chenab**.
- **Pakistan** received **funds** to build **link canals** and **dams** (**Mangla and Tarbela**) to replace its lost water.

Consequences. It settled a **major conflict** and gave Pakistan a basis for development, but the **eastern rivers** became **dry** in Pakistan, and later **disputes** appeared over Indian dams on the western rivers.

Silting of reservoirs

Causes: steep, fast rivers in the northern mountains carry huge amounts of **silt and gravel**, made worse by **deforestation** and erosion. **Effects:** dams such as **Tarbela and Mangla** lose storage capacity, so less water for **irrigation** and **hydel power**; canals become blocked; and flood flows can damage structures. **Control: afforestation** on the slopes, **silt traps** and check dams, desilting canals, lining canals, and raising dam walls.

Problems of water supply

Problem	Causes	Solutions
shortage	rising **population**, **drought**, **glacier changes**, **wasteful** irrigation (about 40% lost through leakage), **silting** of dams	**new dams** (such as **Diamer-Bhasha**), **lining canals**, **drip and sprinkler** irrigation, **rainwater harvesting**, and **water pricing**
pollution	**untreated sewage** and **industrial waste** in rivers, **fertiliser** and **pesticide** run-off	**treatment plants**, laws on **dumping**, education
waterlogging and salinity	seepage from unlined canals and over-irrigation	**drainage** (**SCARP** tubewells; the Salinity Control and Reclamation Projects began in **1959**), planting **eucalyptus** (it takes up a lot of water), **lining canals**
floods	monsoon rains and glacier melt	**embankments**, dams, early warning

Water and conflict. Disputes can arise **between countries** (Pakistan and India over the **Indus rivers**; Pakistan and Afghanistan over the **Kabul River**) and **between provinces** (**Punjab and Sindh** over the share of water; the **Water Apportionment Accord, 1991**). Shortages can cause **migration** and **unrest**.

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Forests

Types and locations

Type	Where	Trees
Alpine forests	the **highest** slopes of the northern mountains, above the conifers	stunted **pine, juniper** and shrubs; **roots spread sideways** on thin soil and branches slope to shed snow
Coniferous (mountain) forests	the **northern mountains** (Himalayas, Hindu Kush, Murree hills, Swat, Kohistan), roughly **1,000–4,000 m**	**deodar**, **pine**, **fir**, **spruce**: tall, evergreen, cone-shaped
Sub-tropical scrub forests	the **foothills** and drier hills (Potwar, Salt Range, Kohat)	**kikar, phulai, wild olive**; trees of moderate height
Tropical thorn forests (*rakh*)	the **dry plains** of southern Punjab, Sindh and Balochistan	**acacia, kikar, thorny bushes**; small trees (about 6–10 m) with deep roots and thorns to save water
Riverain (riparian) forests	along the **Indus** and its tributaries in **Sindh and the Punjab**	**shisham**, **babul**, **tamarisk**, mostly flooded
Mangrove forests	the **Indus delta** and the coast of **Sindh and Balochistan**	**mangroves** (a salt-tolerant tree)
Irrigated plantations	the **Indus Plain** (**Changa Manga**, **Chichawatni**)	**shisham**, **eucalyptus**, **poplar**, **mulberry**

Forests cover only about **5%** of Pakistan's land (much less than the recommended 25%, and much lower than India or Bhutan). By region, **Gilgit–Baltistan** and **Khyber Pakhtunkhwa** have the highest share, and **Punjab, Sindh and Balochistan** the lowest (figures vary by source). Forests can also be **productive** (grown for timber and fuel) or **protective** (planted to hold soil, give shade and shelter roads and canals). The **irrigated plantations** at **Changa Manga** were first planted by the British to provide fuel for the **railways**. **Mangroves** have **salt-filtering roots** and breathing roots that cope with salty, muddy water, and shelter young fish.

Physical and human factors

- **Physical: rainfall** and **temperature** (conifers need cooler, wetter climate; the dry plateau gets only scrub), **altitude**, **soil**, **flooding** (riverain), **salt water** (mangroves).
- **Human factors that reduced them:** cutting for **timber** and **fuelwood**; **clearing** for **farmland** and **settlement**; **overgrazing**; **forest fires**; and the **"timber mafia"**.

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Plantations and afforestation

- **Plantations** in the Indus Plain supply **timber, fuelwood** and **paper-pulp** wood, and shade, using canal water.
- **Afforestation** on mountain slopes and plateaux **prevents soil erosion**, **landslides** and **silting** of dams, and keeps the **water** balance.

Deforestation: effects and solutions

Effects	Solutions
soil erosion (nothing holds the soil)	**afforestation** and **reforestation** (planting more than is cut, such as the **Billion Tree** project in Khyber Pakhtunkhwa)
silting of **rivers, canals and dams** (Tarbela and Mangla lose capacity)	**laws** to protect forests and **stop illegal logging**
flooding (less water absorbed)	alternative **fuels** (gas, **solar**) to cut firewood use
loss of **wildlife** and **biodiversity**, and **climate change**	**community forestry**, **education**, and **controlled grazing**

Forests are a resource for development (timber, fuel, jobs, tourism, soil and water protection). To be sustainable, the trees cut must be replaced by planting.

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Mineral resources

Mineral	Where	Uses
Limestone	**Potwar**, **Kohat**, **Hub** (Balochistan), the **Salt Range**	**cement**, steel (as a flux), glass, fertiliser
Gypsum	**Salt Range**, **Kohat**, **Dera Ghazi Khan**	cement, **plaster of Paris**, fertiliser, paints, building boards, and spreading on **salty soil** to help reclaim farmland
Rock salt	**Khewra** (Salt Range), Kalabagh	cooking and **industry** (chemicals); the **Khewra Salt Mine** is among the largest in the world
Coal	**Thar**, **Lakhra** and **Sonda** (Sindh), **Sor Range** and **Khost** (Balochistan), the Salt Range	**power** stations and **industry** (brick kilns, cement)
Iron ore	**Kalabagh**, **Chiniot** (low grade)	steel
Copper and gold	**Saindak** and **Reko Diq** (Balochistan)	metals and industry
Chromite	**Muslim Bagh**, **Zhob**	steel alloys
Marble	northern areas and the north-west (for example Mardan, Buner and Chitral)	building, flooring, ornaments
Clays (china clay, fire clay)	various, including the Potwar and Sindh	pottery, ceramics, fire-bricks
Sulphur	**Koh-e-Sultan** (Chagai)	sulphuric acid, fertiliser, paints, explosives
Manganese and bauxite	small deposits in several areas	manganese for steel alloys and **batteries**; bauxite for **aluminium** (utensils, cans)

Exploitation. Pakistan has many minerals but **many are small or low-grade**, the **mining industry is under-developed** (lack of **capital**, **technology** and **roads** in remote areas), and some areas (**Balochistan**) have **security problems**.

Organisations. The **Geological Survey of Pakistan** (1947) surveys deposits, and the **Pakistan Mineral Development Corporation (PMDC)** (1974) explores and develops them. Metallic minerals (such as copper, chromite, iron ore) are found as **ores** that must be crushed and processed; non-metallic ones include salt, gypsum, limestone and coal.

Environmental problems of mining: land scarred and spoiled, **dust and noise**, **water pollution**, **loss of vegetation**, **subsidence**, and **danger to workers**.

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Benefits of developing minerals: employment, **exports**, **less need for imports**, and **industry** (cement, steel, power). **Sustainability** requires careful extraction, **restoring land** after mining, and limits to avoid exhaustion of reserves.

Imports. Pakistan imports **coking coal** and **iron ore** for steel (mostly from Australia and South Africa, and other places), **sulphur** and **other minerals**.

Fish

Fishing methods

- **Marine fishing** (the **Arabian Sea**): large **trawlers** and **mechanised boats** with nets; **gill nets**; small **wooden boats** for **inshore** fishing.
- **Inland fishing: rivers**, **lakes**, **reservoirs** (Tarbela, Mangla), **canals**, and **fish farms** (ponds), mostly in the **Punjab** and **Sindh**.
- **Fish farming:** ponds stocked with carp species; **shrimp farms** in the coastal Sindh.

Fish caught

Marine	Inland and farmed
shrimp, **pomfret**, **tuna**, **sardines**, **mackerel**, **ribbon fish**, **sole**	**rohu**, **catla**, **mrigal** (carp), **trout** (in the northern streams), **mahseer**

Types of fishing and why Sindh leads

- **Subsistence fishing** (fish eaten by the family, small wooden sailing boats, traditional nets, close to the shore) and **commercial fishing** (fish sold, mechanised boats and gill nets that can fish 50–60 km out).
- **Most of the marine catch** is landed on the **Sindh** coast, because it has **creeks and sheltered harbours** (Karachi), a **wide shallow shelf**, rich **plankton and nutrients from the Indus delta**, and the best **roads, ice plants, processing and export** facilities. The **Balochistan (Makran)** coast has small villages and poor facilities; much of its catch is **dried** (and sent to the Middle East).
- **Inland fishing** centres include **Manchar**, **Keenjhar** and **Haleji** lakes in Sindh, the **Mangla and Tarbela** reservoirs, and the Indus at **Sukkur, Kotri and Thatta**. **Fish farms** are rectangular ponds with a lined bottom and trees around to keep the water cool.
- **Marketing:** most people prefer fresh fish, so **frozen and processed** fish are sold mainly to **export** markets (including Gulf, Far East and Europe). Consumption per head in Pakistan is low.
- **Sustainable fishing:** limits on **mesh size** (so that young fish are not caught), **bans on illegal fishing** and on catching **endangered** species, and **quotas**, so that stocks can recover.

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Fishing ports

- **Sindh coast: Karachi** (Karachi Fish Harbour at **West Wharf**), **Keti Bandar**, **Korangi**.
- **Balochistan coast: Gwadar**, **Pasni**, **Ormara** and **Jiwani**.

Uses

Fresh, **frozen** and **dried** fish for food; **canned fish**; **exports** (especially **shrimp**); **fish meal** (animal feed) and **fish oil**; **fish leather** and **fertiliser**.

Improvements, problems and development

Improvements	Problems
motorised and **larger boats**, better nets, **cold storage** and **ice plants**, **freezing and canning**	**overfishing** and **illegal fishing** by foreign trawlers
processing plants and **export** to EU/Asia markets	**pollution** (sewage, oil, industrial waste) killing fish and **mangroves**
fish farming	**poor storage** and **transport**, **low prices** to fishermen, and **old boats**

To develop the industry sustainably: **control the catch**, protect the **mangroves**, **modernise** boats and ports, build **cold chains**, and **expand fish farming**.

> **NOTE**
>
> Numbers (for example how much coal or how many hectares of forest) vary by source and year. Learn the **types, locations, uses and problems**, and use the **figures given** in the exam paper.

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