

# NATURAL RESOURCES AN ISSUE OF SUSTAINABILITY

## Water

### Water – As a Renewable Energy:

- Water is an essential resource for life.
- It runs directly off the Earth in the form of lakes, sea, rivers, and streams.
- It falls from the atmosphere in the form of snow, rain, and hail.
- It is returned to the atmosphere in the form of vapors by transpiration from plants and evaporation from the land.
- The water vapors cool down and become water droplets (the process of condensation).
- Therefore, water is renewable as it comes from the atmosphere, runs through the land, is absorbed by plants then returned to the atmosphere and again discharged from the atmosphere. This cycle is known as the hydrological cycle.

### The Indus River System:

- Its Indus and tributaries are 3180 kilometers long.
- During the monsoon season, it discharges the most.
- Around 20 million hectares of cultivated land that accumulated to 60% of the land of Pakistan is irrigated by the Indus River and its tributaries.
- Its basin includes highly populous areas of Pakistan including Rawalpindi, Lahore, Jhelum, and Gujrat. They accumulate to a population of 50 million.
- The western tributaries of Kurram, Tochi, Swat, Kabul, and Gomal have the most water in the summer season.
- None of its rivers flow into the Arabian Sea.
- For irrigation, purpose canals are taken out of the rivers as none of its rivers are absorbed by the plains.

### Rivers of Balochistan:

- As compared to the Indus River System, the Balochistan rivers are considerably smaller.
- These rivers do not offer any value to irrigation and only flow during monsoon.
- Since Quetta has high altitude it is in the central position.
- Three of Balochistan's rivers drain into the Indus River namely Kalachi, Khandar, and Zhob while flowing eastwards.
- The rivers that flow westwards drain into hamuns.
- Few of its rivers also drain into the Arabian Sea namely Mashkel, Hab, Hingol and Porali.
- The Kachi Sibi Plain absorbs the rivers Mula, Bolan, Loralai, and Chakar.

### Ground Water:

- Water that is above the surface is called groundwater.

### Importance:

- It is high at mountain foothills and lowest in deserts.
- It helps in areas where rain is limited, and irrigation systems are needed. E.g. Balochistan.
- In cities like Karachi, this water fulfills the domestic needs of people.

### Problems:

- In industrial areas, it is not suitable for human consumption as toxic chemicals and sewerage are disposed of in it.

## Water Table:

- It is the uppermost layer of water that is underground.

## Importance:

- It fulfills water shortcomings in cities like Karachi.

## Problem:

- Oftentimes, the water table is also contaminated by toxic chemicals and domestic waste like the groundwater.

## Solutions:

- Laboratory tests must be conducted before its use.
- Plants must be constructed to refine the water from any contamination.
- It must be consumed after boiling.

## Uses of Water:

- There are many uses of water and few of them are listed below:
- Domestic – It is used in washing, cooking, drinking, and sanitation.
- Industrial – It is used to cool down furnaces in steel & iron industries, to dilute chemicals, pharmaceuticals, textile industries for humidity, dyeing and washing, mineral water and food processing.
- Agricultural – It is used for irrigation.

## Canal Irrigation:

- Irrigation is the artificial supply of water that helps in crop cultivation.

## Importance of Irrigation Systems:

- There is insufficient and unreliable rain in Pakistan.
- Since in many areas, summer is very hot, the evaporation rate of water is also high.
- The weather has long dry spells.
- In the monsoon season, rainfall is experienced in heavy showers resulting in a quick surface run-off.

## Factors Affecting Canal Construction:

- The Indus plain has soft soil that makes digging easier for canal construction.
- The Indus Plain has a flat surface that incorporates better use of machinery.
- The workforce is available at cheap rates because of the high population.
- Cement is easily accessible making canal construction easier.
- The natural slope from north to south helps in the smooth flow of water into canals.

## Indus Water Treaty:

- It was a contract between Pakistan and India that was signed in 1960 under the supervision of UNO.
- This treaty was considering the water dispute that both the countries faced when it came to the distribution of rivers after partition in 1947.
- Pakistan received the authority of Jhelum, Chenab, and Indus.
- India received the authority of Ravi, Sutlej, and Beas.
- Pakistan received financial aid from India, UK, Canada, Australia, and New Zealand to construct link canals, barrages, and dams.

## Importance:

- After partition in 1947, the headworks of many rivers were left in India at Ferozpur.

- Since Pakistan has unreliable and insufficient rainfall, the water of these rivers was essential for irrigation.
- In 1948, India stopped the water supply of these rivers to Pakistan and Pakistan had to purchase this water from India to support its agricultural economy.
- The Indus Water Treaty saved Pakistan from permanent exploitation by the hands of Indians.

### Dams and Barrages:

- Barrages and Dams are constructed at the cross-section of rivers to store water. This stored water can then be used for various purposes including irrigation.

### Names of Large Dams:

- Tarbela Dam on River Indus, Mangla Dam on River Jhelum and Warsak Dam on River Kabul.

### Name of Small Dams:

- Hab on River Hab, Khanpur on River Haro, Nari/Bolan Dam on River Bolan and Rawal Dam on River Kurrang.

### Name of Barrages:

- Qadirabad Barrage, Chashma Barrage, Rasul Barrage, Guddu Barrage, Kotri Barrage and Marala Barrage.

### Comparison between Small Dams, Large Dams & Barrages

#### Small Dams & Large Dams:

- Both dams are used for fishing, flood control, and irrigation.
- They both can be used for recreational purposes.
- They both support the production of HEP.
- Large dams are multi-purpose.
- Large dams can support irrigation for a larger area. For example, Rawal Dam irrigates 5000 hectares of land while the Warsak dam can irrigate 48000 hectares of area.
- All large dams can produce a huge amount of HEP. Whereas, small dams either can or cannot produce HEP; if they can then the amount of HEP is still very less than big dams' production.
- Large dams are expensive and time consuming to build. They are also hard to maintain.
- The amount of resettlement at large dams is greater than in small dams.

#### Barrages & Dams:

- Barrages are longer while dams are higher.
- Barrages cannot produce electricity because they are built on flat surfaces, Contrary, dams are created over a slope and can produce electricity.
- Dams and Barrages both can be used to support fishing, flood control, and irrigation.

#### Importance of Barrages:

- It helps in irrigation using canals.
- The gates are closed, and water is held in a barrage.
- The link canals then take that water and distribute it into smaller canals.
- The link canals compensate for the loss of water by taking it away from western rivers to eastern rivers.
- Barrages help in providing more agricultural land.
- It helps in yielding more bananas, wheat, rice, etc.
- It helped in the settlement in Lower Indus Plain.
- Barrage offers many benefits but farmers overuse water that results in water salinity and logging.

## Link Canal & Its Purpose:

- There are many link canals, some of their names are as under:
- Rasul Qasirabad.
- Balloki-Sulaimanki 1
- Balloki-Sulaimanki 2
- Chashma-Jhelum
- Marala-Ravi

### Purpose:

- The link canals carry water from the western river to eastern rivers.
- They help by compensating for the water loss to India.
- They help in irrigation by providing water through perennial canals.

## Water Logging & Salinity:

- Perennial canals helped in making water available for everyone all year round.
- However, it increased the water table as well as the salts also came to the surface.
- When the water evaporates the salt remains on the surface and the visible salt patches are called salinity.
- Salinity makes the land unsuitable for farming.
- The rise of the water table to the surface is known as waterlogging.

### Solution:

- Eucalyptus is a tree whose roots go deeper and can absorb water from the water table helping to reduce the waterlogging and salinity issue.
- The waterlogging and salinity issue can also be solved by lining canals and using canal closures.
- Tube wells can also help in solving these issues.

## Irrigation Methods

### Conventional Irrigation Systems:

- Shaduf – It is a system in which water is drawn from a canal, river or well using a bucket that is attached to a pole.
- Charsa - In this system, animals are used to pull water from the well.
- Persian Wheel – In this system, a wheel is used that supplies water continuously and irrigates a larger area.
- Karez – In this system, a horizontal underground canal is dug that is several kilometers long.

### Modern Irrigation Systems:

- Perennial Canals – This system provides water throughout the year. These canals are attached to dams and barrages.
- Tubewells – It has pumps that are operated with fuel (diesel or electricity) to raise water from the depths. It also helps by lowering the water table.
- Sprinkler/Spray – It is a system that is commonly used to water garden plants. In this system, sprinklers are attached to water pipes directly. It is an expensive method.
- Tankers – Tankers are used in an emergency to provide water to fields and households by collecting it from ponds and lakes.

## Surface Water Pollution:

- Water pollution is a serious issue.
- It is a result of dumping industrial and domestic waste.
- The waste contaminates the groundwater and if people drink it, they can suffer from diseases like hepatitis, diarrhea, etc.
- In agriculture, pesticides are used that can also contaminate the ground and surface water.
- Oil seepage from ships in Karachi.

# Forests

## Productive & Protective Forests:

- There are two types of forests:

### Productive Forests:

- These are natural forests.
- These forests are used to extract products like timber.
- They have more commercial value.
- These forests have high tree density and closed canopy.

### Protection Forests:

- These are man made forest i.e. people planted these.
- These forests are linear.
- These forests have less commercial value.
- They do not provide any valuable wood.
- The main purpose of these forests is to protect the soil.
- They help in controlling the temperature and provide shade.

## Importance of Forests:

- Forests protect erosion of soil.
- Keep the environment clean and help in lowering the temperature.
- Forests help in the formation of humus that maintains soil fertility.
- Forests also help in reducing flooding.
- They provide raw materials to industries including paper, timber, etc.
- They promote tourism and provide employment.

## Types of Forests:

### Alpine Forests:

- They can be found in Northern areas including Chitral, Kohistan, and Dir.
- The trees found in these forests have less growth because of low sunlight and low temperature.
- The trees' roots have a better grip on the ground because they spread sideways and absorb more nutrients.
- The branches of trees are upward normally to absorb more sunlight.
- The wood from these forests is only used for fuel.

### Coniferous Forests:

- They can be found in Northern Areas including KPK, Balochistan Mountains, Murree, Islamabad, and Rawalpindi.
- These forests can survive at low temperatures.
- The trees are conical in shape and have sloping branches.
- The leaves are usually needle-shaped, leathery, small and thick to check excessive transpiration.
- Less humus is formed in these forests.
- They offer timber, environment protection, tourism, wildlife, and beautiful scenery.

### Tropical Thorn Forests:

- They can be found in Punjab Plains, Sindh Plains, and Western & southern Balochistan.
- They are low in height, usually 6 meters to 10 meters.
- They have thorny hardwood mostly; trees have deep roots to search for water and low vegetation because of less water.
- The wood from these forests is generally used for fire only.

### Sub-Tropical Scrub Forests:

- They can be found in Himalayas' hills and foothills, Kirthar and Sulaiman Ranges, Makran Coast Range and Western Mountains.
- These forests have tropical thorny and sub-tropical broadleaf species.
- They are used for grazing, watershed protection, and firewood.

### Riverain or Bela Forest:

- They can be found in River Indus and its tributaries.
- These forests have linear plantations along the banks of rivers.
- They have high yielding commercial hardwood species.
- They provide Shishum and Babul wood.

### Mangrove Forests:

- They can be found in Sindh and Balochistan's coastline areas.
- They have broad, leathery leaves with drip tips.
- The trees there are low in height and shrubs are grown on the flats.
- The trees can survive in saltwater. As their roots spread into seawater.
- In better conditions, the trees can rise to 6 to 8 meters, but they are generally 3 meters long.
- Waste is dumped in the Arabian Sea that has stunted the growth of these trees in the Indus and Hub Delta.
- Because of pollution limited species are grown there.
- They offer firewood, timber, breeding ground for fish, prevent coastline from erosion and absorb shocks of tsunami and earthquake.

### Irrigated Forests:

- Changa Manga near Lahore, Wan Bachran near Thal, Chichawatni in Sahiwal are Irrigated forests.
- In these forests, economically important species of trees are planted in large quantities.
- They have species like Shishum, Babul and Eucalyptus.
- They produce firewood and timber.

### Deforestation:

#### Causes:

- Rise of urbanization.
- Use of wood for the fire.
- Use of timber in industries.
- Construction of roads.
- Mining.
- Overgrazing of land.

#### Effects:

- Deforestation has many bad effects on our environment. Some of them are listed below:
- Erosion of soil by water and wind.
- Increase in floods.
- Surface run-off carrying sand and silt.
- The generation of electricity is affected because of siltation in reservoirs.
- Destruction and extinction of natural habitats.
- Food and crop production has been affected greatly.
- Irrigation canals are blocked.
- Harmed the fisheries.
- Extreme climate change and global warming.

## Solutions to Problems Caused by Deforestation:

- There should be selective cutting that will forbid the cutting of young trees.
- Heavy machinery should be restricted in forests.
- Reforestation must be initiated to cover up for the loss of forestation.
- Fuelwood plantation should be done on reserved lands to preserve valuable wood species for other wood industries.
- Forestation should be done on hill slopes to prevent silting, flooding, erosion, etc.
- Media should be used to spread awareness about the importance of trees and forests in general.

## Afforestation:

- In Pakistan, many afforestation projects have been started:
- In Balochistan, Agha Khan Rural Support Program has been initiated that has planted 80 thousand plants.
- The Tarbela/Mangla project is planting trees on privately owned badland.
- The Rechna Doab Project is planting trees between Ravi and Chenab.

## Sustainable Forestry:

- The cutting rate of trees must not be more than the rate of their growth.
- If a tree is cut, then it must be replaced from a sapling from the nursery.
- If forest areas are cut down, then new forest areas must be planted to accommodate for the loss to nature.

# Mineral Resources

## Formation of Minerals:

- Hot Magma – When heat and pressure transform one form of rock to another when the hot magma cools down mineral crystals start to become visible.
- Mineral Rich Fluids – When mineral-rich fluids are evaporated.
- Volcanic Rocks – When volcanic rocks are broken down by wind and water.
- Many minerals form crystals.
- If the crystals take too much time to form, they become gemstones.

## Processes of Mining

### Open Cast Mining:

- Giant excavators and power shovels are used to mine minerals like iron and coal that are near the surface.

### Underground Mining:

- There are two types of underground mining:
  - Adit Mining – On hillsides minerals are often exposed on a seam. Miners mine by creating a passage that can be horizontal or slope depending on the mineral seam angle.
  - Shaft Mining – To mine coal especially, vertical shafts are dug down first by miners and then horizontal tunnels are dug. Minerals are then extracted from tunnels.

## Problems Faced by Miners:

- There are many problems that miners face including:
  - Flooding.
  - The fall of tunnel walls.
  - Leakage of poisonous and dangerous gases.
  - Explosions.

- Ventilation shortage.
- Underground transport.

## Types of Minerals

### Metallic Minerals:

- These minerals are more valuable.
- They are usually shiny, hard and tough.
- They can change shape without breaking.
- They are malleable.
- Many of the metallic minerals are good electricity conductors.
- They are reactive with acid and water.
- Examples of metallic minerals are copper, iron, silver, gold, tin, etc.

### Non-Metallic Minerals:

- They are less valuable.
- They do not shine, are rough and soft.
- If their shape is shaped, they can break down.
- They are not malleable.
- They are bad electricity conductors.
- They are less reactive with water and acid.
- Examples of non-metallic minerals are coal, Sulphur, gypsum, limestone, marble, etc.

## Advantages and Shortcomings of Mining:

### Advantages:

- It will create more employment.
- It will increase exports.
- It will increase foreign trade.
- It will make Pakistan self-sufficient and there will be less import needed in minerals like limestone.
- There will be improved roads and communication in Balochistan.
- Advancement in mining machinery.
- There will be more industries.

### Shortcomings:

- There are not many skilled individuals.
- For modern technology, Pakistan will need to import machinery.
- The development of the mining industry will increase pollution.
- Pakistan has an investment shortage.

### Effects of Mining on Environment:

- There will be more soil exposure because of vegetation cut down.
- Land pollution will be increased because of mining waste.
- Noise pollution will be increased because of blasts.
- Water pollution will be increased because of mineral waste.

## Sustainable Mining:

- Policies should be made and strictly implemented for the sustainable development of the mining industry.
- Modern technology should be used to increase competitiveness as well as environmental protection.
- The release of heat and discharge of toxic substances should be checked promptly to make sure no serious damage is inflicted on the environment.



# Fish

## Types of Fishing:

### Marine Fishing:

- The types of fish that are caught in the sea are sharks, drums, croakers, catfish, rays and skates.
- Fish are bred in Mangroves at Hub and Indus Delta.
- There are two types of fishing methods used in marine:

- Subsistence Fishing – It is when the fishermen and their families consume the catch. In this fishing, the conventional way of using a net is used.

- Commercial Fishing – It is the type of fishing that is done to generate an income. Several communities are involved in this type of fishing. In this type, new techniques of fishing are used including motorboats.

### Inland Fishing:

- The types of fish caught in inland fishing include palla, trout, thalla, rahu, silver, and Manaseer.
- It is the fishing that is widely practiced throughout the country in almost all rivers.
- The reservoirs of dams, irrigation channels, and abandoned rivers are used for fishing.
- For fish farming, dug pounds are also utilized.

### Fish Farms:

- They are also known as aquaculture.
- They are manmade rectangular fish ponds used for breeding.
- Some of the fish farms are:
  - Reservoirs of Mangla and Tarbela Dams.
  - Keenjhar Lake.
  - Manchar Lake.
  - Haleji Lake.
  - River Indus

## Development in Commercial Fishing:

- For the development of fishing several steps are taken by the government:
- New fishing methods have been introduced.
- Value-added products have been developed such as the frozen/canned fish.
- Awareness about the weather to fishermen by broadcasting.
- The MFD (Marine Fisheries Department) has also started various development projects for the fishing industry including Strengthening of Quality Control Laboratories, Monitoring of Deep-Sea Fishing Vessels.
- Under the guidance of the WTO (World Trade Organization), the MFD labs are further improved.

## Problems of the Fishing Industry

### Water Pollution:

- Oil spillage from ships.
- Discarded toxic chemicals, industry and domestic waste.

### Overfishing:

- Overfishing is threatening the existence of shrimps.
- It is practiced all year round even in the breeding season.

### The threat to Mangrove:

- The forest of mangroves cannot survive in polluted water.

### Lack of Financial Resources:

- There is not enough capital to adopt modern fishing techniques and technology.

### Sustainable Fisheries:

- Prevent foreign deep-sea trawlers to operate in the Arabian Sea.
- Illegal nets to fish must be banned as they can catch baby fish.
- The mangrove forests must be protected.
- Water pollution must be controlled.