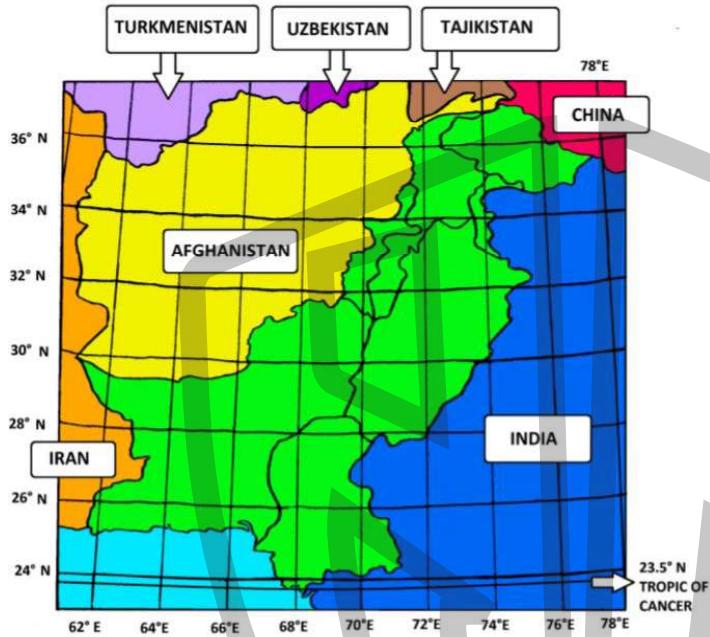


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Unit 0

Introduction to Land of Pakistan



Pakistan is located at the epicenter of three important regions of Asia : centralasia in the north India in the east Middle east in the west.

Pakistan covers an area of 796096kmsq equal to area of Britain and France combined ,
1046 km long coastline,
2252 km border with Afghanistan (Durand line)
Wakhan Strip in the North west connects Tazikistan
South west Iran
East India

Pakistan's four provinces are

- Sindh
- Punjab
- Kpk
- Balochistan



The Geographical Location of Pakistan

Pakistan is situated in the northwestern part of South Asia. It lies between the latitudes 23.45° and 36.75° north and between the longitudes 61° and 75.5° east. Pakistan's 59% area consists of mountains and plateaus whereas; plains and deserts constitute 41% area of Pakistan. Pakistan is surrounded by the Himalayas, Karakoram and Hindukush ranges in the north. In the northeast, Pakistan has a common border with China. Its length is 595 km. Afghanistan is situated in the northwest of Pakistan. The border between Pakistan and Afghanistan is known as the Durand line and its length is 2252 (2240) km. Iran is situated in the west of Pakistan. The length of this border is 909 km. India is in the east of Pakistan. The border between India and Pakistan is nearly 1610 km long. Arabian is situated in the south of Pakistan. Tajikistan is nearly 16 km away from Pakistan. Wakhan, a small Afghan territory, lies in between the two countries. Arabian Sea is situated in the south of Pakistan. Pakistan has more than 1,046 km long coastal line.

The total surface area of Pakistan is 7, 96,096 (803,940) square kilometers. Out of which land mass is 778,720 sq.km and water mass is 25,220 sq.km. Pakistan is divided into four provinces namely, Punjab, Sindh, NWFP and Baluchistan. Islamabad is the capital of Pakistan.

Importance of Pakistan's Geographic Location

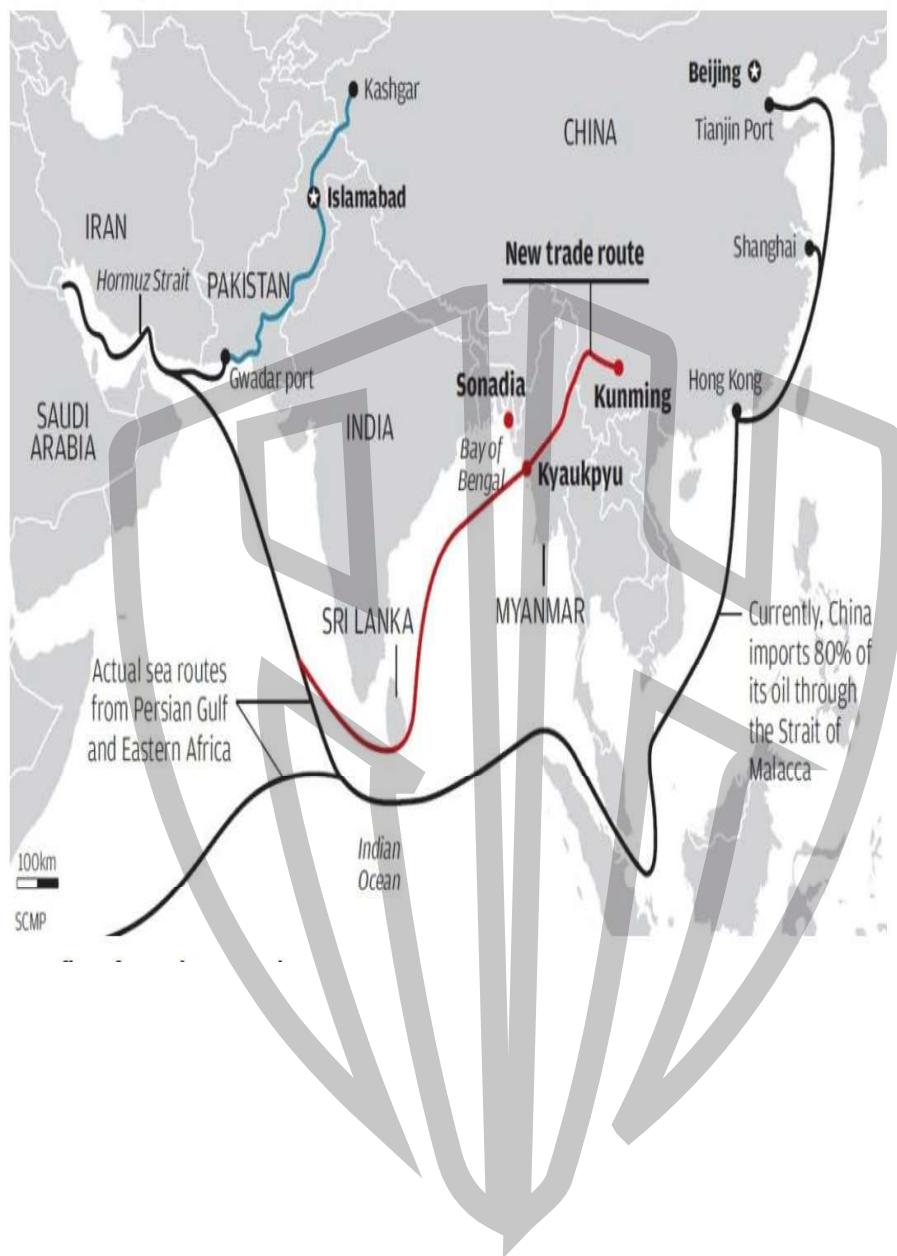
Strategically, Pakistan is situated at a very important place. Pakistan is situated in a region, which has

a great political, economic and military importance. Pakistan is in the neighborhood of two big powers i.e. China and the Russian Federation. Similarly, Pakistan has an access to the six Muslim Central Asian States through Afghanistan. These states are land locked states and Pakistan can provide an inter link between the Gulf States, African, European and Central Asian countries. Our sea route remains open throughout the year due to moderate temperature. There is a series of Muslim countries from the Middle East to the African continent, which are easily accessible from Pakistan. Pakistan, thus, connects almost all the Muslim countries of the world from Atlantic Ocean to the Arabian Sea

Importance of Gawadar port

During recent years china has emerged as new economic power and trading giant in the international market. **Gwadar** can act as an alternative route to Indian Ocean or South China Sea routes. It is the third **important** International **port** in Pakistan after Karachi and Qasim **ports**. It is located at cross junction of international sea shipping and oil trade routes. Gwadar is highly beneficial for influx of Chinese oil and other products to the middle east reducing the distance and time from its traditional route of south china sea





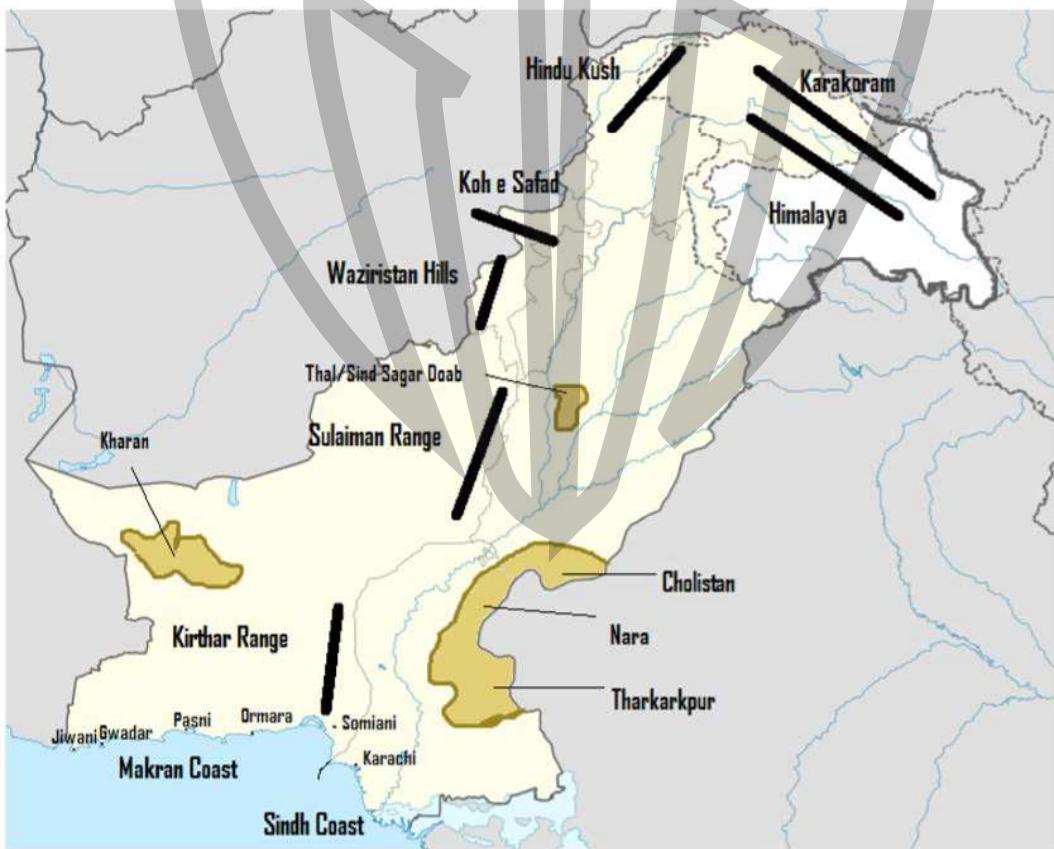
Unit: 1

"Topography of Pakistan"

Topography (Topos, "place", and grapho, "write") is the study of surface shape and features of the Earth.

Pakistan is divided into the following physiographic regions:

- The Mountainous North.
- The Western Highlands.
- The Indus Plain & Tidal Delta.
- The Desert Areas.
- The Coastal Region.



Important Definitions

- **Topography:**

It is the detailed study of the surface features of a region.

- **Hills and Mountains:**

A Hill is generally considered to be an elevated piece of land less than 600 -610 meters high.

Mountain is an elevation of land that is more than 610m high. Some hills are called mountains while some mountains are referred to as hills.

- **A Mountain Range:**

Mountain Range is a succession of mountains which have the same direction, age and same causes of formation etc. A snowfield is a huge permanent expanse of snow.

- **Relief/ Topography:**

The condition of the land related to the rocks, ups and downs eroded and depositional features like valleys, rock type, passes etc.

- **Drainage:**

It is related to the eroded and depositional features of the rivers like ox-bow lake, meander, levees etc. All types of river patterns including dentifrice are part of drainage.

- **Gorges:**

They are an irregular depression in a valley.

- **Cirque:**

They are regular depression made by the movement of glaciers.

- **Valley:**

Plain land between two mountains.

- **Passes:**

A natural path which connects two areas in mountainous region.

- **Snowfield:**

A plain field covered with snow usually above the snow line (4000m).

- **Ravine:**

A deep narrow gorge with steep sides.

- **Gully:**

A ravine formed by water activity.

- **Glaciers:**

Tongue shaped mass of ice moving slow down the valley.

- **Streams / Springs:**

Channels of water from snowcapped mountains towards valley.

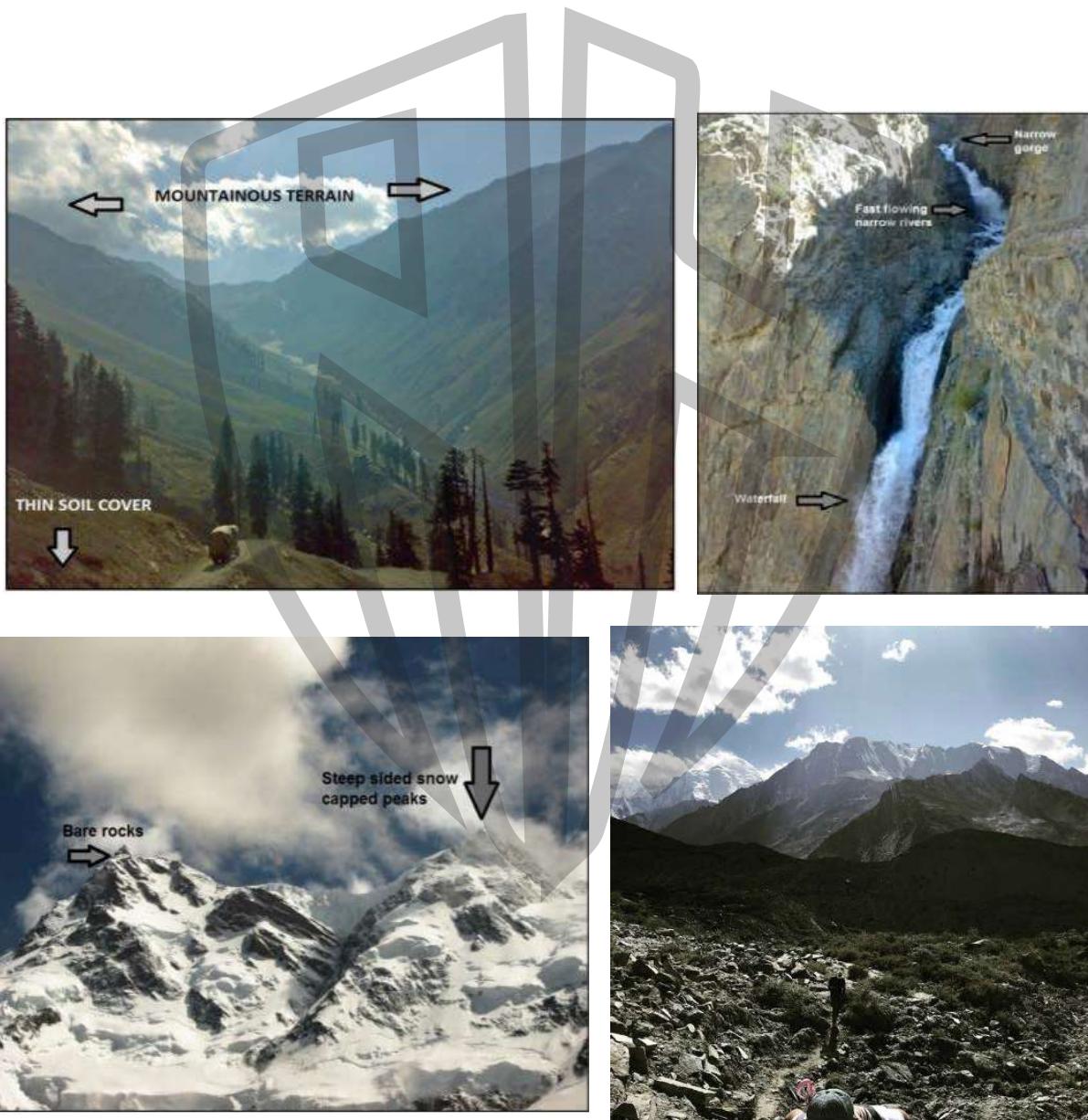
- **Cirque/ Corrie:**

A steep walled basin or a kind of lake, example: Lake Saif-ul-Mulook.

- **Serrated Landscape:**

Elevated mountain zone used for agriculture.

- Bare Rock:**
Rock without vegetation due to accumulation of snow.
- Scree:**
Accumulation of loose rock debris.
- Abrasion:**
The scraping of rock surface frozen into the moving ice.
- Plucking:**
When ice freezes onto rocks surface and pulls off pieces or blocks of moving ice.
- Snowline:**
An area above 4000 M where vegetation could not survive





Northern Mountains:

The Northern Mountains are divided into three main mountain ranges:

- **The Karakoram:**

- Average Altitude: 6000m
- Highest peak: K2 (8610m)
- Lifestyle: Nomadic agriculture and livestock is practiced.
- Products: Apples, barley, millets.
- Valleys: Gilgit, Hunza, Baltistan.

- **Himalayas:**

- Average altitude: 4000m lesser or lower Himalayas.
- Highest peak: Naanga Parbat (8126m).
- Lifestyle: Nomadic
- Economic activity: Tourism/ agriculture and livestock are practiced.
- Important locations: Murree, Nathya Gali, Ghora Gali.
- Valleys: Murree gullies and Naran Kaghan.

#

- **The Hindu Kush:**

- Average Altitude: 5000m.
- Highest peak: Tirich Mir (7690m).
- Historical Importance: Alexander Timurlane, Mughals, Ghazni and Ghauris passed it to attack India.
- Important locations: Sawat, Kohistan, Chitral, Dir.
- Products: Rice apples apricots tobacco
- Valleys: Sawat, Chitral, Dir.

SPECIFICATION	NORTH-EASTERN MOUNTAINS		NORTH-WESTERN MOUNTAIN
RANGE	KARAKORAM	HIMALAYAS	HINDU KUSH
AVERAGE HEIGHT	6000 m	4000 m	5000 m
HIGHEST PEAK	K-2	Nanga Parbat	Tirich Mir
PASSES	Kunjerab	Babusar, Banihal	Shandur
VALLEYS	Skardu, Shyoke, Shigar	Rapul, Kagan	Swat, Dir, Hunza, Chitral, Kalash
GLACIERS	Siachen, Biafo, Baltora, Batura	Nanga Parbat	Tirich Mir, Rich
RIVERS	Gilgit, Shyok, Hunza	Indus	Panjkora, Kunar, Swat



Topographical Features of the Northern Mountains

- Parallel ranges run mainly from west to east.
- The height of the ranges increases from south to north.
- Permanent snow fields / glaciers.
- Steep, deep and narrow valleys e.g. Swat valley, Hunza valleys etc. and gorges.
- Fast flowing rivers. E.g. Shyok, Gilgit.
- Rugged landscape.
- Alluvial fans.
- Pyramid / conical shape sharp peaks.

Drainage Features of the Northern Mountains;

- The River Indus and its tributaries which originate from the Northern Mountains, dominate the drainage pattern of the Northern Mountains.
- Eastern tributaries of River Indus (Ravi, Jhelum, Chenab, Sutlej, and Beas) originate from Himalayas and after passing through Kashmir, enter into the plain areas where they join River Indus.
- The River Indus and its tributaries form the features like Gorges, waterfalls, rapids, streams and springs.

Lifestyle and Economic Activities in the Northern Mountains;

- Economy has developed on traditional lines.
- The rugged landscape of the Mountain makes it difficult to move either on foot or vehicles.
- Even the Passes are at high attitudes like the Karakoram pass is at 5568 m.
- Most of the population depends on primarily subsistence agriculture and cattle breeding.
- Farming is practiced on terraced fields where soil is suitable and water is available
- At some place rice is cultivated where water is plentiful.
- Semi nomadic or transhumances life is practiced.
- Transhumance:- Seasonal movement of pastoral farmers and their livestock seeking fresh pasture between two areas of different climatic conditions.
- During winter people work in cottage and small-scale industries.
- Tourism is also popular, domestic and foreign tourists visit these places mainly in the summer season.

- These mountains have major hydro-electric potential.
- There are coniferous and alpine trees which are being deforested for timber.
- Low population density due to harsh climate.

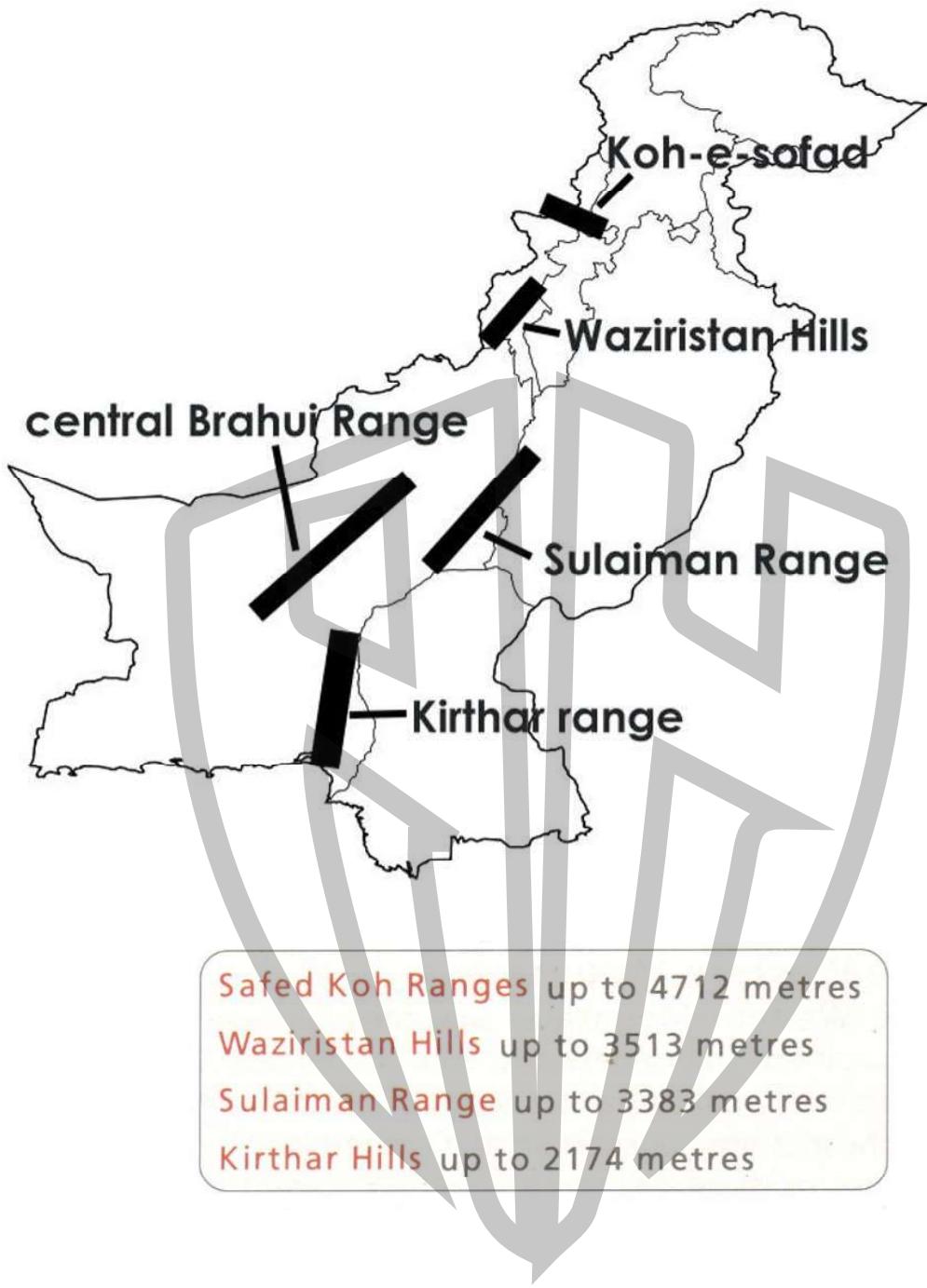
Environmental Issues:

- Deforestation and overgrazing caused soil erosion.
- Deforestation has increased due to demand for firewood and timber.
- Construction of roads causes landslides.
- Rapid population growth has resulted in rapid pollution.
- People living on hills suffer due to polluted water.

Western Mountains

Topographical Features of the Western Mountains;

- The western mountains divided into four parts. The Safed Koh, The Waziristan hills, The Suleiman mountain range and The Kithara hills.
- Consist of several parallel ranges.
- Most of these ranges are dry and barren.
- Small streams and torrents begin to flow in rainy season.
- The river beds are usually dry but occasional torrential rains cause destructive floods.
- Steep, deep and narrow valleys e.g. Bannu, Kohat, Peshawar etc. and gorges.
- No of small rivers. E.g. Kabul, Kurram , Gomal etc
- Rugged landscape.
- Pyramid / conical shape sharp peaks.
- Alluvial fans
- Deposits of clay and boulders.



Drainage:

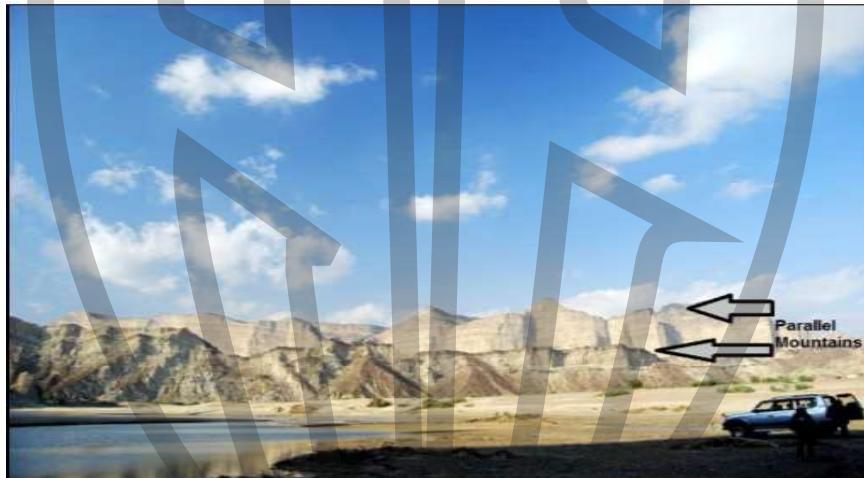
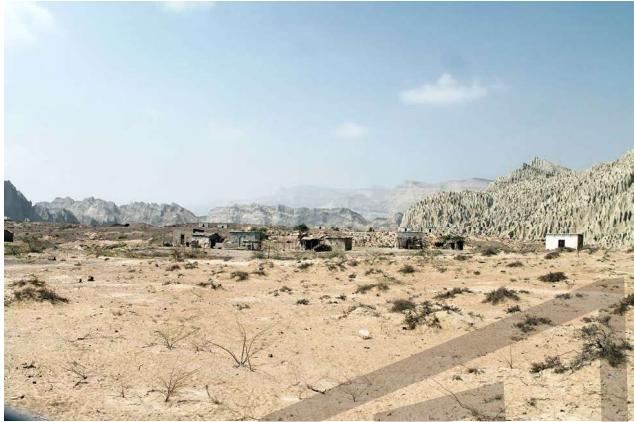
- The Safed Koh range is drained by River Kabul, which runs in West to East direction and eventually joins River Indus. The Waziristan hills are drained by small seasonal rivers like Kurram, Tochi and Gomal.
- These rivers run from West to East and all are the Western tributaries of the River Indus. The Sulaiman range is drained by small hill torrents and small seasonal rivers such as the Bolan and Mula.
- These rivers usually lead to small inland lakes, where the water collects and then dries up (for example the lake Damas). The rain falling on Eastern slopes of Sulaiman range runs down the slopes and falls into piedmont plains leading to the formation of alluvial fans.

- The Kirthar range on the other hand is drained by the River Hab (seasonal river) which flows in a North to South direction and eventually joins the Arabian Sea.

Lifestyle and Economic Activities in the Western Highlands:

- Mountains mostly bare of vegetation.
- Climate and relief are not suitable for agriculture.
- Transport facilities are limited.
- Few areas are connected by metalled roads, most are unmetalled.
- Except for few cities, rest is unconnected from air or rail.
- Difficult life due to rugged landscape.
- Developmental Projects have not been established due to high costs of construction.
- Nomadic lifestyle is common.
- Population density is lower than 100 persons per square kilometers.
- Abundant minerals, but difficult to extract





Balochistan Plateau

Plateau: It is an area of highland which is usually flat although a heavily dissected plateau can also exist.

Features are:

- Balochistan Plateau has a height varying from around 600m to around 3000m.
- Total covered area of 347190 sq. km.
- It has deep narrow valleys like Quetta.
- They have bare rocks due to lack of rainfall.
- The mountains have steep slopes and none are snowcapped.
- There are parallel ranges running in East to West direction, for example: The Chagai Hills, Raskoh Range and Makran Coastal Range are all parallel ranges.
- Parallel ranges running North-South direction are Central Brahui and the Hala range.

Drainage Features;

- There are no small rivers in Pakistan which dominate the drainage pattern of Balochistan plateau.
- Rivers like Zhob, Khandar and the Kalachi drain into River Indus because they flow eastwards.
- The rivers Loralai, Chakar, Bolan and Mula are absorbed into the Kachhi Sibi Plain.
- The rivers Hab, Porali, Hingol and Mashkel drain into Arabian Sea.
- There are many small rivers that flow westward and drain into shallow depressions called Hamuns also called Playa. Hamum-e-Mashkel on the western side is biggest salt lakes.

Economic activities and Lifestyle in Balochistan plateau;

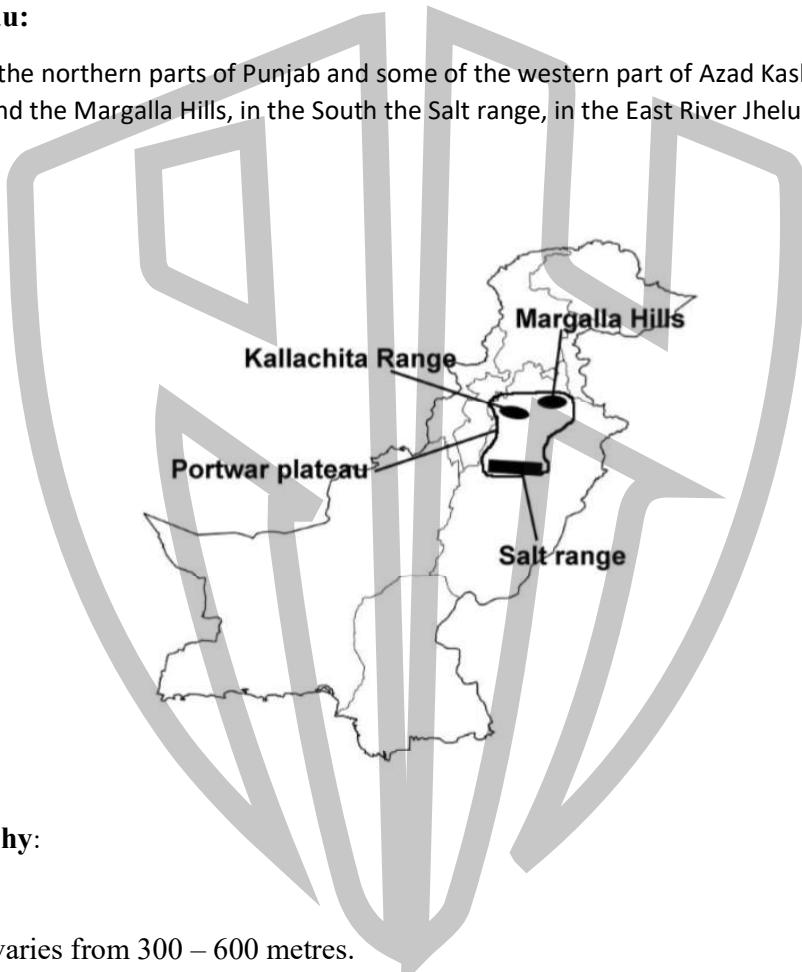
- People face a scarcity of both drinking and irrigated water.
- Small water schemes such as Karez system, flood diversion channels and a small no. of tube wells mostly supply water.
- There is an absence of link roads between producing areas and the main roads.
- The railway line covers only a limited area.
- Crop farming and livestock raising are the main occupation of the people.
Saindak Copper-Gold project and the Pakistan Mineral Development Corporation is also working there.
- Balochistan has appreciable deposits of crude oil and natural gas.
- Still large part of the plateau untapped.
- 75% of the total production of fruits is produced here
- Main fruits include dates, grapes, apples, almonds, apricots, plums, peaches, melons and pomegranates.
- Cold winters suits the cultivation of the vegetable seeds.
- Nomadic livestock farming is common in this region.
- Fishing activity is done for domestic and commercial purpose.
- 3 main fishing ports are Gwadar, pasni and Ormara.

Mountain Ranges of Balochistan:

- Ras Koh
- Hala
- Makran coastal range
- Central Brahui
- Toba Kakkar
- Siahn

Potwar Plateau:

This plateau covers the northern parts of Punjab and some of the western part of Azad Kashmir. To the North of the plateau we find the Margalla Hills, in the South the Salt range, in the East River Jhelum and on the West the River Indus.



Topography:

- Height varies from 300 – 600 metres.
- Residual hills rise over 1000 metres.
- Large part has been eroded by action on running water and has a varied landscape.
- ‘Badland topography’ due to dissection.
- Landscape of ridges, ravines and troughs.
- Soan River has formed gullies and large alluvial plains.

Salt Range:

The Salt range is bordered by Potwar Plateau in the North, River Indus on the west and River Jhelum on the east topography. It consists of parallel mountains, which generally run from North-East to South-West. The height of the range varies from 750m-900m. The mountain range slopes gently towards the Potwar Plateau (in the north) but slopes steeply towards the Upper Indus Plain (in the south).

Topography

- Mountain ranges covering Jhelum, Chakwal, Kalabagh, Mianwali districts.
- Salt mines at Khewra, 160 km from Islamabad.
- Avg. height: 750 – 900 m.
- Sakesar peak (1527m) is highest point.

- Ranges are badly faulted and eroded.
- Lakes like Kallar Kahar and Khabeki add to scenic beauty
- River Soan is partially separating Potwar with salt ranges.
- Salt ranges are steeper towards Potwar Plateau.
- They have higher altitude in the south which decreases northwards.
- There are few beautiful lakes in the region like Color, Kalarkahar, Makrachi and Dhabi.
- Salt ranges are covered by gullies which are making Bad-land topography. This is because of deforestation.
- Small scale subsistence farming is possible around river source and its tributaries.

Drainage of Potwar Plateau and Salt Range:

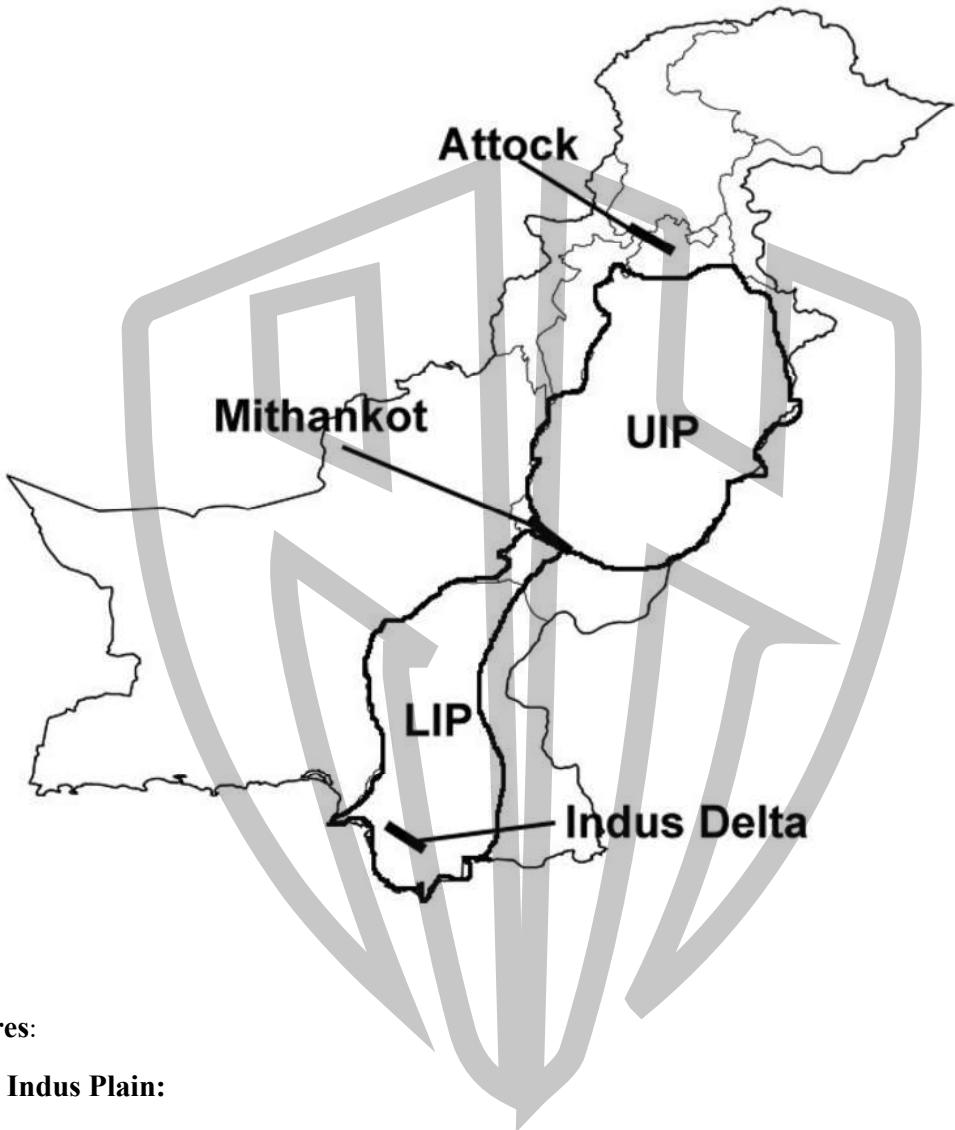
- There are no. of perennial and non-perennial streams in the Potwar Plateau which swell up in rainy season.
- River Soan is an important river which flows through the Potwar Plateau and joins River Indus.
- There are no of small salt lakes in the plateau such as Kallar Kahar, and Khabeki which add to the scenic beauty of the area.

Economic activities and Lifestyle in Potwar Plateau and Salt Range:

- Mining is done for marble, rock salt, dolomite etc as rich in non-metallic minerals.
- No. of oil and gas fields are also located in this region, Attock Oil refinery is refining the oil produced in Potwar Plateau.
- Farming depends on rainfall, as on rugged landscape irrigation is not possible.
- Wheat, maize, barley and gram are cultivated.
- Road, rail and air transport facilities available.
- Small salt lakes in the plateau such as Kallar Kahar, and Khabeki, add the scenic beauty of the area and attract tourists.
- High population density.

Indus Plain

The Indus Plain is divided into two regions; the Upper Indus Plain and the Lower Indus Plain. The Upper Indus Plain extends from areas below Kashmir and Lesser Himalayas to Mithankot. The Lower Indus Plain extends from Mithankot to the Indus Delta.



Features:

Upper Indus Plain:

- In the upper Indus plain there are doabs (a doab is a land between two rivers) e.g. Bari Doab.
- Bars (alluvial terraces) are also present, which are 7-12m high e.g. Nilli and Ganji Bars.
- The rivers keep on changing their course slightly (meanders).
- There are levees along the river bed, which help contain the river.
- Active flood plains are present alongside the river; these are low lying areas of flat land, which are annually flooded in the rainy season. The active flood plain is made up of new alluvium
- The old flood plains are also present. They are flat areas, which are higher than active flood plains. They are made up of old alluvium, which had been deposited a decade ago. They're flooded after a decade or so, when strong monsoon winds combine with the heavy melting of snow and ice in the glaciers of the Northern Mountains.

- Piedmont plains are found at the foothills of the Himalayas in the Salt Range. They are formed by the deposition of material by hill torrents, when they lose their speed. Kirak Hills exist between the River Chenab and Jhelum.

Topographical Features:

The landform of the Indus plain has the following distinct features.

- | | | |
|-----------------------|--------------------|------------------------|
| → Active flood plains | → Old flood plains | → Alluvial terraces |
| → Piedmont plains | → Tidal Delta | → Rolling sand plains. |

Lower Indus Plain:

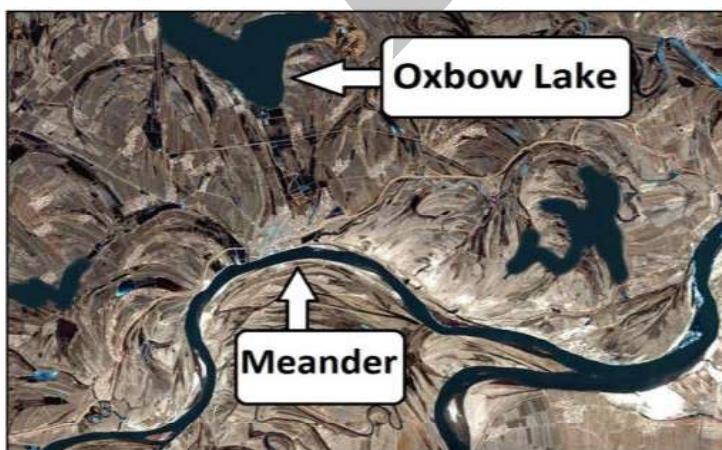
- The Lower Indus Plain principally differs from the Upper Indus Plain due to presence of a tidal delta (the Indus Delta) and also because in the Lower Indus Plain only one river that is, the river Indus, flows.
- Indus delta exists in some of the southern parts of the Lower Indus Plain. A delta is a low lying triangular area which has alluvial deposits.
- The river divides into distributaries before entering a larger body of water (in this case the Arabian Sea). The delta exists because of the deposition of material carried by the river. This happens because when the river enters into the sea, it loses its speed and thus also loses its ability to hold this material, which is therefore deposited at the mouth of the river.
- In the lower Indus Plain, we may find limestone ridges which are known as cuestas, a few examples being; Rohri and Gango Takar Cuestas.
- Oxbow lakes are also present in the lower Indus plain.
- Active and Old Flood Plains are also present, but a doab and alluvial terraces are absent. Meanders however are present too.
- Piedmont Plains are present at the foothills of Kirthar and Sulaiman Mountain ranges.
- Part of the Indus plain that extends into Balochistan is known as the Kachi Sibi Plain. Both these plains have rolling sand dunes (Thal and Thar deserts), flat plain areas, have some low lying hills, oxbow lakes and meanders etc.
- The main differences are the number of tributaries and distributaries (delta) in both the plains.
- The Upper Indus Plain is also a bit higher than the low lying Lower Indus Plain. Considering the altitude of these two plains, we see that it decreases from North towards the South generally.

Fig. 1.45	UPPER INDUS PLAIN	LOWER INDUS PLAIN
	Located in the northern part of the Indus Plain.	Located in the southern part of the Indus Plain.
	River Indus and its major tributaries flow here.	The River Indus flows alone.
	The Jhelum, Ravi and Sutlej have joined the Chenab at Panjnad to form the River Panjnad which joins the Indus near Mithankot.	River Indus flows into the Arabian Sea south of Thatta through its distributaries which flow across its delta.
	Nearly flat, undulating plain sloping towards the south-west.	Nearly flat undulating plain sloping towards the south.
	The average width of the Indus is 1.4 km till Kalabagh and 1.6 km near Sukkur.	Width of the River Indus is 1 .6 km.
	River Indus is in its middle course in the north and enters its lower course towards the south.	River Indus is in its lower course.
	Both erosion and deposition take place with deposition becoming increasingly dominant southwards.	Deposition is the main function of River Indus.
	Meanders, oxbow lakes, braided channels & levées are present in doab areas.	Meanders, ox bow lakes, braided channels & levées are present.
	Alluvial terraces or bars are formed between the rivers.	Alluvial terraces or bars are non-existent as the Indus flows alone.
	Piedmont Plain with alluvial fans to the north and west.	Piedmont Plain with alluvial fans to the west.
	Ideal for agriculture with a network of link canal irrigation.	Ideal for agriculture with irrigation.

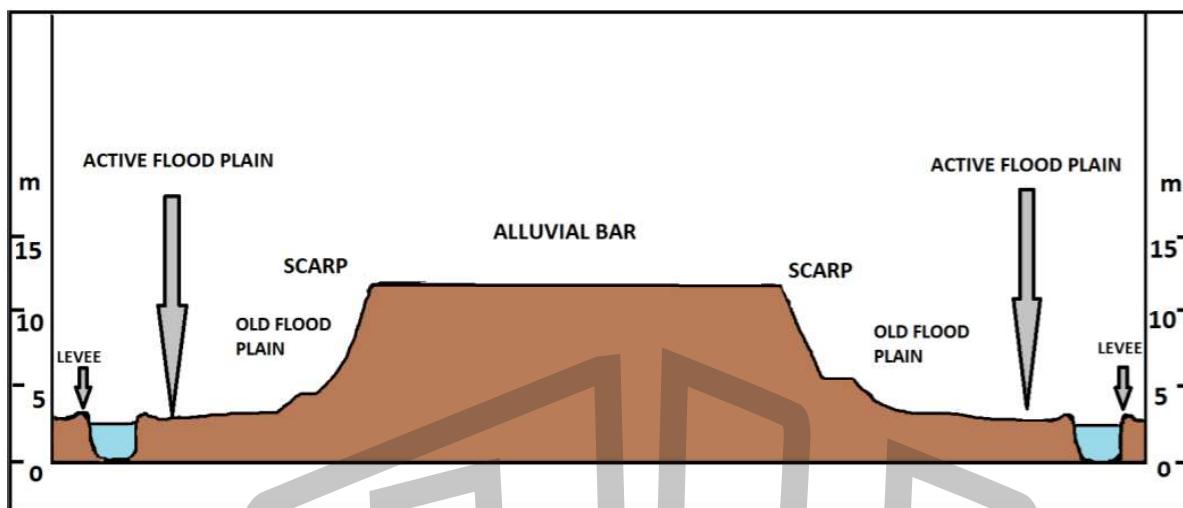
Drainage of Indus Plain:

The Lower Indus plain is drained by the River Indus mainly flowing in the North-South direction. Meanders and oxbow lakes also exist. Piedmont plains exist in-between the river Indus and Sulaiman and Kirthar Mountain ranges. In the Upper Indus plain, River Indus and its Eastern tributaries flow in North- South direction. Tributaries are Jhelum, Chenab, Ravi and Sutlej. Meanders and oxbow lakes also exist.

- **Meanders:** Zigzag pattern of rivers is called Meander.
- **Oxbow Lake:** Crescent shaped part separated from a curve of Meander is known as ox-bow Lake, it is a temporary feature.
- **Levees:** Natural increase of land near river banks is called levees. This is because of the deposition of sediments alongside the river banks.(Embankment walls are artificially man-made walls alongside the river bank).



Features of a Doab:



Active Flood Plain:

It is a flat plain on both sides of a river, which suffers annual floods during the rainy season. It is around 2-3m above the level of a river. It is around 10-20 km long. The river always changes its position, thus meanders have come into existence. Abandoned (dry) and braided channels are also visible in the dry season. Meanders, oxbow lakes and embankments of a river can be seen as well. Soils of loam and silt (Alluvial Soils) which are good for farming are present in both the UIP and LIP.

Old flood Plain:

It is higher than active flood plain around 5m higher than river level. It is around 10-20m long. It is made up of old alluvium. Evidence of meanders and of levees is present in these plains. Oxbow lake depressions can also be seen. The old flood plains are present in both UIP and LIP.

Bars (Alluvial Terraces):

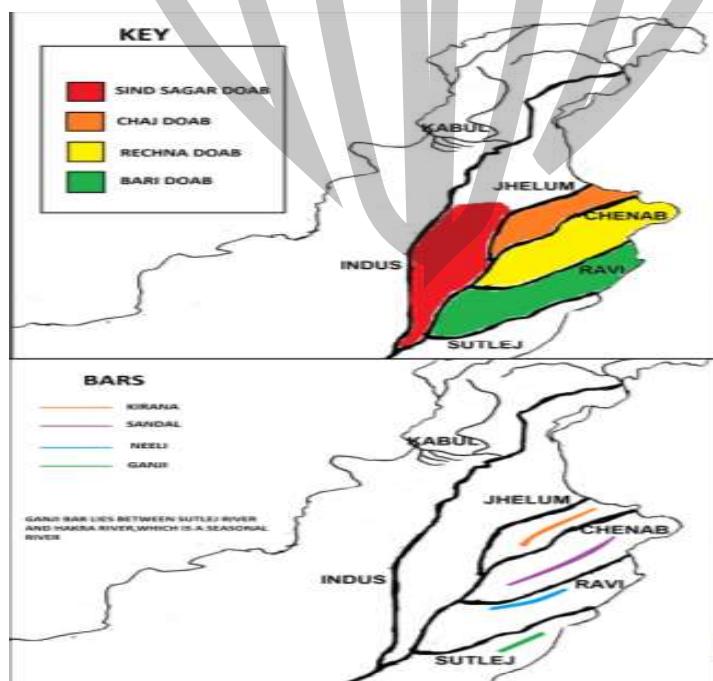
These are flat areas which are only found in the Upper Indus plain. They are 7-12m high and last for 25-35km. They are made up of areas of silt and clay. In Pakistan all the bars have a south west direction.

Scarp:

Scarp is a slope which separates the old flood plain from the bar upland. It is around 20m long and 11m high above the river level. It is made when old alluvium on the bar upland is eroded, thus, leaving a slope which connects both old flood plain and the bar upland.



Rivers and Doabs of UIP / LIP:



Chaj doab lies between Chenab and Jhelum rivers.

Rachna lies between Ravi and Chenab rivers.

Bari doab lies between Beas and Ravi rivers.

Deserts:

A desert is a place that receives very low amount of precipitation (less than 250mm). It is an area that can support almost no vegetation. Deserts can be cold as well as hot (have a high rate of evapotranspiration). Pakistan has 3 main deserts; the Thal, Tharparkar and the Kharan desert, all of which are hot deserts.

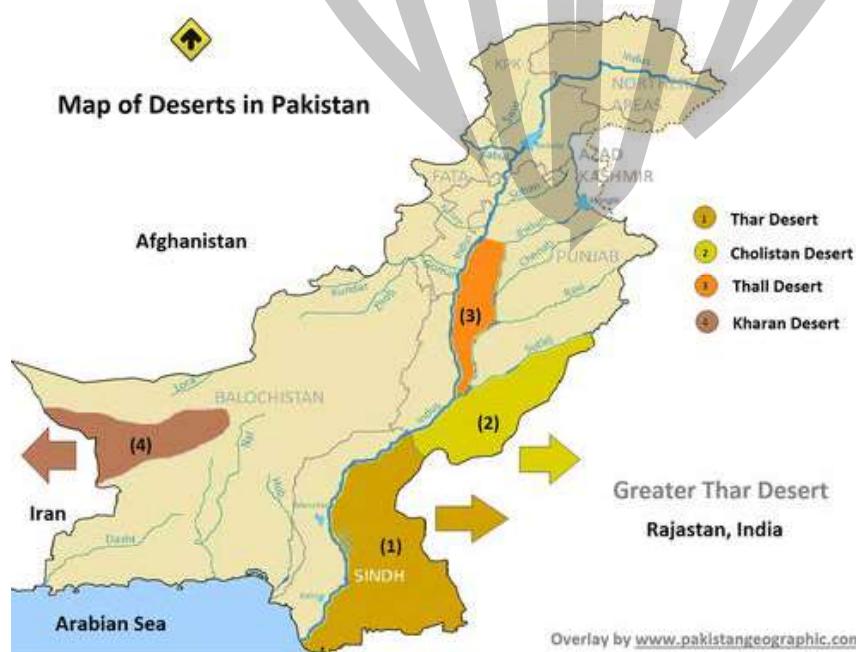
- Thal is found in Punjab between Jhelum and Indus Rivers.
- Tharparkar is divided into 3 parts; Cholistan is found in Southern Punjab, Nara in Eastern Sindh and Thar in the South East of Sindh.
- Kharan is found in Western Balochistan.

Topography:

There are strips of soil found between sand dunes along with the sandy plains. Sand dunes shift grain by grain due to the pattern of the blowing wind. Sand dunes sometimes reach a height of 150m and are both longitudinal and latitudinal in direction. All of the sand dunes are crescent shaped. When the wind blows away the top cover of sand away, bare and weathered rocks are exposed onto the surface.

Desertification:

Desertification occurs due to continuous land abuse. It is caused by both natural and manmade factors. Among the natural forces are continuous wind and water erosion (which erode the fertile topsoil so only few plants can then grow) along with long-term changes in rainfall patterns due to climate change (such as a drought). Human factors include overgrazing by animals, strip mining, the excessive usage of groundwater supplies and deforestation (mainly shrubs and wild grass).

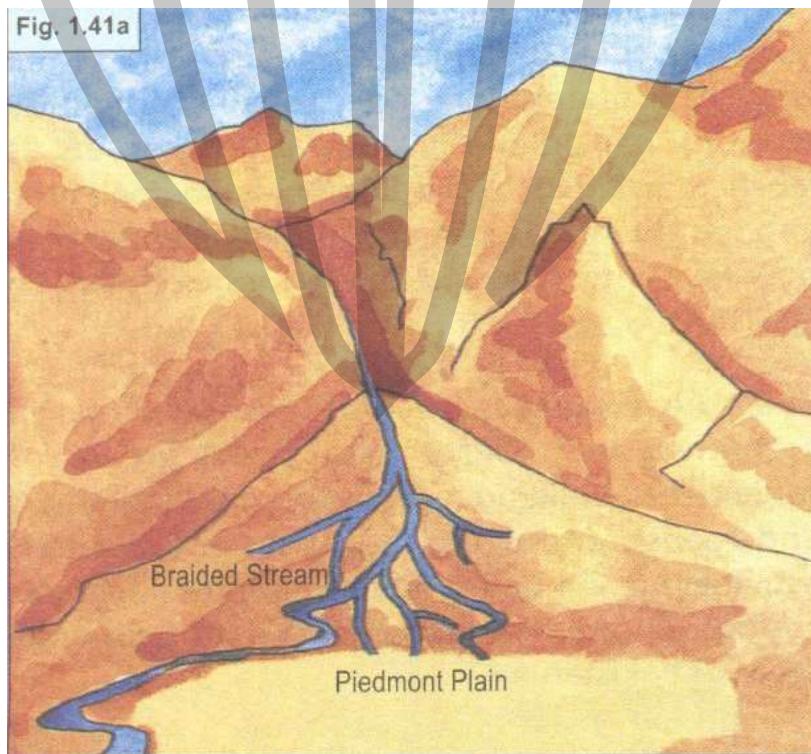


Alluvial Terraces;

- Alluvial terraces have developed in some parts of the interfluves of the Upper Indus Valley.
- These interfluves are locally called Doabs & the terraces are called Bars.
- These are areas of higher ground between rivers, formed by erosion of old alluvium.
- Also called 'scalloped interfluves and Bar upland.
- Surface is flat and has a south-west slope.
- Ideal for agriculture and residence.
- Bar-uplands are safe from flood.
- Sandal Bar on Rechna Doab, Ganji Bar on Chaj Bar, Nili bar on Bari Doab and Kirana Bar on Chaj Doab.

PIEDMONT PLAINS:

- Plains located at foothills of mountains namely Sulaiman, Kirthar and Himalayan (Siwaliks).
- Most dominant feature alluvial fans.
- Formed by the deposition of the rivers.
- These rivers flow only where & when rainfall takes places.
- Rivers come down the mountain slopes at great speed.
- The stream split into a no of channels.
- Gravel, sand and alluvium deposited by rivers forms alluvial fans.
- A no. of the small piedmont plains has developed in the northern Punjab.
- Piedmont plains are mainly agricultural areas.



Unit: 2: “Climate”

Weather:

It refers to daily changes in atmospheric conditions (temperature, rainfall, humidity and pressure) for a short period of time locally.

Climate:

The generalization of day to day weather conditions of a particular area/region over a long period of time (33years).

Pakistan is divided into four climatic zones with respect to altitude:

1. Highland climate
2. Lowland climate
3. Arid climate
4. Coastal climate

CLIMATIC ZONES	AREAS	SOURCES OF RAINFALL	TEMPERATURE	ECONOMIC ACTIVITIES AND LIFESTYLE
HIGHLAND CLIMATIC	<ul style="list-style-type: none"> Northern Mountains Western Mountains 	<ul style="list-style-type: none"> Relief rainfall Monsoon rainfall Thunderstorms Western Depressions 	<p>Winter: Long and cold</p> <p>Summers; Mild and Short.</p> <p>Precipitation; All seasons. (Wet).</p>	<ul style="list-style-type: none"> Farming not possible as areas covered with snow in winters Indoor activities Transhumance Seasonal tourism
LOWLAND CLIMATIC	<p>Whole Indus Plain</p> <ul style="list-style-type: none"> Sindh Punjab 	<ul style="list-style-type: none"> Convectional rainfall (Northern Punjab) Western Depression (Northern Punjab) Monsoon rainfall 	<p>Winter: short, Cool to cold.</p> <p>Summers; Long and Hot</p> <p>Precipitation; Upper Indus plains are wet while the aridity increase towards south.</p>	<ul style="list-style-type: none"> Agriculture Most productive region
COASTAL CLIMATIC	<ul style="list-style-type: none"> Sindh Coast Makran Coast. 	<ul style="list-style-type: none"> Monsoon rainfall (Sindh Coast) Western Depression (Makran Coast) Tropical cyclones 	<p>Winter: Short, Mild to cool.</p> <p>Summers; Long and Warm</p> <p>Precipitation ; Semi-arid</p>	<ul style="list-style-type: none"> Trade throughout the year. Fishing
ARID CLIMATIC	<ul style="list-style-type: none"> Thar desert Kharan desert 	<ul style="list-style-type: none"> Monsoon rainfall Western Depression 	<p>Winter: Short & Cool</p> <p>Summers; Long and hot</p> <p>Precipitation ; Dry, very less rain</p>	<ul style="list-style-type: none"> Nomadic Lifestyle. Fruits farming. Mining

Features of Highland Climate:

- It includes Northern, North Western and Western highlands of Pakistan (Kashmir, Gilgit, KPK and Balochistan).
- Rainfall and temperature depends on altitude the higher the altitude lower the temperature and higher the rainfall.
- Northern Mountains range from 2000 to 8000 m having cold winters mild summers and rainfall in all seasons.
- Western mountains range from 1000 to 4000 m having cool to cold summer, mild to warm winters and rainfall in winters only
- Summers are short mild and wet in Northern Mountains but dry in Western Mountains.

Features of Lowland Climate:

- It includes the whole upper and lower Indus plain excluding coastal areas.

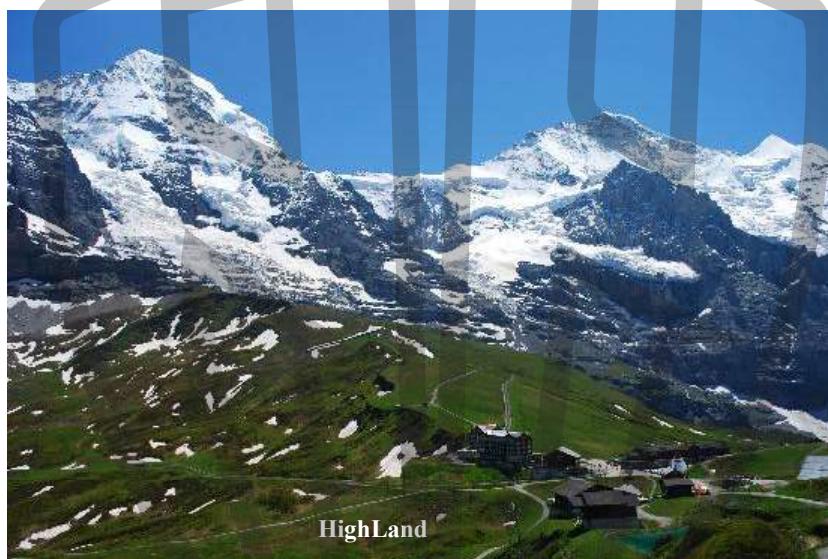
- Mostly consist of arid and extreme climate with hot summers cool winters and summer monsoon rainfall.
- Rainfall increases from south to north.
- Also receives rainfall from western depression.
- Comparatively most irrigated and fertile land of Pakistan lies under upper Indus plain.
- Continental effect drives the climate.

Features of Coastal Climate:

- It includes southern coastal strip Indus delta Karachi and the whole of Makran coast.
- Sea breezes dominate the climate throughout the year and keep it moderate.
- Maritime effect dominates the climate.
- Humidity level is mostly high reaching 50% in April to September.
- Mean monthly temperature is 32 % May June are hottest months.
- Rainfall is less and scanty mostly during monsoon season.

Features of Arid Climate:

- It includes south western desert of Balochistan (Kharan) & South eastern desert of Sindh (Tharparkar).
- Dominated by dry and hot climate throughout the year.
- Hot Dusty winds prevail from May to September.
- Low amount scanty rainfall during winters in Balochistan.
- Summer monsoon brings little rainfall in Sindh.
- Extreme heat dryness and dust storms are common.





There are four climatic elements responsible for seasonal variations in the climate of Pakistan:

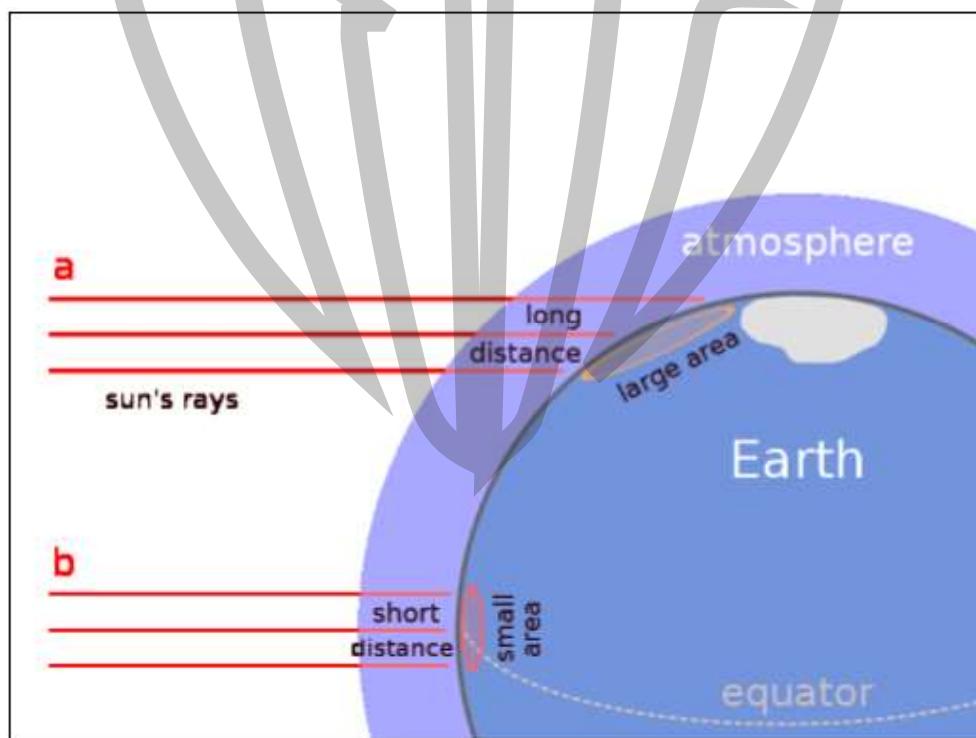
- Temperature
- Rainfall
- Pressure
- Winds

Factors effecting temperature of Pakistan:

1. Angle of Sun and Latitudinal Effect:

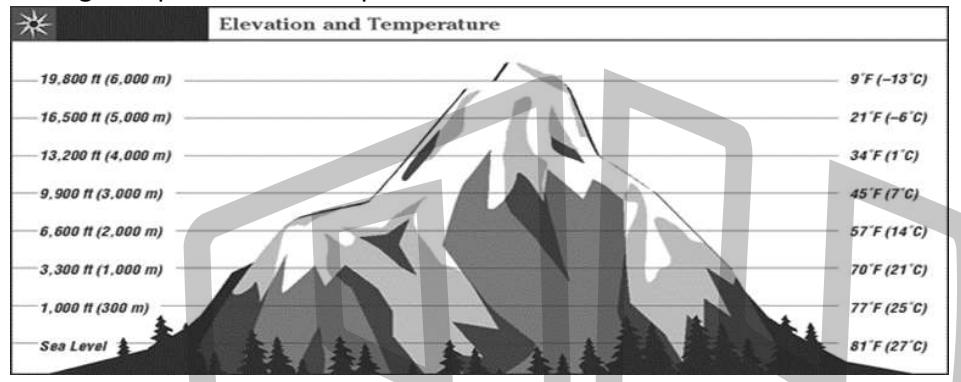
Temperature and rainfall are both dependent either directly or indirectly on the influence of the sun. The sun's influence varies from place to place due to factors like angle of sun at a particular place.

As it is evident the Polar Regions or regions far away from the Equator are generally cooler than the ones nearer the Equator. This is because of solar radiation to reach the poles and heat them it has to travel a larger distance in space, thus it loses its intensity (energy). Also, near the poles the radiation arrives at an oblique angle so solar energy spreads over a large area. Since Pakistan lies in subtropical areas it does receive most of intense solar radiation concentrated on a small area thus the temperature in general is warmer. So in general terms Faisalabad will be cooler than say Hyderabad.



2. Altitude and Temperature:

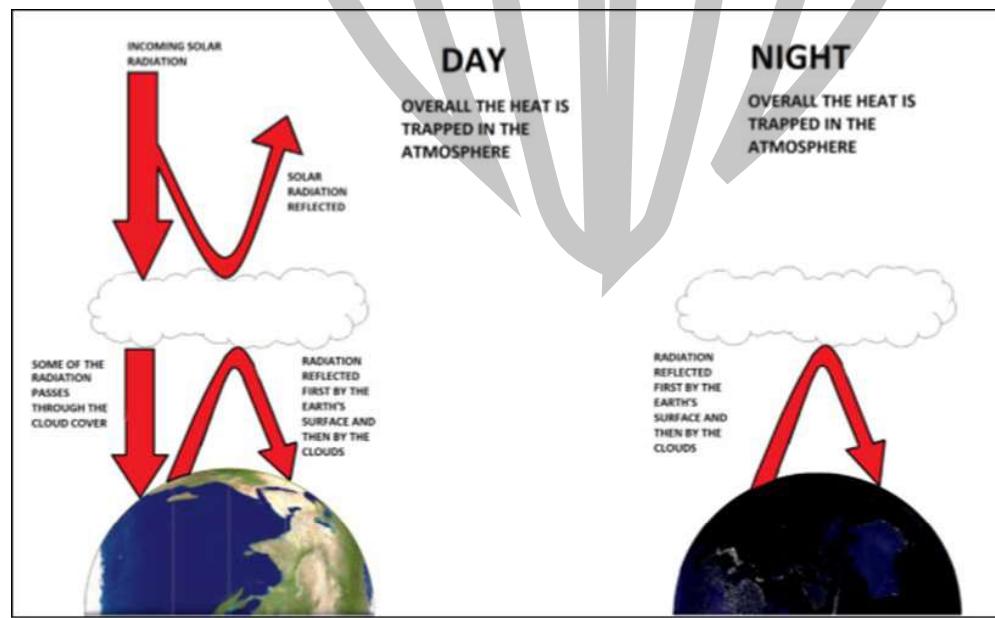
The temperature is highly dependent on altitude, air density and temperature. The air is densest at sea level due to water vapors, dust particles and solar radiation and least dense at high altitude because of less solar radiation is absorbed with less air to absorb heat. There is an average drop of 6.5 C in temperature for each 1000 meter increase in altitude.



3. Cloud cover and Temperature:

Temperatures decrease when clouds appear and block out the Sun's rays, which are then reflected back into space. However, cloud formation only takes place when air contains sufficient moisture

and has been sufficiently cooled. Thus cloudy days are much cooler than sunny days during the same months



4. Continental Effect:

It refers to all those areas having distance from the sea (interior region) hence does not get maritime influence of the sea on temperature therefore the temperature is never moderate hence extreme winters and summers are recorded.

5. Maritime Influence

- Influence of the sea on the temperatures of any area.
- Due to unequal heating of land and water, land and sea breezes also called day and night breezes will blow.
- This difference in specific heat affects temperature ranges on both seasonal and daily timescales. Land surfaces react quickly to heat gain and loss, becoming warm in summer, cold in winter.
- The oceans react far more slowly and during the summer they are cooler than the adjoining land, whilst in winter they are warmer.
- Days are cooler, and night's warmer, over the oceans than on land.
- High atmospheric pressure usually develops over cold areas where air is descending, whilst low pressure forms over warmer regions where air is rising.
- This has an effect on coastal areas, keeping temperatures down during the day, and preventing them from dropping very low at night.
- Therefore moderate or mild winter and summer temperatures are recorded in the coastal areas.

Wind;

Wind is moving air. Normally blow from cooler areas to the warmer areas.

OR

From higher pressure areas to the low pressure areas.

Air; is the mixture of gases, dust particles and water vapors.

Pressure; force per unit area.

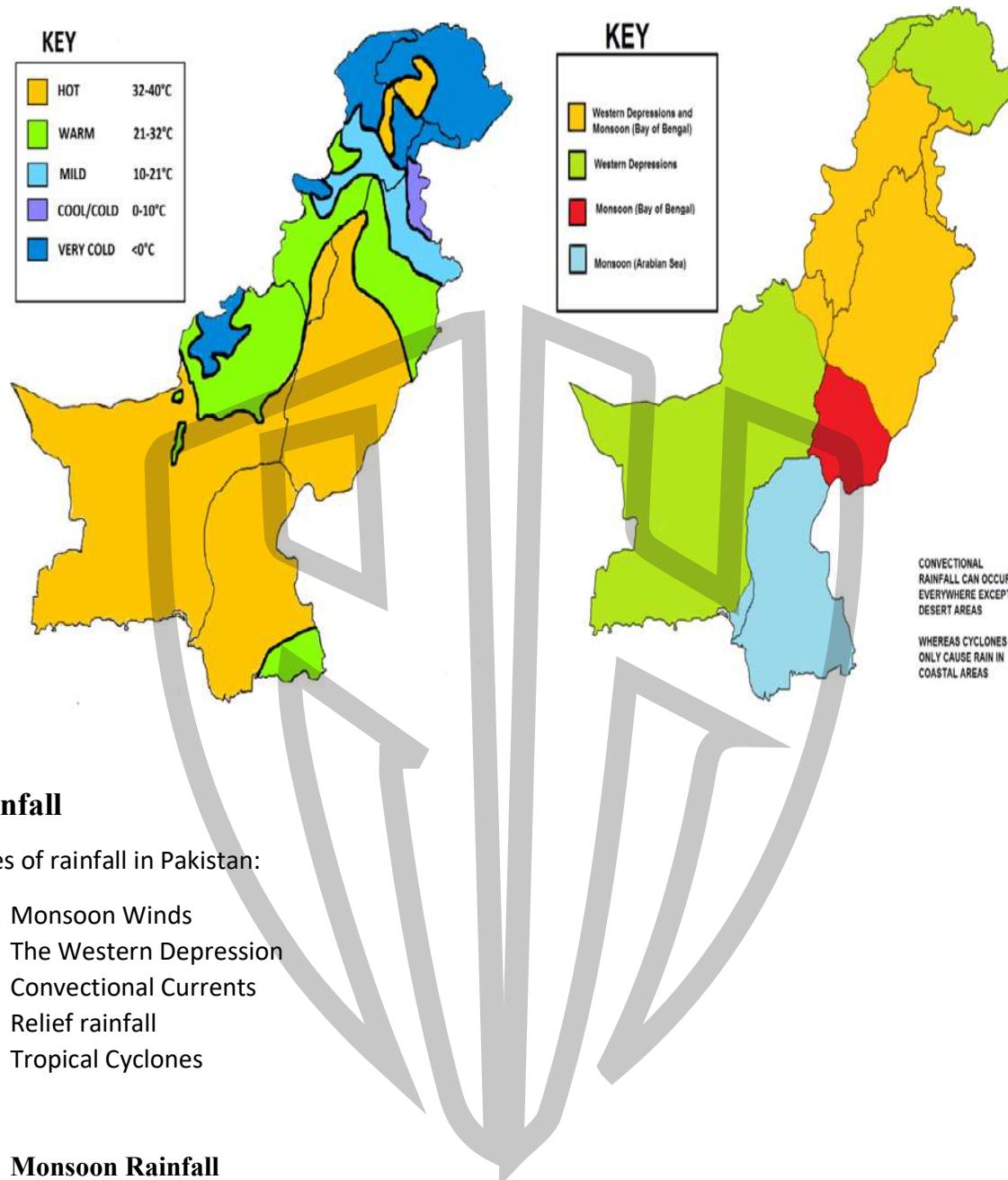
Air Pressure; force exerted by the air on a unit area.

Relationship between Temperature and Pressure;

- **High Temperature = Low Pressure**
- **Low Temperature = High Pressure**

Precipitation;

Any state of water (liquid, solid or gas) received by the earth from the atmosphere.



Rainfall

Sources of rainfall in Pakistan:

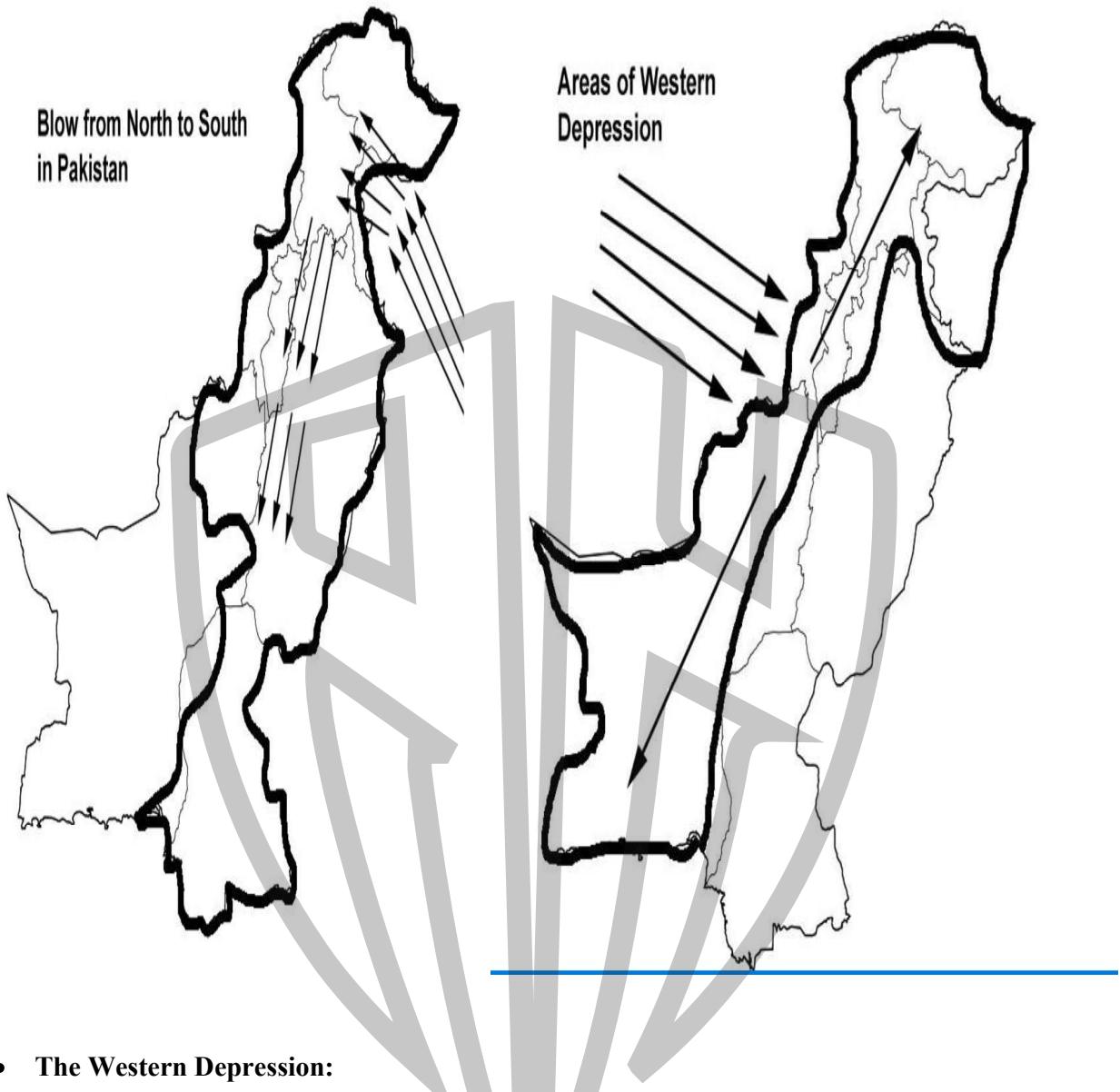
- i- Monsoon Winds
- ii- The Western Depression
- iii- Convectional Currents
- iv- Relief rainfall
- v- Tropical Cyclones

- **Monsoon Rainfall**

Monsoons are seasonal winds that blow from sea towards land from July to August (summers). After it they reverse their direction and blow from land towards the sea (winters).

There are two monsoon systems, one originating from the Bay of Bengal and other from the Arabian Sea. Moist laden winds from high pressure areas of sea blow towards land. From the east the monsoon clouds are deflected along the Himalayas from Nepal to Pakistan. Along the way these clouds rise, cool and thus condense eventually bringing rainfall to Pakistan. They affect northern Punjab, Khyber-Pakhtunkhwa, Gilgit-Baltistan and Azad Kashmir.

On the other hand another monsoon system that originates in Arabian Sea also travels inland and delivers little rainfall to Sindh.

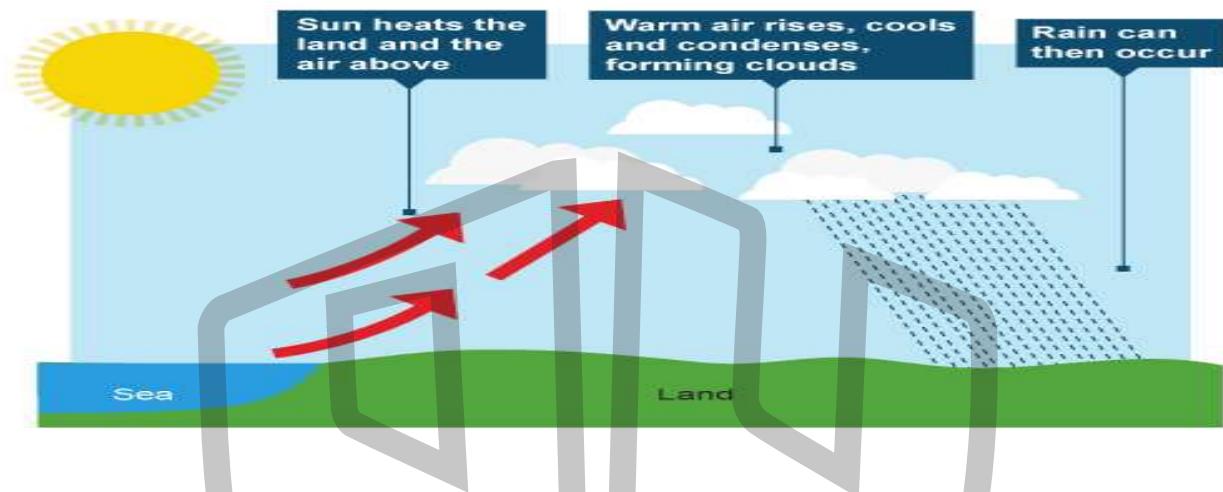


- **The Western Depression:**

These are wind systems that originate from the Mediterranean Sea and travel eastwards towards Afghanistan and Pakistan. Since they make a long journey they lose most of their water when they reach Pakistan. During the winters (Late November to March) they bring rainfall because during winters the Arabian Sea retains its warmth and thus cold air from coastal areas flows towards sea. These western depressions move from high pressure area (Mediterranean Sea) towards the low pressure area (Indus Plains).

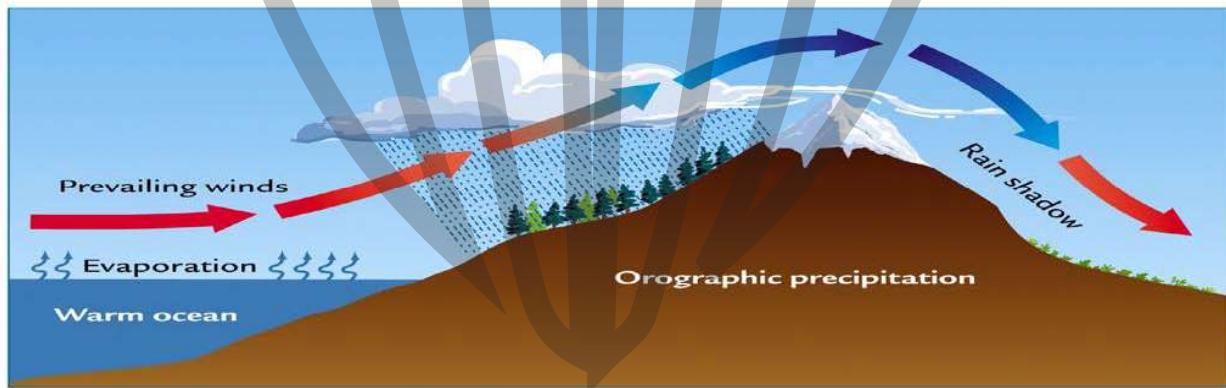
- Convection:**

Convection rainfall occurs when the sun heats up the land. The air near the land absorbs heat by conduction and thus gets less dense and rises. The moisture in air condenses to form clouds, when this air is cooled to a certain minimum level rainfall occurs.



- Relief Rainfall:**

Relief or orographic rain is formed when air is forced to cool when it rises over relief features in the landscape such as hills or mountains. As it rises the chilling cause's condensation and precipitation on the windward side and forms rain. The leeward side becomes rain shadow.



- Thunderstorm:**

Thunderstorms occur in the same fashion as convectional rainfall with the main difference being that the air here rises very quickly forming Cumulonimbus clouds, which are very tall and big. This is followed by strong winds, lightning and heavy rainfall. Hailstones may also be formed, when the water vapors are cooled multiple times (to form water first and then ice).

- **Cyclone:**

Cyclones are formed when the average temperature of large water body exceeds 27° C, thus forming an area of very low pressure. This area then draws further air from high pressure areas quickly. A cone is formed when two oppositely travelling cold and warm winds meet. Intense lightning followed by very strong winds and heavy rainfall occurs. Their effects are similar to that of floods.

CLIMATIC HAZARDS:

1. Floods:

Flood is a temporary covering of land by water which is dry. They can be caused by variety of factors like:

Heavy monsoon rainfall accompanied with melting of snow and ice in glaciers causing excess of water in rivers, dam or barrage failure, unusually high tides in coastal areas and by a tsunami

The Indus tributaries overflow almost every year but only sometimes the flood risk is serious.

Floods can also be caused by following reasons:

- Deforestation
- Failure to heighten or strengthen embankments.
- Poor medical and communication facilities in aftermath of disaster.
- Inadequate warning systems to allow people time for escape.

Benefits of flood:

- Restoring underground water supplies.
- Filling reservoirs of dam.
- Makes the soil fertile by alluvium deposits.
- Increases fish production in the sea and land.

Reducing Effects of Floods:

- Dams could be built to contain and regulate the flow of water and prevent flash floods.
- Advanced warning systems should be installed in flood prone areas to warn people to get out before it's too late.
- Medical and transport facilities be regularly updated and checked.
- Embankments and levees should be heightened and strengthened.
- Afforestation and reforestation projects should be carried out in Northern Mountains to reduce run-off and thus reducing chances of flash floods.

STORMS:

- An atmospheric disturbance associated with strong winds accompanied by rain, snow, or other precipitation and often by thunder and lightning.
- Thunderstorms and conventional currents common in Northern and North-western areas of Pakistan.
- Dust storms and windstorm in Balochistan.
- Less frequent and usually localized (limited area get affected).
-

EFFECTS OF STORMS

- Crops destroyed.
- Farms and livestock will be destroyed.
- Electricity & communications systems disturbed.
- Roofs of houses are affected.
- Mud houses and hut are destroyed.
- Trees are uprooted.
- Destruction and damage of life and property.
- Land sliding, soil erosion and lightening.
- Infrastructure (roads, railway tracks) could be damage.

Droughts:

There are four types of droughts:

1. Permanent drought:

Occurs when crop cultivation is highly dependent on irrigation only.

2. Seasonal drought:

Occurs when rainy areas faces dry seasons for longer period than usual.

3. Invisible drought:

Occurs when water deficiency reduces crop yield but does not destroy them.

4. Unpredictable drought:

Caused by abnormally low rainfall in areas of humid climate

Effects:

1. Dust storms can occur, when drought hits an area suffering from desertification and erosion. This can lead to siltation in reservoirs of dam, hampering electricity generation and weakening dam's foundation.
2. Habitat damage, affecting both terrestrial and aquatic wildlife.
3. Malnutrition, dehydration and related diseases could affect millions.
4. Mass migration causing the increase in internal refugees or international refugees.
5. Reduced electricity production could occur as reduced water flow through hydroelectric dams leads to low industrial production and less exports resulting in less foreign exchange.
6. Shortages of water for industries like (juice etc.) which affects employment and GDP.
7. Social unrest may follow leading to instability, which can discourage foreign investment thus local sectors may suffer from outdated machinery techniques etc. resulting in low production.
8. War could occur over natural resources, including lakes and fertile areas etc.
9. Wildfires can become common and can cause health hazard to people.

Desertification

- Desertification is the land degradation in dry lands.
- In it a relatively dry land region becomes increasingly arid, typically losing its bodies of water as well as vegetation and wildlife.

Causes

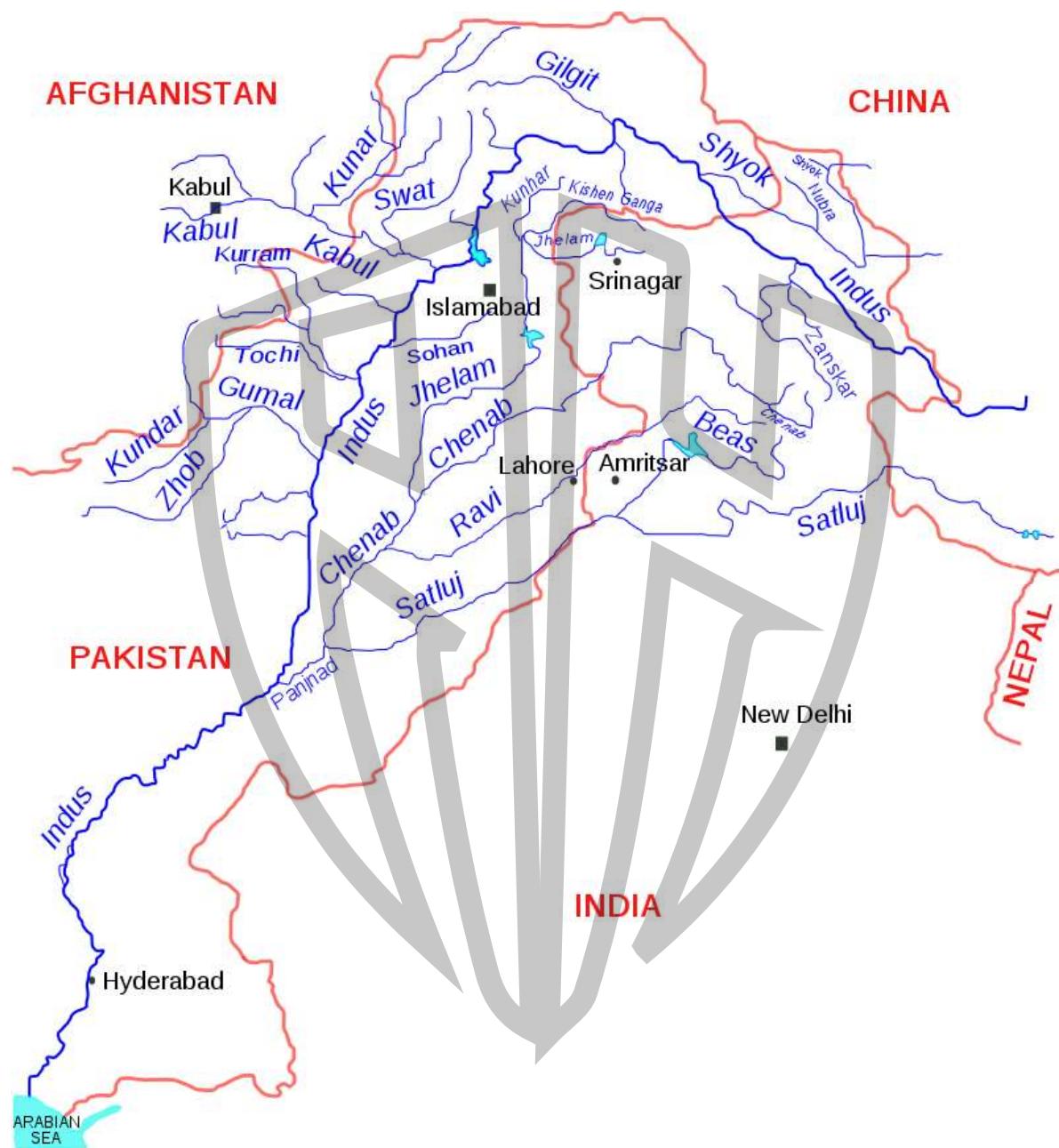
- The causes of desert formation include frequent droughts.,,
- Deforestation.
- Extensive cultivation.
- Overgrazing
- Industrialization and urbanization without environment considerations.

The Effects of Desertification

- Crop cannot grow.
- Death of livestock.
- Shortage of raw material to industries.
- Reduced exports and increased imports.
- Devastation (destruction) of economy
- Widespread famine (food shortage) leads to starvation (death due to lack of food).
- Malnutrition (lack of proper nutrition due to food shortage), health problems.
- Loss of lives.
- Migration from drought affected areas.
- Break-up of rural social set-up.
- Nomadic lifestyle.
- Reduced exports and increased imports. Devastation (destruction) of economy

Unit: 3 “Water Resources”

River System of Pakistan



Eastern tributaries

The river system of Pakistan originates from the snow-covered Himalayan and the Karakoram Range. The system comprises mainly five rivers that pass mostly through the Punjab province; therefore the name 'Punjab' - 'panj' meaning five and 'aab' meaning water. The five rivers of Pakistan are Jhelum, Chenab, Ravi, Sultej and Indus.

Drainage Pattern of River Indus:

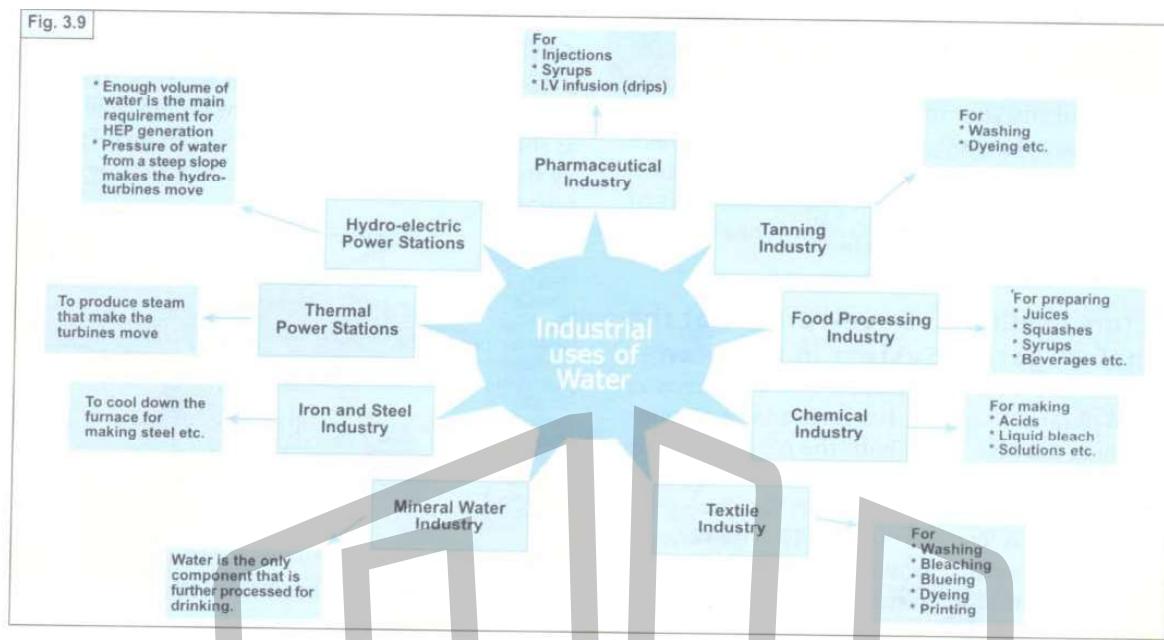
Indus River originates from the Tibetan plateau near Lake Mansarovar in China. It then runs through Jammu and Kashmir, enters the Gilgit-Baltistan (formerly Northern Areas of Pakistan) region and flows through the entire length of the country and merges with the Arabian Sea. The Indus River fulfils the water requirements of Pakistan and is the main support for agriculture. The main tributaries of Indus are Swat, Kabul, Tochi, Gomal, Zhob in the West and Ravi Jhelum, Chenab, Sutlej in the East.

Ineffectiveness of Rainfall

- High Variability in Distribution
- Long Dry Spells
- Heavy Shower erode fertile soil
- Less number of rainy days
- High Rate of evapotranspiration
- Low amount of Rainfall

Uses Of Fresh Water:

- **Domestic** (Washing ,Cleaning,Drinking etc)
- **Agricultural** (Irrigation of Crops)
- **Industrial**



Ground Water:

The water beneath the surface of the ground, consisting largely of surface water that has seeped down the source of water in springs and wells.

Irrigation Systems:

Traditional Methods:

i. Karez:

Karez water system is made up of a horizontal series of vertically dug wells that are then linked by underground water canals to collect water from the water surface runoff from the base of hills or mountable beneath a mountain/hill slope.

The canals channel the water to the surface, taking advantage of the gravity. The canals are mostly underground to reduce water evaporation. Vertical wells are dug at various points to tap into the groundwater flowing down sloping land from the source. These vertical wells are also used for maintenance of Karez.

i- Persian Wheel

This is a system of continuous supply of water to irrigate a comparatively larger area. In this method, blind folded Bullock is used to move a horizontal wooden wheel. This wheel is geared to a field is vertical wheel at the distant end of the shaft. This carries the vertical metal attached to a chain of bucket. The bucket raises water from the well and spills their contents into the channel landing to the irrigation field.

ii- Simple Lift Irrigation

It is mostly practiced in the remote and back ward villages of Pakistan. In this method, people take out water from a shallow well with the help of a rope and bucket. Through this system farmers can irrigate a small piece land. It is a time consuming method of irrigation.

iii- Shaduf:

In the Shaduf system, water is drawn from a shallow well river organized by a bucket which is attached to a wooden pole on one side and weight heavy rocks on the other side a small area can be irrigated by this method. In some of the places also use of pulley to take water out from a well.

iv- Charsa:

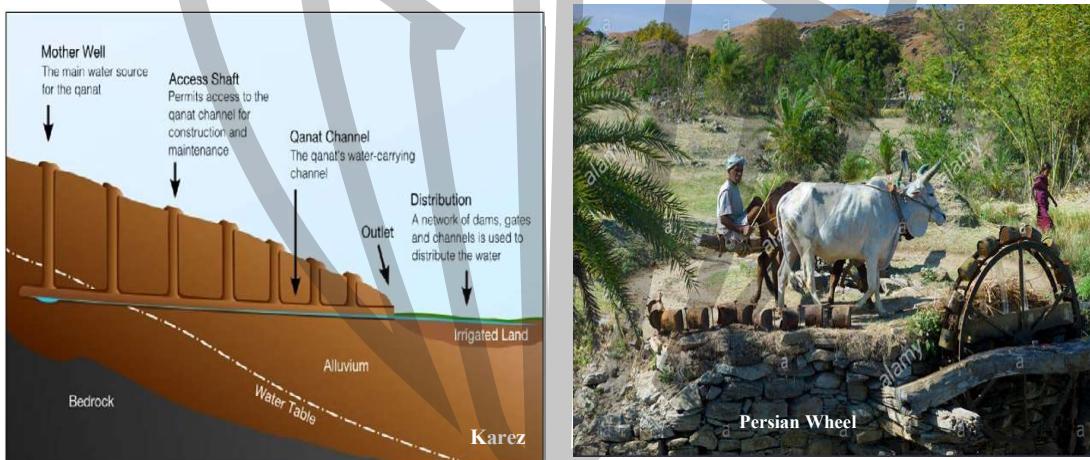
In this method, animal power is used to pull water from the well. A bucket is suspended by a rope and with the help of animals people take out water from slightly deep wells.

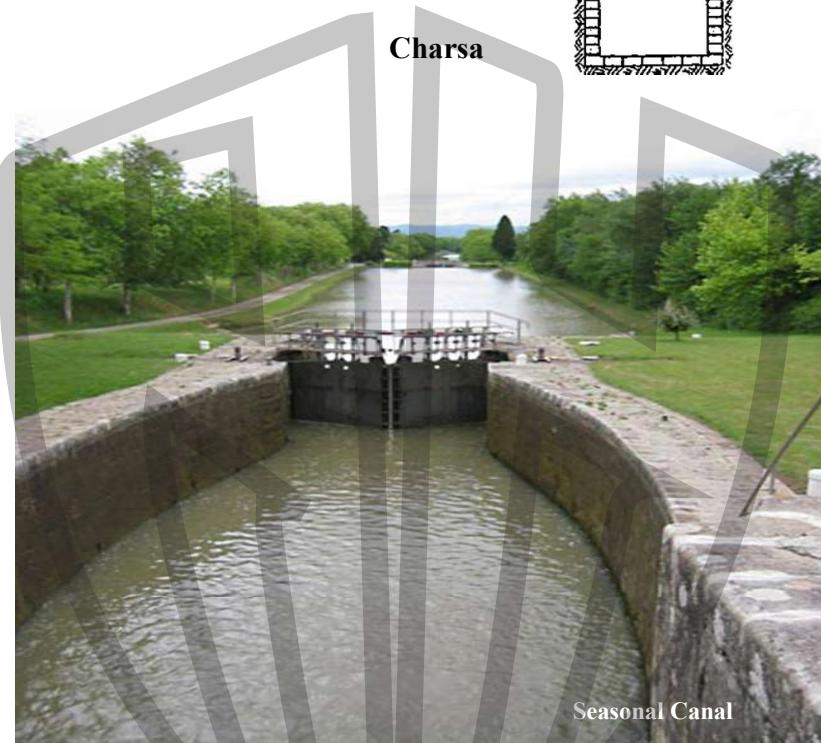
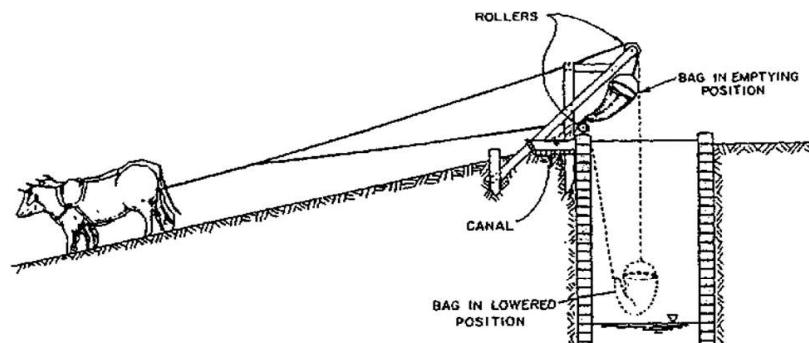
v- Inundated /Seasonal /Flooded Canals/ Sylabas:

Long canals taken from large rivers are called inundation canals. They received water when the river is highly enough and especially when it is in floods.

vi- Tank Irrigation:

Tank irrigation is practiced by constructing mud banks across small stream to make a small reservoir which collect excess water during the rainy season. These reservoirs are sometimes covered with plastic and the water is used for irrigation domestic purpose and livestock etc.





Modern Methods:

- **Perennial Canals:**

These canals run throughout the year and are linked to dams and barrages for continuous supply. They irrigate large parts of land.

- **Tube well:**

These are electrical or diesel powered machines which are used to fill water from the depth of 92 meters or more to irrigate large parts of lands. These also help in lowering the water table by protecting the land from water logging and salinity.

- **Sprinklers Spray Irrigation:**

Sprinklers are devices attached to the public water supply or tube wells. They are centrally located in the field to irrigate/ water the plant mainly in Orchard and Gardens. It is an efficient method of irrigation. This is rarely used to irrigate agricultural crops.

- **Tanker Irrigation:**

This is the most expensive method of irrigation. Tankers collect water from small water bodies (in land) and supply them to household in case of emergency.

- **Drip Method of Irrigation :**A Method in which Individual plants are supplied with water by the use of drip



Perennial canal



Tubewell

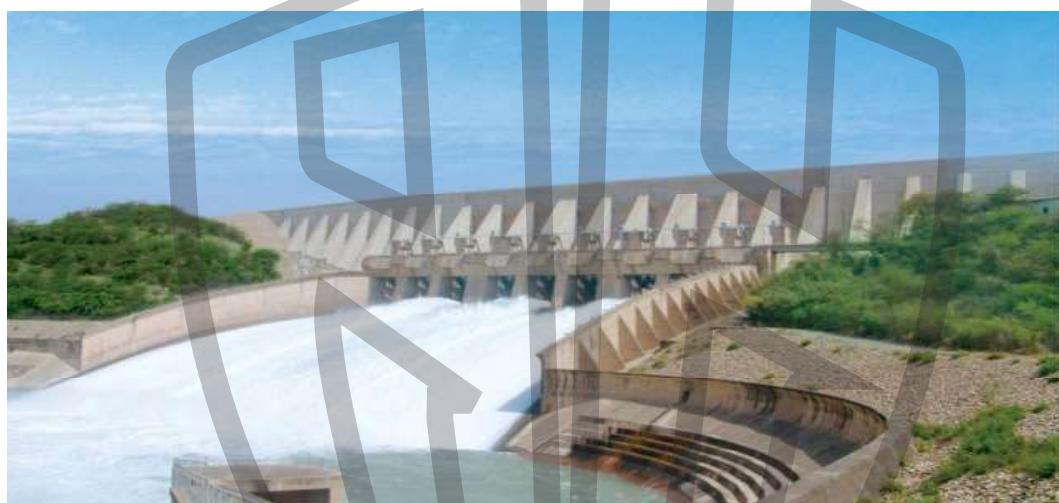


Sprinkle/spray



Water Tanker

v- Dams:



Mangla Dam/Tarbela Dam

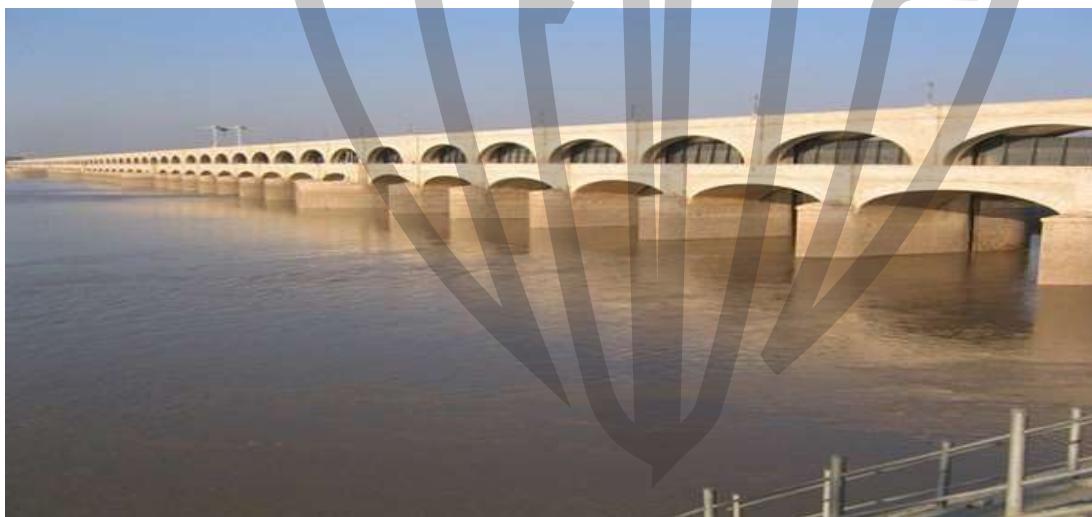
Pakistan has two large dams (Tarbela and Mangla), while all other dams are either small or medium sized. Tarbela and Mangla are multipurpose dams which store water not only for irrigation but also for generating power. These dams have reservoirs because the dam wall holds up the water. Spillways are gates through which the water is allowed to go downstream due to either deficiency of water downstream or flooding upstream. A dam may break if it is filled beyond its capacity.

Both Tarbela and Mangla store water during the main rainy season (monsoons), which accompanies the melting of snow and ice (due to high temperatures in summers) in the Northern Mountains. The rainwater and melted snow drains into the rivers and ultimately ends at the reservoir.

Factors important for selecting dams:

- >Presence of deep, wide mountainous valley
- >Fast flowing river (so the reservoir fills quickly)
- >Glaciers (snow melting provides water)
- >Higher Precipitation rate than evaporation so less loss of water
- >Hard impermeable rocks at bottom to support heavy dam wall
- >Presence of Height to help produce HEP

Barrages



- Chashma barrage
- Rasul Barrage
- Marala barrage
- Qadirabad Barrage

Barrages are long structures similar to a dam. They divert water that is in the river into the canals. They have many gates, which either can be closed to create a lake with the embankments of a river serving as a container wall. The gates of a barrage can be opened and allow water to continue its course in the river. Barrages have been built to transfer water between rivers via link canals, like Rasul Qadirabad Link Canal. Sukkur Barrage has 60 gates with total length of 4000 feet.

Dams and Barrages

Differences (-)

- Larger quantity of water in dams
- Dams present on high mountains but barrages are present on plain areas
- Barrages provide crossing of river
- Dams produce HEP

Similarities (+)

- +Both store water
- +Both control floods
- +Both provide water for irrigation, industries and domestic use

Comparison between large/small dams

Differences (-)

- Large vs Small quantity
- Small dams rarely produce HEP
- Large dams irrigate vast areas
- Silting is a big problem in Large dams
- High maintenance cost in Large dams
- Long Construction time in Large dams
- More people displaced in Large dams
- Bigger impact on ecology of delta by Large dam

Similarities (+)

- +Both store water
- +Both control floods
- +Both provide water for irrigation, industries and domestic use

INDUS WATER TREATY



After the partition of subcontinent the headworks (headworks of Madhopur on the Ravi and Ferozpur on the Sutlej were given to India). Canals from these headworks irrigated a vast area in Southern Punjab.

On April 1, 1948, India stopped the supply of water to Pakistan. Pakistan protested and India finally agreed on an interim agreement on May 1948. According to this the Pakistani government was to pay for the water it required. The agreement was not a permanent solution. Thus, Pakistan approached the World Bank in 1952 to help settle the problem permanently.

Negotiations were carried out between the two countries through the offices of the World Bank. Finally an agreement was signed between India and Pakistan in September 1960. This agreement is known as the Indus Water Treaty.

This divided the use of water between the two countries. Pakistan obtained exclusive rights for the three western rivers, namely Indus, Jhelum and Chenab. India retained rights to the three eastern rivers; Ravi, Beas and Sutlej. The treaty also guaranteed ten years of uninterrupted water supply period during which Pakistan was to build huge dams, financed partly by long-term World Bank loans, UK and US aid and compensation money from India. Three multipurpose dams; Warsak, Mangla and Tarbela were built. Eight link canals were also built to transfer water from three western rivers into three eastern rivers. Five barrages were also made:

- Chashma barrage
- Rasul Barrage
- Marala barrage
- Qadirabad Barrage
- Kotri barrage

Waterlogging and Salinity



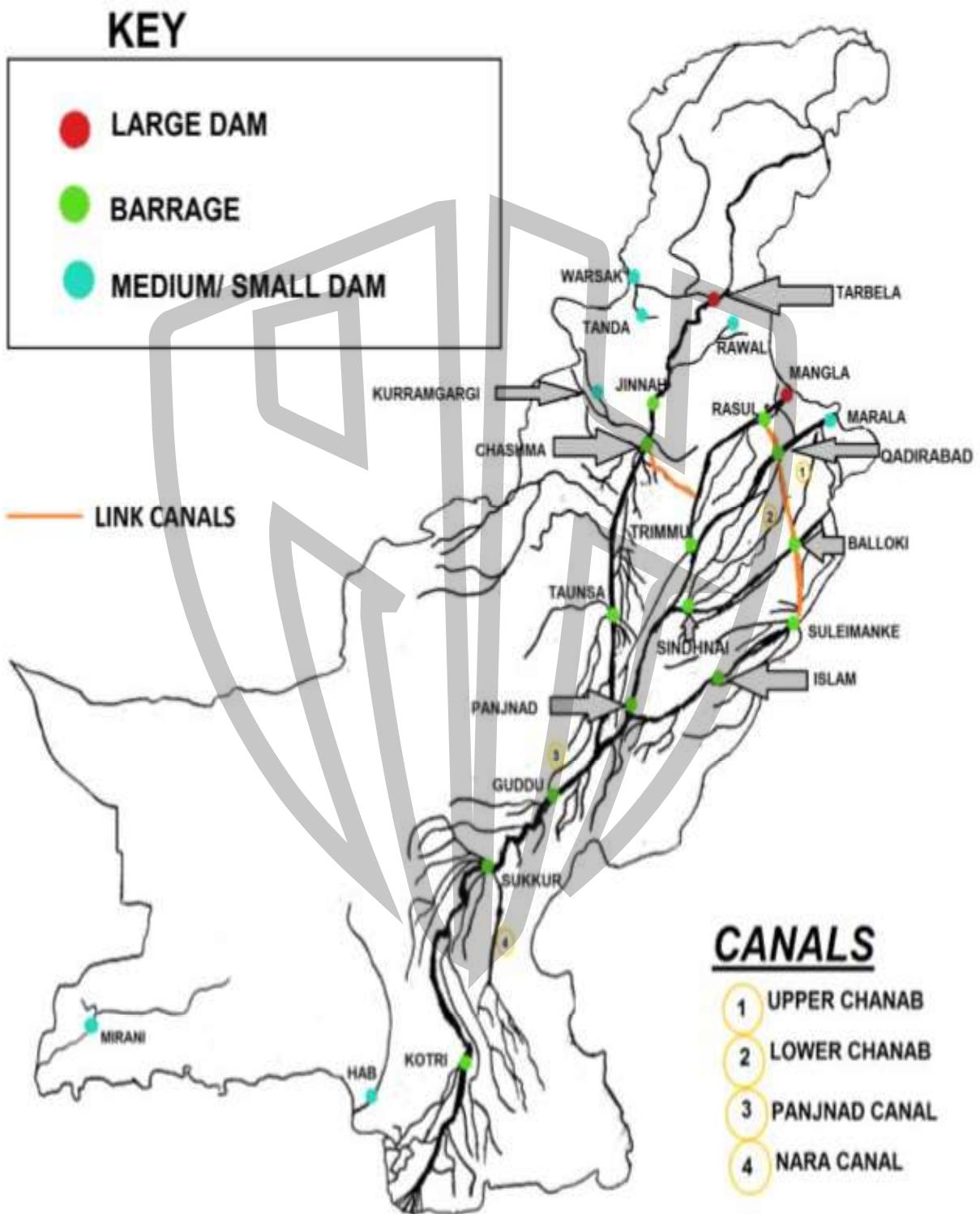
The rise of water table to the surface level is called water logging and the appearance of salty patches is called salinity.

It is mainly the outcome of canal irrigation in Pakistan. With the introduction of perennial canal water was available throughout the year, resulting in the rise of water table. Salt in the soil also rise to the surface with water table (water evaporate and salt deposited on the surface).

It affects 3.5 million hectares of agricultural land.

Solution:

- 1) Lining canal to control seepage of water.
- 2) Canal closure on temporary basis so water can be used in the time of need only.
- 3) Installing tube-wells to lower water tables.
- 4) Planting Eucalyptus trees which roots absorb more water go deep down.



CANALS

- 1 UPPER CHANAB
- 2 LOWER CHANAB
- 3 PANJNAD CANAL
- 4 NARA CANAL

Conflicts over Water

- **International**

Indus water Treaty 1960 between India/Pakistan

In 1948 India diverted the water of main rivers(Sutlaj,Ravi,Beas) coming to Pakistan which led to conflict between two countries. World Bank resolved the issue and Indus water treaty was signed in 1962

- **Provincial**

Conflicts Between Punjab/ KPK /Sindh over Kalabagh Dam

Punjab, KPK and Sindh had a conflict over the construction of Kalabagh dam on River Indus. The Dam project was never completed

- **Users or Domestic**

Agriculture /Industry/Household

People of both Rural and Urban water scarce areas often fight over the distribution of water for their agricultural, domestic and industrial needs

Siltation

A process of accumulation of loose rocks, pebbles /cobbles taken by rivers in the basement of reservoir

Siltation In Reservoirs

Causes

- Abundance of Silt eroding from mountain ranges
- Deforestation causing soil erosion into rivers
- No silt traps allowing pebbles and cobbles to enter Reservoir of Dams

Effects

- Blockage of Canals
- Weaken foundation of Dams
- Chocking of Irrigation Canals
- Reducing capacity of Reservoirs
- Less water storage for irrigation
- Floods due to overflow of water

Solutions

- Large scale afforestation around river banks
- Cemented embankments to avoid silt accumulation
- Installation of Silt traps on reservoirs
- Raising height of Dams

Water Pollution

Causes:

- Dumping of Industrial, Solid, Sewage Waste.
- Usage of Chemicals

Effects:

- Underground water is contaminated, unfit for consumption (can cause intestinal diseases).
- Unfit for agriculture (Chemical is transferred into human food).
- Affects Marine life (Thus human life).
- Extensive use of chemicals in agriculture causes the growth of algae, which absorbs oxygen and marine life is affected (Eutrophication)

Control:

- Strict rules on industries for disposal
- Awareness by education and realization of the importance of environment
- Installation of Treatment Plants in Industries
- Proper Dumping of Solid Waste
- Treatment of sewage waste
- Discouragement of excessive chemical use

Methods for Sustainable development of water

- Awareness of water usage
- Lining of Canals
- Making of new reservoirs to store surplus flood water
- Minimizing Pollution of water
- Implementation of Strict Rules on water wastage
- Desalination of sea water

Unit 4:

“Forests”

Aniq Hashmi

Types of Forests:

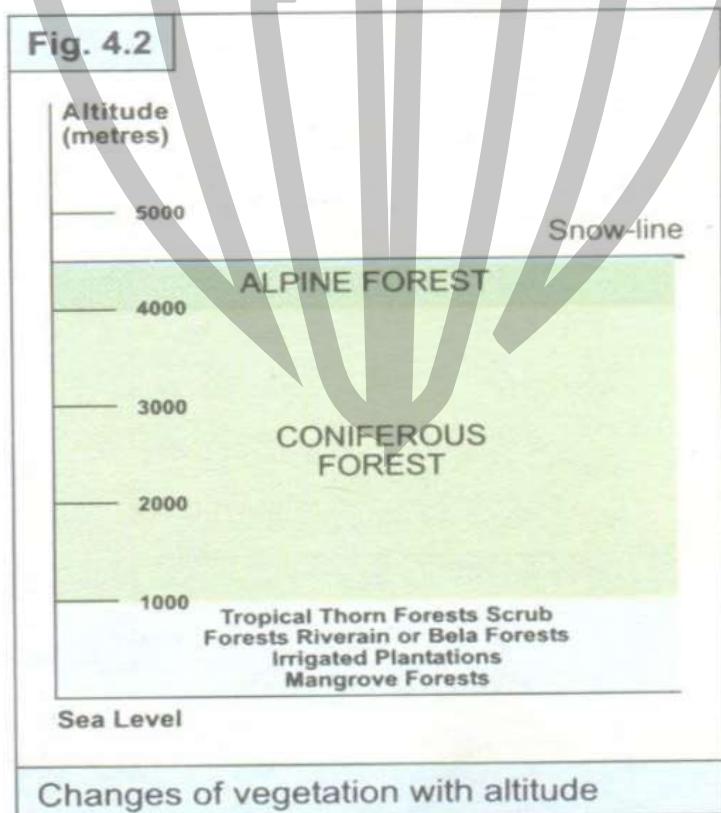
Productive:

- These are natural forests.
- They usually have a closed canopy, which blocks out the light reaching the forest floor hence, the forest floor has little vegetation
- These forests have high tree density and trees are highly valued due to their timber.

Protection:

- These forests are planted by man.
- These forests are evenly spaced out and usually the forest floor also has some vegetation.
- Tree density is not very high
- They don't have much commercial value and are instead planted to control soil erosion, provide shade and lower the temperature.

Forestation at different Altitudes:



Types of Forests in Pakistan:

Fig. 4.3	Types	Examples of Areas	Description	Importance
	Alpine Forests	Northern areas (Chitral, Dir, Kohistan)	Trees have stunted growth due to low temperature and less sunlight. Roots spread sideways on thin soil to absorb more nutrition and to have better grip on the ground. Normally upward branches to attain more sunlight.	Used as fuel wood only.
	Coniferous Forests	1. Northern areas. 2. NWFP (Abbottabad, Mansehra, Kohistan, Shangla, Swat) 3. Rawalpindi, Islamabad, Murree. 4. Balochistan Mountains. (Quetta & Kharo divisions)	Evergreen forests survive in low temperatures. Conical in shape. Sloping branches which prevent snow accumulation. Small, thick, leathery and needle-shaped leaves to check excessive transpiration. Less leaf-fall provide less humus formation.	Important source of timber for making furniture and boxes. Environmental protection. Conserve soil and help in checking floods. Good breeding and conserving centres for birds, wildlife. Attract tourists and promote winter industry. Add to the scenic beauty of the area.
	Tropical Thorn Forest (Rakh)	1. Punjab Plains. 2. Southern & Western Balochistan. 3. Sindh Plains.	Low height (6 - 10 metres). Forest dominated by thorny hardwood. Deep roots to search for water. Scanty vegetation due to water shortage.	They are used as firewood.
	Sub Tropical Scrub Forest	1. Hills and foothills of Lower Himalayas. 2. Sulaiman and Karak Ranges. 3. Western Mountain (Peshawar, Waziristan, Kohat, Mardan) 4. Above the Makran Coast Range.	Sub-tropical broad-leaved and tropical thorny species.	Watershed protection. Supplying firewood. Grazing purposes.
	Riverain or Bela Forest	River Indus and its tributaries.	Linear plantation along the banks of rivers. Normally high-yielding commercial hardwood species.	Provide Shisham and Babul, two valuable species, which are used for making furniture, agricultural implements.
	Mangrove Forests	1. Coastal areas of Sindh. 2. Coastal areas of Balochistan (Deltaic regions)	Broad leaves with drip tips. Leathery texture to minimize transpiration. Low trees and shrubs grown on the tidal mud flats. Mangrove roots spread into sea-water and survive in salty water. In better water areas, the trees rise to 6 - 8 meters but their general height is 3 meters. Stunted growth of trees in Indus and Hub delta because of dumping of industrial, agricultural and chemical waste into Arabian Sea. Limited number of species in polluted water.	Supply of firewood. Coastal communities use these forests for timber. Breeding grounds for fish and shrimps. Camels and livestock feed on the leaves of mangrove. Fallen leaves provide nutrition for marine life. Protect coastline from erosion, storm damage and wave action. Act as barrier against intensity of earthquakes and Tsunamis by absorbing shock waves.
	Irrigated Forests	1. Changla Manga near Lahore. 2. Wan Bachran in the Thal area. 3. Chichawatni in Sahiwal district & Ghulam Mohammad and Godda Barrages.	Economically important species are planted in large blocks of the same species. Shisham, Babul and Eucalyptus are normally preferred.	Important sources of timber, firewood. When planted in linear form they provide shade.

ALPINE FORESTS



CORNIFEROUS FOREST



TROPICAL THORN FOREST



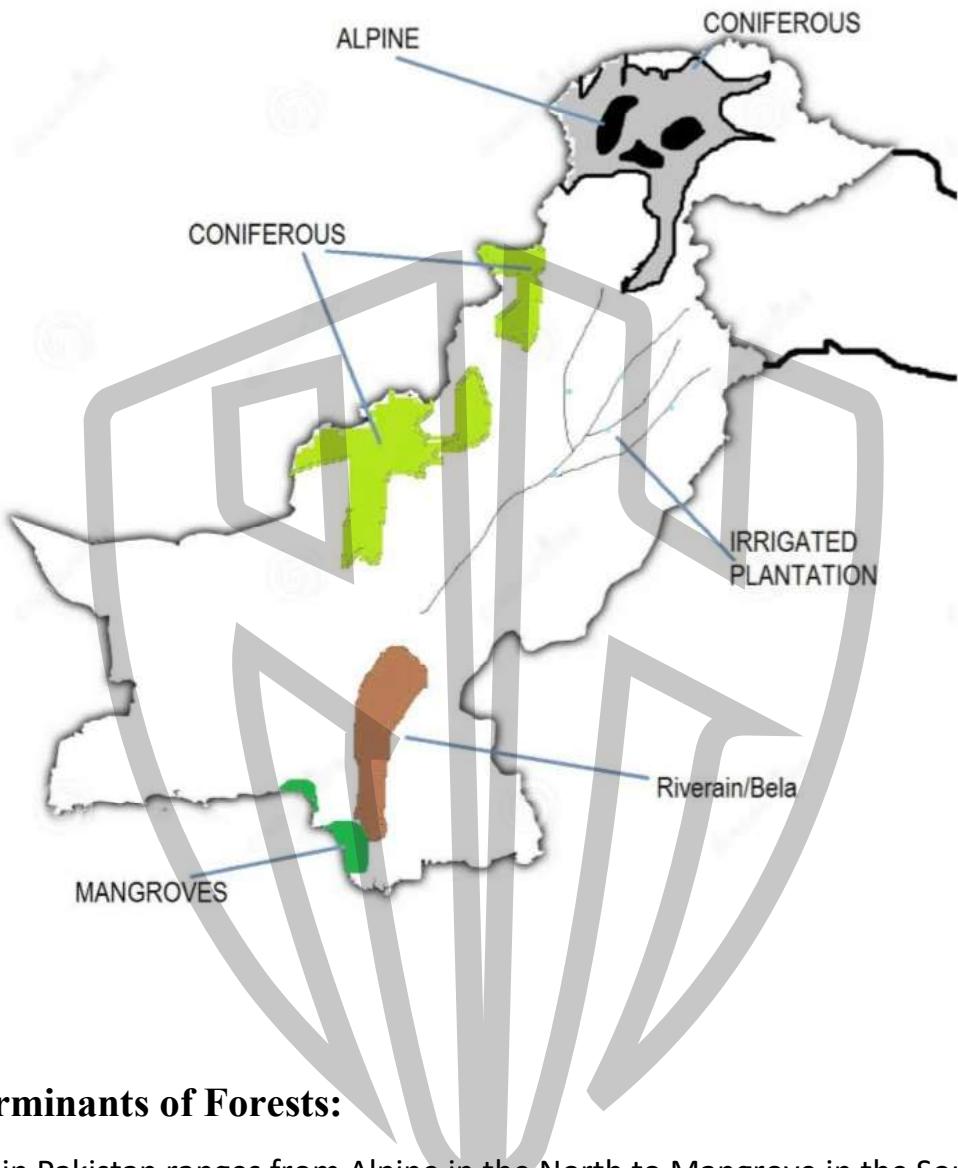
Sub-tropical Scrubs:**IRRIGATED FOREST:**A photograph of a dense forest. Sunlight filters through the canopy of tall, thin trees, creating bright highlights and deep shadows. A small logo in the bottom right corner reads "CONSUMER NEWS".

DID YOU KNOW?

Changa Manga is one of the largest man-planned and man-grown forests in the world. It covers the area of approximately 12,000 acres.

REVERINE**Mangrove**

Distribution of Forests in Pakistan:



Determinants of Forests:

Forests in Pakistan ranges from Alpine in the North to Mangrove in the South .The density depend on rainfall temperature, altitude and soil.

Factors determine the type and density of forests are:

- Different altitudes have different forests types.
- Climatic variation also describe the types of vegetation
- Arid areas have Thorny bushes and scrubs.
- High precipitation in north leads to growth of coniferous tree.
- Type of soil also defines the type and density of forests in different areas.



Q: How do Mangroves survive in salty water?

- They have highly impermeable roots, which limit the amount of salt entering the plant.
- The salt which eventually enters the plant is stored in old leaves when they are to shed away.
- They have thick leathery leaves which can control the size of their pores (stomata) effectively limiting the amount of water the plant transpires.

Uses:

- They are used for timber, fuel wood, leaves for camel fodder and branches for roofs along with mud and for extraction of honey.
- They also reduce soil erosion in coastal areas due to tidal action, thus they extend time for ports after which dredging is required to make them deep again.
- They form important breeding and protection grounds for fish.
- They reduce the impact of tsunami and tropical cyclones by acting as barriers to their brute force.

- They are found in Indus delta (Karachi and Thatta districts) and Hab delta (Gwadar district).

Threats:

- Cutting of Mangroves for fodder and firewood.
- Sea water and river pollution.
- Removal of sand from beaches.
- Construction of roads and buildings at beaches.
- Municipal waste and sewage dump into mangrove area poisons them.

Linear Plantations:

- They are planted by man. These are plantations alongside roads, parks, railways, motorway etc.

Deforestation

Causes of Deforestation:

- Growing population means more land is required for housing, construction of roads, railways and airports so forests are cleared.
- Demand for forest based products like timber for furniture, ploughs, ephedra, paper from pulp etc. has increased. Forests are cut down to fulfil the demand of these products.
- To provide room for growing more crops to fulfil demand and also for grazing animals (cattle ranch).
- Before open cast mining starts an area is cleared for its vegetation.
- Farmers tend to clear a patch of land and to use it for growing crops. (Over-Cultivation)
- Overgrazing by cattle and goats reduce the chance of land regaining its vegetation.
- In Northern areas which have no gas supplies for cooking and heating; wood is used from forests.
- Wildfires also cause a lot of damage to forests.
- Corruption amongst forest officials, who allow illegal cutting.
- Industrial waste and effluent discharge in the Indus Delta has caused damage to Mangroves.

Effects of Deforestation:

- During heavy rainfall, massive soil erosion occurs along with landslides.
- This loss of soil may result in removal of top few inches of fertile soil over period of some years.
- Landslides block roads, railways and disrupt communication and supplies mostly to Northern areas of Pakistan.
- Power lines may be washed away by landslides and floods.
- The eroded soil settles in the reservoirs of dams and barrages and reduces HEP production along with reducing storage capacity, it also damages power lines.
- Patterns of rainfall may also change leading to drought conditions as trees absorb ground water and transpire it into the air.
- Cutting of trees may also affect tourist destinations leading to loss of tourists as the case with Murree.

Reducing Effects of Deforestation:

- Terraces prevent erosion by shortening the long slope into a series of shorter, more level steps.
- Contour ploughing can be practiced which reduces soil erosion.
- Selective logging that is cutting of only mature hardwoods should be enforced and use of heavy machinery must be limited.
- High yielding varieties of crops can be used which give more yield per unit area and are resistant to pests etc. so less forests are cleared for growing crops.
- Regions which have large forest cover must be declared national parks, where logging and hunting is prohibited by law.
- Gas can be provided to Northern areas so fewer forests are cut for firewood.
- People of Northern areas must be better educated about importance of forests. They could be better trained in management of forest resources.
- Afforestation and re-afforestation schemes can be started.
- Strip farming can be practiced in which alternate strips of cotton, wheat and corn crops are planted. This forms a formidable barrier against wind erosion.

Afforestation:

Afforestation is the process of planting trees or sowing seeds, in a barren land devoid of any trees to create a forest. Afforestation is the creation of a 'new' forest.

Reforestation:

It is a process of specifically planting native trees into a forest that has decreasing numbers of trees. Reforestation is increasing the number of trees of an existing forest.

Contour Ploughing:

When crops are planted on parallel contours at the side of the hill it reduces soil drain off and turns a gentle slope into a field in order to grow crops

Terraced Farming:

Terrace farming is a method of farming whereby "steps" known as terraces are built onto the slopes of hills and mountains. When it rains, instead of rain carrying away the soil nutrients and plants down the slope, they flow to the next terrace. Every step has an outlet which channels water to the next step. This helps in keeping some areas dry and others wet. On very high altitudes, other crops apart from rice can be grown.



Importance of Forests to Pakistan:

- Roots help to prevent soil erosion.
- Area under forests must be increased so as to reduce imports of timber. This will save precious foreign exchange.
- To retain beauty of tourist sites like Murree etc. where a lot of local earning is dependent upon tourism.
- To relieve waterlogging and salinity as some trees lower the water table as their roots absorb a lot of water.
- Mangroves prevent erosion in Indus delta as they reduce the impacts of tidal waves by serving as a barrier. Less erosion means less deposition occurs at which need not to be re-dredged for a longer period of time. This saves huge sums of money.
- Mangroves also form important breeding and protection grounds for fish.

Uses

- Provide fuel wood.
- Provide raw material for wood based industries.
- Provide herbs for pharmaceutical.
- Prevent desertification.
- They are source of charcoal.
- Provide fodder for animal.
- Prevent hooling on mountain slopes.
- Provide humus.
- Protect wild life.

SUSTAINABLE FORESTRY:

Sustainable forestry means when forestry is done in such a way that present demands can be met, while not compromising on the ability of future generations to derive their demands from the resources they will have.

So forest management becomes very important, where only a few hardwood species are cut down every year. For every tree cut, 5 trees are re-planted, to make sure that damage is catered well.

These trees take a lot of time to grow back (long term investment) and thus the pay-off comes late. It costs a lot to sow the plant, water it and maintain forests while keeping illegal loggers out of the area.

Unit 5

Fishing Industry

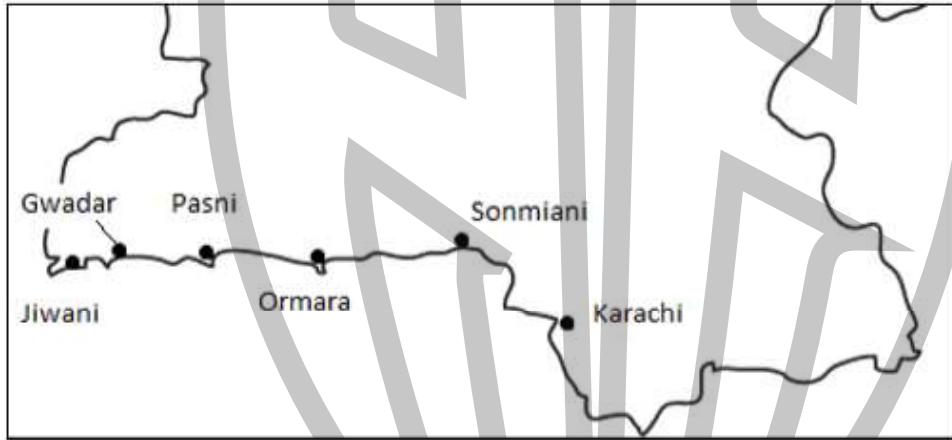
Fishing is a primary sector industry. It is the main occupation of people living in the coastal areas of Pakistan; serving as their main source of food and cash as the surplus catch is sold.

There are two types of fishing:

- i- **Marine fishing** that is carried out on the coasts of Sindh and Balochistan.
- ii- **Inland fishing** that is carried out in reservoirs of dams and barrages, lakes and rivers along with fish farms.

Marine Fishing:

Marine fishing is carried out by both **subsistence** and **commercial** methods in the coasts of **Sindh and Makran**.



Method of Subsistence Marine Fishing:

- It is carried out by illiterate and poor people living in coastal villages.
- A fisherman has a wooden sail boat which can only go for 5-10 km away from the coast. Since his boat uses land and sea breezes for locomotion, he can only go for fishing in morning and come back in afternoon.
- The subsistence fisherman may also use a wooden row boat or a wooden boat fitted with a small engine.
- Since the distance travelled by these boats is small (5 to 10 km), the fisherman can only exploit the fish near the continental shelf but not in deep sea. Thus, fish stocks in continental shelf are overexploited. The fisherman has a traditional small net so his catch is small.

- During the monsoon season the sea is rough so he can't go out, thus the fisherman must find some alternative work.
- The fisherman takes ice with him in a small bucket to store his limited catch.
- The whole family is involved; male catches the fish, rest of the family cleans off the scales and removes the gut of fish.



Method of Marine Commercial Fishing:

- It is practiced by fishing companies mostly along the developed Sindh coastline. It involves fish catch in bulk, thus it is a permanent source of income.
- Motorized boats are used which can travel 40-50 km off the coast and into the deep water to catch the unexploited stocks of fish.
- These boats also have refrigeration facilities so fishing can be done uninterruptedly for 10-15 days.
- Ice is bought in large quantities from ice factories along both coasts and loaded onto the fishing vessels.
- Gill netters help in quickly catching large amount of fish.
- Weather forecasts are used for safe navigation and for returning catch without sinking.
- GPS helps in quickly locating fish/crab pots.



Types of Marine Fish catch

- | | | |
|----------|------------|----------|
| ■ Sharks | ■ Croakers | ■ Skates |
| ■ Drums | ■ Cat fish | ■ Rays |

Q: Why Sindh coast have more fish catch than Makran coast?

Pakistan's Marine fish catch is divided into (70% from Sindh coast) (30 % from Makran coast). Most of catch is along Sindh coastline is because of following reasons:

- Large population of Karachi offers a bigger market for the fish catch. Catching fish near the demand source lowers the transport cost of fish for the fishermen.
- Most fishing companies operate near Karachi as it is more developed than other coastal areas of Pakistan.
- Indus Delta in Sindh is much larger than Hab delta in Balochistan. Indus delta has a much bigger river, which brings in more silt for Mangroves. Mangrove roots provide protection and breeding ground for fishes.
- Karachi fish harbour is more developed than fish harbours on the Balochistan coast.
- Ice units required for commercial fishing is available at Karachi. The ice prevents the catch from getting spoiled too quickly.

Inland Fishing:

Subsistence:

- Fishing is practiced in rivers, lakes, reservoirs of dams (like Tarbela) as an extra source of income. In Northern Areas it is done for sports by catching trout.
- Small traditional nets are used to catch the fish.
- It is practiced by small scale fishermen living in continental areas of Pakistan.
- Most of the fishing is done for the consumption of family.



Commercial (Fish Farms):

- Rectangular ponds are dug into the ground (in a regular pattern), which makes it easy to corner and catch the fish ultimately. The ground must be flat for maintaining water level, soft for digging and must have an impermeable soil layer to reduce water loss.
- Different ponds contain different types of fish. Numerous ponds help to prevent diseases.
- Embankments are made of soil dug out.
- Trees are planted to provide shade, reduce soil erosion.
- The sides of pond are lined with stones or cement to reduce water loss.
- Cow dung or fertilizer is spread on surface as food for micro-organism which is eaten by fish.
- When they reach a certain size they are caught and sold.



Types of Inland or Fresh Water Fish

- | | | |
|---|---------|----------|
| ■ Manaseer | ■ Palla | ■ Thalla |
| ■ Rahu | ■ Trout | |
| ■ Grass, Silver – Chinese species of Carp | | |

Uses and Importance of Fish Caught:

- Source of food for growing population and decreases the burden on other types of meat.
- Fish guts, eyes and scales are used to make fertilizer and animal feed.
- Fish scales are used to make cosmetics.
- Fish is sold to earn cash; the sale price is increasing due to ever increasing demand from a growing population.
- Shrimps are exported to USA etc. and some fish is dried and then salted for export to Middle East and Sri Lanka.
- Fish meat is better than red meat as it has Omega 3 so it is better for heart patients. With increasing awareness about benefits of eating fish, the demand for white meat is increasing steadily.
- Fish catching also may serve as a tourist attraction in Northern Areas of Pakistan.
- It also provides employment to many.
- Contributes 6% in GDP.
- Contributes 1% in GNP.

Problems for Fishing Industry:

- Main problem facing the fishing sector is the lack of funds or mismanagement in development.
- The longest coast (Makran) is least developed.
- Obsolete methods of catching fish are still being used.
- No training and education of fishermen means that only a small number of them can be trained to operate big fishing boats or work in processing factories.
- Telecommunication facilities are still poor, thus there is a communication gap between fishermen and buyers (buying and selling).
- Overfishing is also another problem.
- By-catch also occurs in commercial fishing. Fish not required by the operators is accidentally caught along with other economical fish. This disturbs the balanced marine ecosystem.
- Much of Pakistan's fish products like canned fish are banned in EU due to the unhygienic processing conditions.
- Fishing during breeding season is harmful and may lead to extinction of valuable fish species.
- Use of illegal nets with small holes.

Problems

Due to water pollution Marine fishing industry and inland fishing industry both are facing problems. This is because of leakage of oil which harms especially in the Sindh coastal areas. Oil not only kills the fish but also destroy the fishing grounds and slope of fish.

Industrial Toxic Material:

Industrial waste is directly dumped into the sea from the industries of Korangi and SITE is harmful for the Marine fishing and the industrial waste from the industrial waste of Punjab dumped directly into the rivers is harmful for land fishing.

Use of Artificial Fertilizers:

Pesticides, insecticides etc. are dangerous for inland fishing because of eutrophication

(Layer of chemicals accumulates on the surface of river water which does not allow sunlight and oxygen to penetrate in the water) which kill the fish.

Political Instability

Due to uncertainty in Karachi, the Karachi fishing industry known as fisheries cannot sell in the domestic market or export to other countries.

Fishing Breeding Season:

The poor fisherman who live at the continental water bodies or Makran coastal areas catch fish in breeding season because they do not have alternative job opportunities. Thus, fishing in breeding season is decreasing the population of fish in rivers and other water bodies.

Overfishing:

Fish is a sustainable resource which is decreasing rapidly because of the overfishing by large foreign ship which use modern technology and catch large amount of fish.

Use of small hole illegal nets:

In Pakistan local fisherman use small hole nets and catch uneatable fish can be only used for making poultry feed.

Financial Constraints:

Due to the financial constraints local fishermen cannot afford fishing technology to catch fish from deep sea and do not have proper refrigeration facilities.

Solutions:

- Government should provide loans on easy installments with low interest rate to encourage fishing industry by modernizing the fishing methods.
- Government should create awareness about not to catch fish in breeding season and not to use a small hole nets.
- There should be a ban on the slumping of industrial toxic materials directly in to water.
- Government should provide alternative jobs to the fisherman in the breeding season of fish.
- Government should also provide alternative energy resources to the people who used wood as fuel and hence not harm Mangrove Forests. They must allow fresh water to come in the delta in order to encourage the growth of mangroves.
- Government should create awareness among the people about the importance of mangroves forests and harmful effects for fishing Industries.
- Refrigerator and packing facilities should be provided near the harbour.

Sustainable Fishing:

It refers to fishing in such a way that it could be saved for future.

Sustainable fishing is possible by adopting following methods:

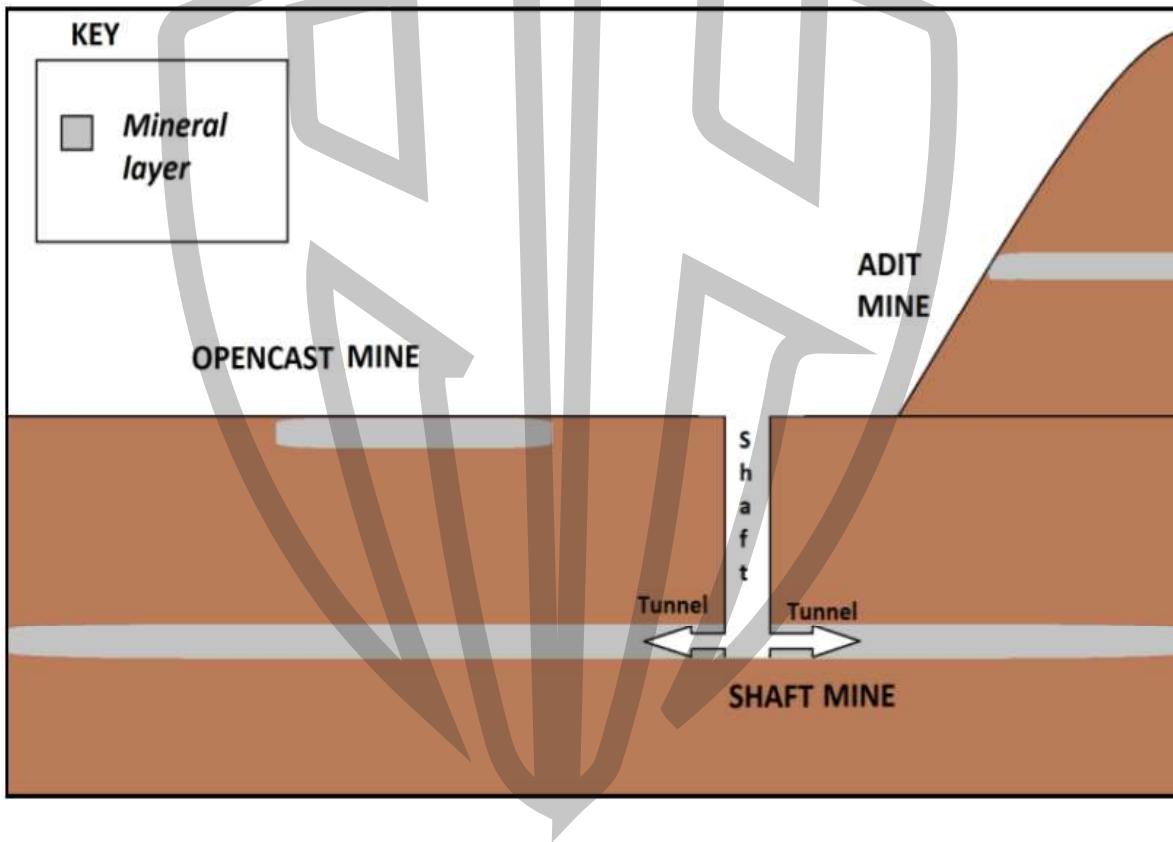
- Fishing of endangered species of fish must be banned to allow stocks to recover.
- Nets with certain size of holes must be used to avoid by catch of smaller fish and also allow immature fish to escape so they can breed in the future.
- Fishing should be banned during the breeding season of the fish, so stocks can be recovered.
- Illegal fishing must be stopped. They catch smaller and immature fish to maximize their profits, at the expense of future Stocks which should be stopped.
- Strict patrols must be carried out on the edges of Pakistan's waters, where foreign trawlers illegally catch fish, without port charges/license/taxes etc.

Unit: 5**Mineral Resources**

Mining : It is a process of extracting minerals from earth found in different depths

Methods of mining:

- 1) Open- cast /pit mining(if minerals are close to the surface)
- 2) Adit mining (Hilly mountaineers region deep in the earth)
- 3) Shaft Mining.(Huge vertical passages then pipes are inserted)
- 4) Drilling of Oil and Gas (requires- no manual)
- 5) Hand panning method (separating sediments from minerals)



Open- cost pit mining:

Some minerals like coal and oil often found near the surface open cast mining scoops up these minerals from near the surface. These minerals bearing rocks are stripped off by giant excavator and power shovels.

Adit mining:

An Adit is an opening or passages. adit mining is done in hilly areas where a seam (layer) is exposed on a Hill side. Horizontal tunnels are dug into the side of valleys or hill to reach to reach the mineral deposit.

Shaft mining:

Vertical shafts are dug down to the mineral. Tunnel is dug horizontally to the layer or seam of the mineral. highly risk mining because sometimes mines collapse due to thin seam

Drilling of oil and gas:

Oil or gas occurs in porous spaces of sedimentary rocks. They are normally trapped deep down in the ground. once the drilling site has been selected a derrick and drilling rig is set up. The derrick is a large steel structure that holds the pipes and other equipment. The derrick is dismantled after oil has been found. rig is replaced by pipe and valves which control the flow of the oil .then it is transported through the pipelines to the refineries.

Hand panning method:

In this methods minerals are separated from sediments left by river with the help of shaking machines.

Quarrying

A form of surface mining used to extract rocks and stones to make buildings .

Renewable resources

Those resources which reoccur instantly for unlimited use .

- Sunlight/ solar energy
- Water/ Hydal power
- Tidal power
- Geothermal power (not available in Pakistan)
- Wind power (limited scale)

Non renewable resources

Those resources which does not reoccur instantly

- Coal
- Oil
- Natural gas
- Metallic Minerals
- Non metallic minerals

Uses and Description of Metallic and Non-Metallic minerals

Metallic Minerals	Non-metallic Minerals
<ul style="list-style-type: none"> ▪ Iron Ore ▪ Copper ▪ Antimony ▪ Chromite ▪ Celestite ▪ Manganese ▪ Gold ▪ Silver ▪ Tin ▪ Bauxite 	<ul style="list-style-type: none"> ▪ Coal ▪ Sulphur ▪ Rock Salt ▪ Barite ▪ Gypsum ▪ Soapstone ▪ Fluorite ▪ Limestone ▪ Marble ▪ Clays
Fig. 5.4	
Metallic Minerals	Non-metallic Minerals
<ul style="list-style-type: none"> ▪ Economically more valuable 	<ul style="list-style-type: none"> ▪ Economically less valuable except for the power resources e.g. oil, coal, natural gas.
<ul style="list-style-type: none"> ▪ Generally hard, tough and shiny 	<ul style="list-style-type: none"> ▪ Softer, rough and may not shine.
<ul style="list-style-type: none"> ▪ Can change shape without breaking 	<ul style="list-style-type: none"> ▪ Breaks away when shape is changed (except oil and natural gas)
<ul style="list-style-type: none"> ▪ Can be stretched and compressed 	<ul style="list-style-type: none"> ▪ Cannot be stretched or compressed (natural gas can be compressed into a liquid by cooling)
<ul style="list-style-type: none"> ▪ Many are good thermal and electrical conductors 	<ul style="list-style-type: none"> ▪ Poor thermal and electrical conductors
<ul style="list-style-type: none"> ▪ More reactive with water and acid 	<ul style="list-style-type: none"> ▪ Less reactive with water and acid (except limestone and salt)

Fig. 5.13	Name	Uses
1.	Chromite	Chromite gives hardness and electrical resistance to steel. It is used for bridges and railway carriages. It is also used as a lining in metallurgical furnaces and for making engineering tools and stainless steel etc.
2.	Iron Ore	Steel making, construction and the transport industry.
3.	Copper	Making electrical wires and other electrical appliances, especially switches that carry current, also used in making alloys, water pipes and tanks.
4.	Manganese	Used in making dry batteries, paints. It is a vital alloy in steel making, flares and flash bulbs.
5.	Bauxite	Aluminium is mainly obtained from bauxite and is a valuable metal. Uses: utensils, tins, cans etc. and many other products.
6.	Celestite	Found in the cavities of sedimentary rocks. Uses: tracer bullets, fireworks, ceramics, paints and plastics.
Metallic Minerals		

USES OF MINERALS

GYPSUM

- Gypsum Board primarily used as a finish for walls and ceilings
- Plaster ingredient
- Fertilizer and soil conditioner
- Plaster of Paris (surgical splints; casting moulds; modelling)
- Adding hardness to water used for home brewing
- A component of Portland cement used to prevent flash setting of concrete.
- Soil/water potential monitoring (soil moisture tension)
- In foot creams, shampoos and many other hair products

LIMESTONE

- The manufacture of quicklime (calcium oxide) and slaked lime (calcium hydroxide)
- Cement and mortar
- Pulverized limestone is used as a soil conditioner to neutralize acidic soil conditions
- Crushed for use as aggregate—the solid base for many roads
- As a reagent in flue gas desulfurization (sulphur dioxide air pollution control)
- Glass making, in some circumstances
- Added to paper, plastics, paint, tiles
- Toothpaste
- Re-mineralizing and increasing the alkalinity of purified water to prevent pipe corrosion and to return essential nutrients
- Used in blast furnaces to extract iron from its ore
- Medicines
- Cosmetics

ROCKSALT

- Cooking
- Spreading on icy roads to improve traction
- Manufacturing pulp and paper
- Setting dyes in textiles and fabric
- Producing soaps, detergents, and other bath products
- Major source of industrial chlorine and sodium hydroxide
- To preserve fish after it has been caught

Barite:

- It used for making Barium Sulphate. Barium sulphate is used in the inner walls of oil pipeline to control the pressure of oil.
- It is also used in the chemical and fertilizer Industries

Marble:

- Marble is used in building at for making chips for flooring
- Decorative pieces are made.
- Ceramics and sanitary are made from marble

Fluorite:

- The large deposits of fluorite are found in koh-e -Sultan and koh-e- meran near Toba kakar ranges.
- flourite is mainly used for making steel and glass
- cooking utensils
- chemical Industries

Magnetite

- It is used in the manufacture of cement, paper pulp Rayon.

EFFECTS OF MINING

- Economical

Mining brings jobs to the local people, which provides them with employment opportunities and raises their income, which in turn raises the standard of their living.

The country can export the mined mineral and earn foreign exchange or reduce the import of a mineral. The capital saved can be used to build schools and colleges etc

- Environmental

The environmental impacts of mining are huge and catastrophic if check on the environment aren't carried out and environment laws aren't enforced. This is because many mining companies are always looking to reduce their costs by either dumping waste illegally or not treating it properly

Opencast mines leave a huge hole on the surface. If it is not filled after mining has been finished it can be filled partly by rain water. This can lead to leaching of dangerous substances like arsenic into the ground water (water table) thus poisoning the water supply

At times the solid waste is dumped onto the surface and when it rains heavily, this dump can become unstable and flow into rivers and streams thus killing fish

Also local wildlife may move out of the area due to constant sound of explosions and vibrations. Trucks and chimneys can also cause air pollution

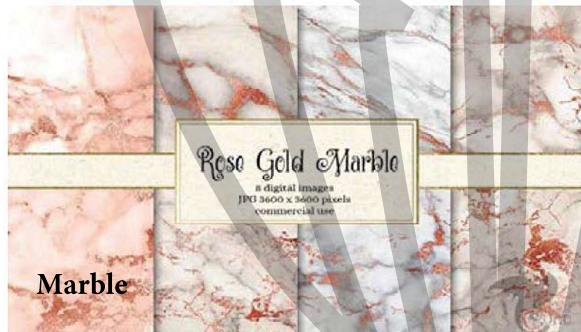
- Miners

Miners can suffer the most especially if they aren't given proper safety gears like masks etc or clean food and water. This can lead to lung cancer. Also, if proper ventilation systems aren't installed, explosions can occur due to collection of methane in the mine

The miners may also drown if they accidentally hit an underground reservoir of water or they may be trapped if the roof caves in

Problems of mineral sector in Pakistan

- Lack of Technical knowledge
- Lack of experts
- Lack of machinery
- Low priority of government
- Lack of finance
- Inaccessible mineral deposits
- Institutional mismanagements



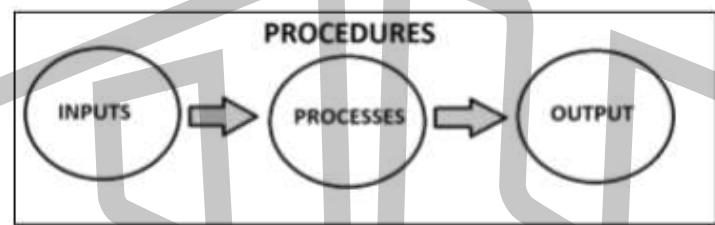
Unit :7

“Agriculture Development”

Agriculture is the process by which food crops and other goods are produced, including Wheat, Rice, Sugarcane and Maize along with Cotton etc.

INPUTS:

These are both human and physical resources that go into the farm.

**Human (Economic):****Capital:**

This is all the money and machinery that is invested into the farm including tractor and harvester etc.

Fertilizer:

These replace the nutrients that have been used up by the crop. With the use of fertilizers, nutrients are available for plant growth resulting in higher yields.

Insecticides:

These are sprayed to kill insects, which damage crop growth by eating leaves etc. Unfortunately, insecticides also harm other useful insects and organisms like butterfly, which are vital for pollination.

Labour:

Labour is all the human effort that is put in from the time of plantation of crop to the time of harvest.

Seeds:

A desi variety of seeds produces lower yields as compared to a high yielding variety of seeds. But it must be noted that only desi varieties are adapted to the

local climatic conditions. Therefore, to achieve high yields in an adverse climate a hybrid of the two varieties is required.

Land Reforms:

The government has introduced land reforms to consolidate the holdings of farmers, so that their far flung fields can be combined to form one big economically viable field. It thus becomes easier to use machines on it, obtaining loans becomes easier (as banks are more confident that farmer will be successful after using their money and will be able to repay the loan). Farmer can experiment on his field and can ultimately save the time and hassle of working on multiple farms (this allows him more time to improve things like water supply to a single farm etc. all of which increase crop yields even further)

Also, land is taken away from landlords and given to poor tenants, thus unproductive land is brought into use. Furthermore, tenants have the ability to buy the land they have worked on when the landlord wants to sell it.

Government Support:

The government supports the farmers by giving them interest free or low interest loans. These are used to buy machines and high yielding varieties of seeds.

Physical (Natural):

Soil:

Soil is the material in which the roots of the plant are embedded. A soil suitable for growth contains sufficient minerals for crop growth and also has sufficient pore spacing. The best soil is loamy soil, which contains sufficient pore spaces (to allow for sufficient air and moisture). Spaces aren't too big; so the soil does retain nutrients. The soil must be deep and must contain nitrates and phosphates; which are required for crop growth.

Climate:

Every crop has its own distinct climatic requirements. This includes rainfall, humidity, temperature, amount of sunlight etc.

Land:

Most suitable for farming is plain lands where all the required processes are executed easily.

However, on mountainous terrains farming gets a little difficult due to uneven land scape.

Water:

Fresh water supply is a necessity for crop growth, either provided by irrigation method or by rainfall.

Water is required by all crops during right time.



PROCESSES:**Ploughing:**

Turning over the upper layers of soil to bury weeds and the remains of previous crops, thereby, allowing them to break down meanwhile bringing fresh nutrients to the surface.



Sowing: Planting so seeds in the field.



Spraying: Use of insecticides.



Weeding: Removal of unwanted plants.



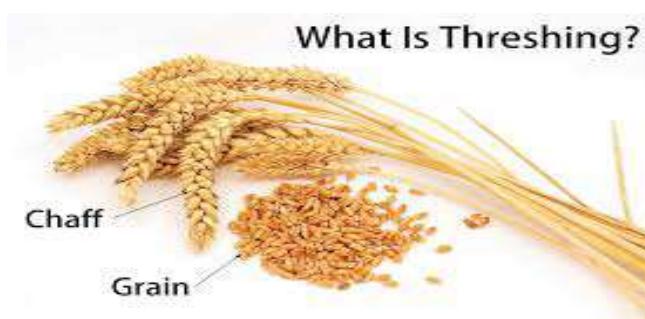
Fertilizing: Applying of chemical or natural fertilizers containing nutrients essential for soil fertility.



Harvesting: Cutting or collecting of crops when ripened.



Threshing: only in grain crops like Wheat, Maize, Rice and Millet (separating edible part of cereal from the scaly chaff).



OUTPUTS:

Crop wastes
Food crops
Seeds

Types of Farming:**Subsistence:**

This type of farming is concerned with those farmers whose primary aim is to grow food to feed their own families. Any surplus of products produced during good years (when rainfall is plentiful and pests don't attack) is sold in local markets for some extra income. Surpluses are rare because traditional farming techniques are used, which give low production such as:

Wooden Plough:

(Pulled by a bull) is used, which barely ploughs the surface in comparison to the tractor (which ploughs very deep into the soil). With the use of wooden plough the fertility of land is low because less mixing of upper (nutrient deficient) and lower (nutrient bearing) layers of soil occurs. Also, exposing of the soil layer to air helps in nitrogen fixation, which fixes nitrogen in the soil. With a tractor plough it is easier for the bud to break through the soil, if that is not the case then plant

growth can be severely hampered and seed may not germinate at all.



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Desi seed varieties are used:

These give low yields as compared to high yielding varieties of seeds. The high yielding variety is produced from successive generations of parent plants all of whom give high yields.



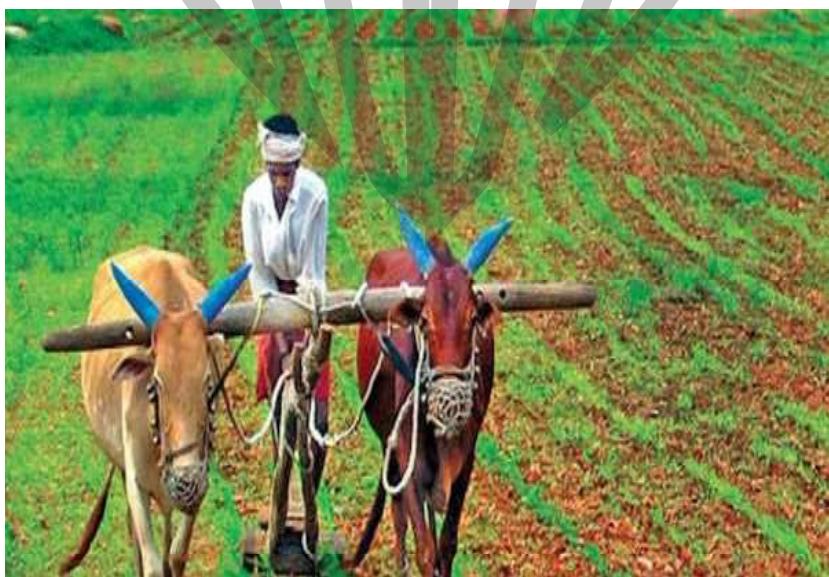
Rainfall is the primary source of water for these subsistence farmers, since in Pakistan rainfall is variable in amount, intensity, distribution and timing. Thus, depending on rainfall for watering the crop is the least reliable method which gives low yields.

Variance in amount means that one year we have a lot of rainfall and in the next year there is low amount of rainfall. This means that the farmer won't actually be able to know whether he should plant a water hungry crop like rice or a lesser water hungry crop like cotton etc.



Bull (male) is used to plough the land (not cow as cow is a female), remove weeds, cut the crop (harvest), remove husk (by grinding) and transport the seeds and the grain etc.

Buffalo they draw water from wells like Charsa or Noria etc.



Cattle/buffalo dung is used as a fertilizer for crops; this dung decomposes slowly, hence plant roots receive nutrients in small amounts as compared to artificial fertilizers. These artificial fertilizers dissolve quickly in water and have a broader range of minerals like phosphorous, sodium and potassium as compared to cattle/buffalo dung.

Since the area of farm under cultivation ranges from 0.25 – 10 acres, every year due to varying climatic conditions etc. production is variable (and most of the times low). Hired labour is rarely used as it is usually uneconomical (when the returns of a facility are lower than the amount spent to get it). Instead, all members of family take part in at least one agricultural activity.



The farmer's crop is totally vulnerable to any attacks by **fungi or pests** because the farmer doesn't use any fungicide or pesticide. Therefore, year by year his crop yield can vary.



Since surpluses are rare, profits are also low so these farmers don't have much money to re-invest in the farm. Thus, they cannot buy high yielding varieties of seeds, farm machinery etc. Sometimes, if they are lucky and the climatic conditions are right they may make a profit by selling the surplus which can be sold. The money earnt can be used to repair agricultural implements, buy some HYV's of seeds, improve water supply, buy some fertilizer or pesticide etc.

Sometimes the farmer may not find enough hired labour to harvest his crop on time. This because of rural-urban migration (explained in the last chapter), due to which many males move out from rural areas to find work in cities

The farmer gets sick and may not be fit on time (due to poor medical facilities in rural areas).

Commercial /Large Scale:

This type of farming is concerned with making a vast profit by investing heavily in human inputs. This is done to achieve maximum possible yields and earn the highest possible level of profit upon sale. Inputs include:

- **Capital:**

This is the most important commodity for a commercial farmer. It is used to buy fertilizers, seeds, pesticides, machines etc. A commercial farmer must have a lot of cash as this type of farming is mainly capital intensive.

- **High Yielding Varieties of Seeds:**

These are the varieties of seeds which have been developed through selective breeding, a process in which plants with specific characteristics are pollinated with each other. This process is repeated on the next generation of plants until a totally new variety is developed with favorable characteristics such as, resistance

to disease or pests, high yield, quick growth, strong stems, ability to survive in adverse conditions like high temperature and low rainfall etc. Their use is encouraged by the government by the provision of subsidies (reduction in cost).



- **Fertilizers:**

They are used by farmers to increase crop yields. The fertilizer is added on to the soil and then water is sprayed on it. The water dissolves the mineral ions and takes them into the root zone, where they are absorbed by the plant. Fertilizers replace the nutrients in the soil that have been used up by the crop. For example, Magnesium is required for photosynthesis to occur, which is a process by which plants make their own food etc. It is important that they are applied at the correct time in the right amount.



- **Pesticides:**

Pesticides are used by farmers to kill those pests which lower crop yields, for example: to kill aphids which suck the sap of the plants. It is important that they are applied at the correct time in the right amounts.



- **Irrigation:**

It is used to supplement the amount of water available for the crop from rainfall. In Pakistan, the amount, intensity, timing and distribution of rainfall are variable from year to year. So, irrigation (that is artificial supply of water) is necessary to compensate any shortage of water that may occur due to changing weather patterns. Low rainfall may result in lower yields and an eventual loss to the farmer. Irrigation must be carefully managed so as to prevent waterlogging and salinity



Machines:

Machines like combined harvesters quickly harvest the wheat crop; they separate the grain from the chaff. The stem of the wheat plant is quite weak and can break during the month of March; when thunderstorms accompanied with strong winds blow across the Punjab plains. If the stem breaks, then the grain will be exposed to water and leaving it vulnerable to fungi attacks (by a process known as rusting, which ruins the whole crop).

By using a harvester a farmer can quickly harvest his crop before the storm hits. These machines are also very efficient (almost all of the grain is separated from the chaff, leading to higher profits for the farmer).



But the cost of fuel, maintenance etc. is high. The cost is further increased if skilled workers are hired to operate these machines etc. Machines are very expensive to buy.

Also, these machines can't be used on very small farms or farms which are located in mountainous terrain. Their use also results in unemployment in rural areas.

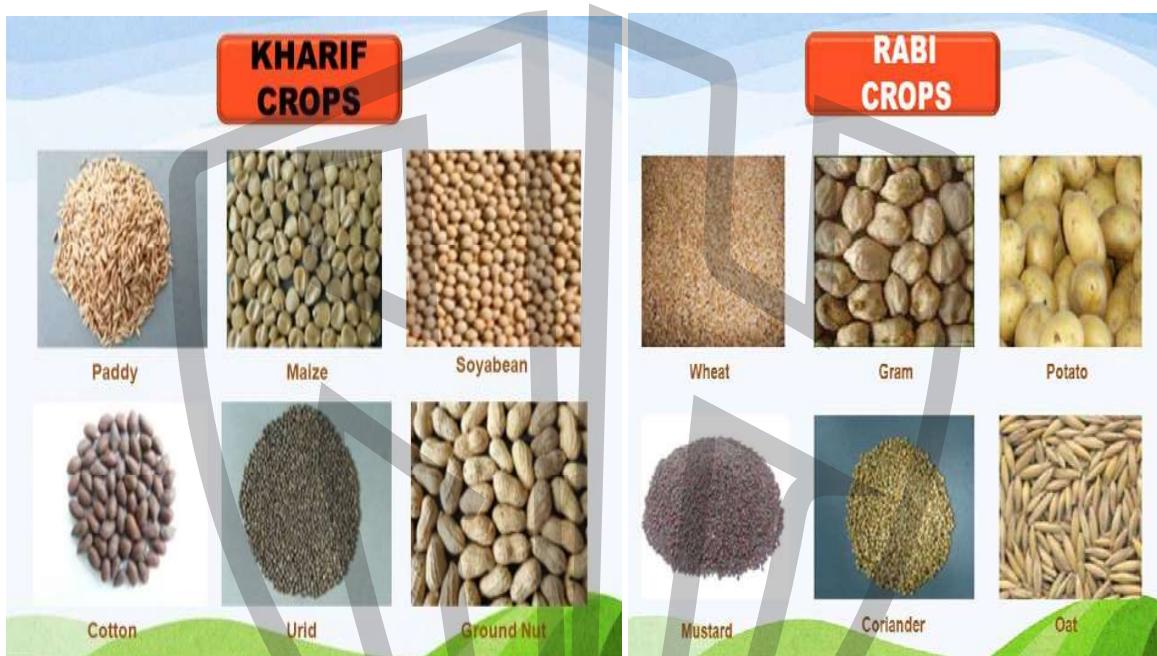
CROPS:

The crop season in Pakistan is divided into two parts.

First is the Kharif season and second is the Rabi season.

Kharif Season:

This season consists of crops planted around April-June and harvested in October November. This includes cotton, sugarcane, rice etc. These crops need high temperatures (25-40°C), so they can fulfil their necessary heat units required for their successful growth and harvest. Also, monsoon rains help to bridge the gap between amount of water available from irrigation and the water required by the crop. These crops also require a dry season for harvest.

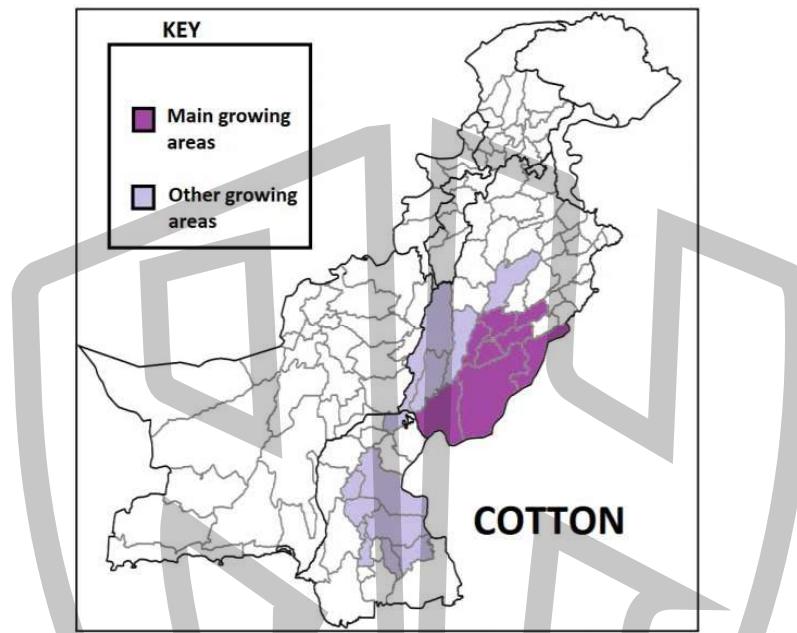


Rabi Season:

This season consists of crops planted around Mid-November- December and harvested during April – May. These crops require temperatures ranging from 15- 35°C for their growth and harvest. Water requirements are moderate as compared to Kharif crops. These crops include Wheat, Maize, Pulses, and Oilseeds etc.

1. Cotton:

Cotton is a Kharif crop that is planted in April-June and harvested in October-November. It is mainly grown in southern (arid) parts of Punjab, with other growing areas in eastern Sindh and other parts of Southern Punjab.



Sowing:

- Temperature during sowing must be from 25- 30°C.
- Before sowing, the seeds must be treated with chemicals to prevent seed borne diseases.
- The seeds must be sown with a driller to ensure a uniform depth of all the sowed seeds.
- Sowing must occur in the anticipation of rain or immediately after it to take advantage of any moisture left in the soil.

Growth:

- Temperature during growth must be from 25- 40°C.
- Irrigations must be carried out with an interval of 10-12 days in between. Weeds are removed by hand when needed

Harvest:

- Temperature during harvest must be from 30- 32°C.
- Harvesting is carried out when the bowls become dry and become fully open.
- 1st picking is at 120 days, 2nd at 140 days and 3rd at 160 days. These pickings are done by women and children since the use of machines for cotton picking is expensive.
- The diseased/ damaged bowls are kept separate from the fine quality bowls.

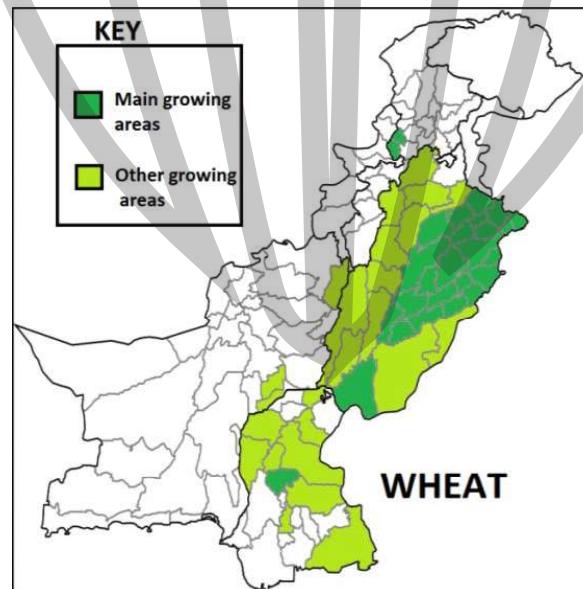
Geographical Requirements:

- Ideal temperature 25-35 C during cultivation and harvesting.
- Sensitive of frost.
- Ample rainfall around 1000mm with sunny periods in between.
- Irrigation is needed in case of 500mm or less rainfall.
- Medium loamy soil.
- Plain land.
- Pesticides, insecticides, irrigation, fertilizer.



2. Wheat:

Wheat is a Rabi crop it is planted in Mid-November, December and harvested around April - May. It is mostly grown throughout the central parts of Punjab with other growing areas including the rest of Punjab. Other growing areas are in eastern, central and western parts of Sindh.



Sowing:

- Temperature during the sowing must be from 4 - 25°C.
- Before sowing, the seeds must be treated with fungicides to prevent borne diseases.
- The seeds must be sown with a driller to make sure uniform depth of sowed seeds. This is so because if the seed is sown too deep it won't germinate or if it even does so then its growth would be slow or stunted.
- Sowing must occur in anticipation of rain from Western Depression or immediately after it to take advantage of any moisture left in the soil.

Growth:

- Temperature during growth must be from 15 -30°C.
- Irrigations must be carried out with 20 days interval in between.
- Weeds are removed manually as these weeds shed a lot of new seeds upon maturity, which can lead to explosion of weeds in the fields and cause massive loss to farmers.
- Fertilizers and insecticides may be applied.



Harvest:

- Temperature during harvest must be from 35- 38°C along with sunny conditions.
- Harvesting is carried out when the stems become brown with their height around 4 feet. The grain becoming golden hard too.
- Harvest must be carried out in March-April before rain.

Geographical Requirements:

- 10 -20c growing and 25 to 30 ripening.
- 90 to 120 days growth period.
- Moderate rainfall.
- Moderate loamy and clayey soil.
- Flat well drained land.

3. Sugar cane:

Sugarcane is a Kharif crop that is planted in April-June and harvested in October November.

Sugarcane is mostly grown in central Punjab, central Sindh and Peshawar along with adjoining district in Khyber-Pakhtunkhwa. Other growing areas include Western and Southern Punjab, along with parts of Eastern Sindh.

Plantation (Not sowing):

- Temperature during the plantation must be from 30 - 35°C.
- Sugarcane stalks should be planted at a row spacing of 90 cm to 1 m with the depth of not more than 4 inches.

Growth:

- Temperature during growth must be from 38-40°C.
- 10 irrigations must be carried out with 10 to 12 days interval in between.
- Weeds are removed manually when required.
- Fertilizers and insecticides may be applied.

Harvest:

- Temperature during harvest must be from 30-32°C.
- Harvesting is carried out when the stem becomes hard.
- The stem is cut above the ground and is immediately transported as any delay can lead to loss of sugar content and weight.

Geographical Requirements:

- 25 -35 c temperature.
- 1500mm rainfall or irrigation.
- Loam and clay soil with silt.
- Consumes nutrients and early exhaust the soil.
- Nitrogen phosphorus and potash containing fertilizers needed.



4. Rice:

Rice is mainly grown in Western Sindh and Northeastern Punjab. Other growing areas include Eastern Punjab, Southern Sindh and parts of Eastern Balochistan.

Preparation:

- Firstly the rice seeds are planted in flooded nursery fields with uniform depth. They are kept in controlled temperatures and after 25 days they are transplanted in the fields.
- Before transplantation the seeds must be treated with chemicals to prevent against seed borne diseases.

Sowing/Transplantation:

- Temperature during transplantation must be from 30 - 35°C.
- The land must be thoroughly ploughed and weeds should be removed before transplantation.
- Bunds are made and land is flooded.



Growth:

- Temperature during growth must be from 38-40°C.
- The fields must be kept flooded all along the growth.
- Fertilizers and insecticides may be applied.



Harvest:

- Temperature during harvest must be from 30-32°C and the weather must be dry and sunny.
- When the ear heads start to show a golden colour, the bunds are broken and the fields are drained.
- Harvesting is carried out when the ear heads become golden and hard due to the weather.

Geographical Requirements:

- 20 to 30 °C with no cold season.
- Warm dry harvesting period.
- 1270-2000mm rainfall is ideal or irrigation.
- 4-6 months of rainfall growing period and sunny harvesting period.
- Level grounds.

Crops	HYV's
Wheat	Maxipak ,Shah Khan 95, Wadnak 95
Rice	Basmati super, Irri 6 ,Rachna, Pajhal
Sugar cane	JN-88-1,Thatta 10
Cotton	Nayab 78,Sarmast Qalander, CIM-70

S. No	Crops	Sindh	Punjab	KPK	Balochistan	Gilgit Baltistan
1	Wheat	Nausharo Firoz, Nawabshah	Bahawalpur, Bahawalnagar, Multan, Rahimyar Khan, Faisalabad	Swat, Bunair	-	-
2	Rice	Larkana	Gujranwala, Sialkot, Shehkupura	-	-	-
3	Sugar cane	Nausharo Firoz, Nawabshah, Hyderabad, Badin	Faisalabad,	Peshawar, Charsadda	-	-
4	Cotton	Nausharo Firoz, Nawabshah, Sanghar,	Bahawalpur, Bahawalnagar, Multan, Rahimyar	-	-	-
			Khan			
5	Tobacco	-	-	Swabi, Mardan, Peshawar		-
6	Maize	-	Faisalabad, Sahiwal, Sargodha	Swat, Mardan, Mansehra	-	-
7	Pulses	Jacobabad, Shikarpur	Sialkot, Mianwali, Khushab	Bannu	-	-
8	Oil Seeds	Nausharo Firoz, Nawabshah, Sanghar, Khairpur	Bahawalpur, Bahawalnagar, Sialkot, Rahimyar Khan	-	Jaffarabad	-

OTHER CROPS:

1. APRICOTS:

Apricots are grown mainly in areas of mid northern Balochistan. Pakistan is the 4th largest producer of Apricots. The apricots need to fulfil chilling units, meaning that they must be exposed to cold for a certain period of time. Winters must be cold (but not colder than -30°C) to allow for proper dormancy. Dry weather must exist at the time of maturity/harvest.



2. MANGO:

Mango requires a wet hot summer season with rainfall around 250mm. This needs to be followed by a long dry winter. Dry winter means that the plant is less susceptible to attacks by fungus etc. It needs deep well drained loamy soil. Mangoes are grown in southeastern Punjab and eastern Sindh.



3. TOBACCO:

Tobacco plants are usually first grown in nurseries etc. and then transplanted in the fields when the risk of frost has passed. They need light rainfall early on, followed by a period of bright sunshine with rains in between, followed by a dry period at harvest. Tobacco is grown in central parts of Punjab, northern Balochistan and central parts of Khyber-Pakhtunkhwa.



4. PULSES:

Pulses require high temperatures but are highly susceptible to frost. They can also tolerate high rainfall provided it doesn't come at time of pollination etc. Also the soil must not be waterlogged or saline. Pulses can be grown on sandy, loamy etc. soils. Pulses are grown in eastern and western Sindh, along with north eastern Punjab.



5. DATE PALM:

Dates are grown in parts of Balochistan and in parts of Tharparkar desert (southern Punjab and eastern Sindh). It needs long hot summers with high day and night temperatures. It can tolerate fluctuations in temperature whether cold or hot. Mild winters and a dry sunny time for harvest are also required. They can grow in salty soils but they must be well drained.



6. APPLES:

Apples are solely grown in northern Balochistan. They have the highest requirement of chilling units in fruits. Winters must be cold to allow for proper dormancy. These must be followed by rains during the growing season. Dry weather must exist at the time of harvest. Well drained loamy soils are best for growing apples.



7. CITRUS:

They grow in tropical or subtropical climate with hot summers and moderate rainfall. They are also sensitive to frost and strong winds. Most of the production is from Punjab including its central but mostly southern parts. Some citrus production also occurs in eastern parts of Sindh.



8. OILSEEDS:

Oilseeds usually require average temperatures varying from 20-30°C. It must also be noted that high temperatures can hamper or delay growth and that frost kills the plants. Oilseeds are tolerant to drought for some periods and require well drained deep alluvial soils.



9. Millets:

Millet requires moderate rainfall and is sensitive to frost. It will not tolerate waterlogged soils or harsh drought. They are grown in southeastern and northwestern Punjab, western Sindh, and central and southeastern Balochistan.



10. MAIZE:

Maize needs a hot bright growing season to flourish. It is very intolerant to frost and needs moderate rainfall well distributed throughout growth. It also needs well drained deep alluvial soils.



11. BANANAS:

Bananas are grown exclusively in southern Sindh. They require a hot dry season lasting for around 2-3 months, with a mean rainfall of around 10 cm. Bananas are very sensitive to frosts, which can suspend maturity or even kill the plant. They are also very vulnerable to strong winds, which damage the fruit etc. They require well drained alluvial soils.



Fruits are mostly grown in valleys in Balochistan where temperatures are bearable, wind speed is low, soil layer is thick and water from irrigation is available.

BARANI FARMING:

It is practiced in areas like the Potwar Plateau which have low amounts of seasonal rainfall. Important crops grown are wheat, maize, millet etc. all which require low amounts of water and sunlight. When the rains arrive or are about to arrive, the land is ploughed so it becomes soft. Immediately after the rain, the seeds are sown and the periodic cycle of sunny weather in between light rainy days continues till the harvest. Within the growing period hoeing is done (to remove weeds), if pesticides and fertilizers are available then they are added otherwise cow dung is used. Lastly the harvest season must be sunny and dry.

IMPORTANCE OF CROPS TOWARDS PAKISTAN'S SURVIVAL:

- Most of Pakistan's population lives in rural areas, where the primary occupation is related to farming.
- Agriculture provides food (wheat being the staple diet) for the ever growing population of Pakistan.
- Increase in crop yields is required to reduce imports (become self-sufficient) and increase exports.
- Agriculture also provides a permanent source of income for the many landless peasants throughout the year in both summers (Kharif crop) and winters (Rabi crop).
- It encourages the growth of agro-based industries like fertilizers etc. Increasing local production of fertilizers

Pakistan is one of the world's largest producers and suppliers of food and crops according to the different sources.

- [Chickpea](#) (3rd)
- [Cotton](#) (4th)
- [Milk](#) (4th)
- [Mango](#) (4th)
- [Date Palm](#) (5th)
- [Sugarcane](#) (5th)
- [Kinnow, mandarin oranges](#), (6th)
- [Apricot](#) (6th)
- [Onion](#) (7th)
- [Wheat](#) (7th)
- [Rice](#) (11th)

Pakistan ranks eighth worldwide in farm output.

