

CHAPTER # 1

TOPOGRAPHY

Topography: description of the surface of the land.

Alluvial: Deposits of silt and gravel

Alluvium: the fertile material separated by the running water (silt and gravel)

Alluvial plain: Levelled ground as each side of a river deposited with alluvial

Basin: A shallow ditch in the land surface, receiving deposits of sediments from nearby areas

Desert/arid areas: Area receives very low rain fall.

Delta: A deposit of sediments formed at the mouth of the river where it enters a sea.

Erosion: The wearing away of materials from the earth crust by water, wind or ice.

Flood plain: Land by the river which is frequently flooded i.e. once in a year.

Gorge: A narrow valley with very steep walls often with a stream flowing.

Hanging valley: A wide, shallow valley not fully formed.

Land Slides: Rapid movement down the slope, of a mass of soil, rock and debris.

Levees: Small mud wall formed as river banks due to the deposition of alluvium.

Meanders: A sharp turn or bend found in the middle or lower course of a river.

Oxbow lakes: crescent shaped lakes found in meanders when cut off from the main river.

Plateau: Elevated flat/levelled land

Perennial: lasts through the year

Relief: the physical shape of the year

Ravine land: Steep sided valley (has been eroded by water)

Scrap: A steep edge which separates flood plain and alluvial terrace

Cirques: When glaciers move, they form plain and form depressions which are called cirques or corries. When these are filled, they become lakes. E.g. Jhell Saif-ul-Mulook.

A retes: A sharp edge ridge of bare rock / sharp edges of mountain.

U shaped valley: Formed by glaciers and if are on top of mountain → hanging valley e.g. Himalia.

Snow-capped mountain: Mountains above 4500 m are permanently covered with snow.

Piedmont Plains: Plain areas located on the foothill of the mountains

Cliffs: Up-lifted terraces found in coastal areas

FATA: Federally administrative Tribal area habited by Pakhtoon tribes

Wakhaan Strip: Small part of Afghanistan which separates Pakistan and Tajikistan

Scree: A pile of large rocks which have been broken by the melting of glaciers

Ridges: Sharp edges formed as the sides of the mountain

Alluvial terraces: Also known as Bas upland. Small strips of uplifted land b/w 2 rivers

Badland Topography: Deeply eroded land farmed by the erosion of softer rocks, leaving behind harder rocks.

Intermountain valleys: Wide valleys loaded with alluvium, found in mountain ranges.

Braided Channels: Tributaries of a river/stream which merge back into a single body.

FISHING PORTS

1. Sonmiani
2. Pasni
3. Gawader
4. Omara
5. Jiwani

RIVERS

6. Zohb
7. Gomai
8. Kurram
9. Kabul
10. Swat
11. Tochi

WESTERN TRIBUTARIES

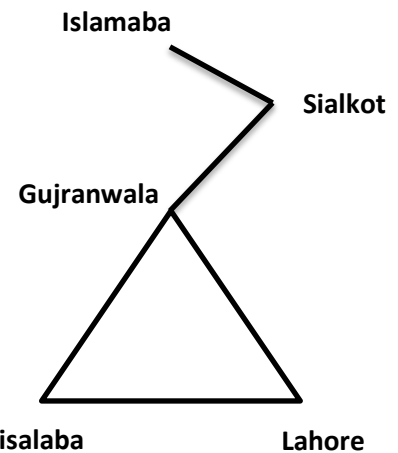
1. Sutlej
2. Chenab
3. Ravi
4. Jehlum
5. Bias

EASTERN TRIBUTARIES

4 rivers combine to form Indus
These meet at Mithankot

MAP HINTS/TIPS

- City by Pinnichis (Quetta)
- Multan on river Chenab (Southern Punjab) } *following pinnichio nose*
- Lahore located on the eastern bank of Ravi
- Faisalabad located on eastern bank of Chenab
- Gujranwala located on western bank of Ravi
- City next to the bump in KPK is Peshawer



LATITUDE

E N↑ end of Pakistan _____ 36° N LONGITUDE 61°E 64°E 68°E 70°E 72°E
76°E

D b/w Bum and pinnichio nose _____ 32° N

C pinnichio nose _____ 30° N

B b/w nose and 23.5° N _____ 28° N

Below Karachi in Pakistan _____ 24° N

E Start of Pakistan _____ 23.5° N

Starting of Pakistan	Through Balochistan	Balochistan and Sindh	KPK / Punjab and Sindh	KPK and Punjab	Gilgit Baltistan
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AREAS OF MOUNTAIN RANGES

NORTHERN MOUNTAINS

1. Karakoram : Hunza, Gilgit, Dardu (Pass → Khunjerab connects N Pakistan to China)
2. Central Himalayas : Kaghan, Skardu
Lesser Himalayas : Murree, Nathiagali
Siwaliks : Jhelum / Margalla Hills
3. Hindukash : Chitral
4. Kohistan, Swat and Dir ranges

WESTERN MOUNTAINS

1. Sajed Koh : Peshawar
2. Waziristan Hills : Bannu
3. Sulaiman Kirthar ranges :

NORTHERN MOUNTAIN

PHYSICAL FEATURES

- Karakoram Rang / Himalayas / Hindukash
- gorges
- precipitation mostly is the form of snow
- glaciers
- pyramid – shaped / snowcapped peaks
- cirques, hanging valley and scree formed due to the movement of glaciers
- U-shaped valley

DRAINAGE FEATURES

- Fast - - flowing rivers : Flow in mountainous areas because down hills increases velocity
- Waterfall : An amount of water falling from the top of the hill to the foothill
- Rapids : A short series of waterfall
- Springs : Water gushing from underground aquifers to the surface
- Lakes : Depression filled with water
- Perennial rivers : Fed by the melting of snow / ice glaciers

Fast - - flowing rivers

1. Himalayas : Indus, Jhelum
2. Karakoram : Gilgit, Saltors
3. Hindukash : Swat

ECONOMY AND LIFE STYLE

- Scarcely Population
- In winter they stay indoor
- No transport (cut off snow) / no infrastructure
- Difficult to install electric poles and wires in rugged landscape
- Frost bites, Hyperthermia
- Gas cannot be pumped up the mountains
- Water in pipes freezes causing them to burst (no source of water)
- Danger of avalanches

ENVIRONMENT

- Deforestation in the foot hills has caused soil erosion
- Deforestation¹ due to high demand for firwood and to feed live stocks
- Construction of roads has increased chances of landslides and deforestation

ECONOMIC ACTIVITIES

- Limited agriculture due to severe cold
- Crops like bajra, wheat, rice barley are grown on terrace fields
- Lumbering is common (thick forest cover and no gas supply)
- Indoor activities like weaving, embroidery and pottery
- Tourism industry provides employment because of mountains scenery
- Trans humans farming is practiced in which the farmer along with his animals moves to pastures on mountain top in summer. In winter they move back to valleys and plain areas
- These areas has major hydroelectric potential because of valleys and gorges
- Agriculture is practiced in valleys because
 - Flat land
 - Water supply from rivers
 - Protected from cold winds
 - Receive more sunshine and less snowfall

IMPORTANCE

- Melting of glaciers during summer contributes to river Indus (and tributaries)
- Passes connect Pakistan to China and Afghanistan for trade activities
- Karakoram highway is the route to connect china
- Tourism due to scenery contribute to the income of local people
- Areas are rich in minerals, gems, timber etc. provided raw materials for industries

WESTERN MOUNTAINS

SAFEDKOH RANGE

Physical Features	Drainage
<ul style="list-style-type: none">• Pyramid – shaped and snowcapped peaks• Mountain passes (Khyber Pass + Kurram Pass)• Rocks are sedimentary containing limestone• Intermountain valleys and landslides• Gorges and Ridges / rugged topography• Screes and vale of Peshawer drained by river Kabul• Join Kohat hills in the East KPK	<ul style="list-style-type: none">• Perennial rivers• Fast flowing rivers in summer (melting snow) e.g. Kabul and Karram• Rivers have rocky beds• Rivers meanders loop between mountains• Waterfalls and rapids can be found• Coniferous and sub-tropical scrub-forests

WAZIRISTAN HILLS

Physical Features	Drainage Features
<ul style="list-style-type: none">• Rugged topography / barres / dry• Highly mineralized zone (gypsum/coal)• Low-lying basins (bowl-shaped depression)• Kurram pass and Gomal Pass• Alluvial fans on the foot hill (collection of alluvial in the shape of fan)• Valleys, ridges, screes and landslides• Soil is thin and poor• Sub-tropical scrub forests	<ul style="list-style-type: none">• Perennial rivers• Fast flowing rivers in summer (melting snow) e.g. Kabul and Karram• Rivers have rocky beds• Rivers meanders loop between mountains• Waterfalls and rapids can be found• Coniferous and sub-tropical scrub-forests

SULAIMAN AND KIRTHAR RANGES

Physical Features	Drainage Features
<ul style="list-style-type: none">• Rocky and rugged landscape (stony area)• Steep slopes, sharp ridges• Limestone and sandstone hills• Piedmont plains with alluvial fans located on the foothills• Sandstone cliffs are found in southern kirthar range	<ul style="list-style-type: none">• Seasonal rivers (active in summers)• Streams from braided channels (rocky beds)• Erosion by fast-flowing rivers creates ravines and gullies• Inland drainage occurs• Low rainfall that's why these are arid areas• Both have mild to cool winters and warm summer

ECONOMY AND LIFESTYLE IN WETERN MOUNTAIN

- Arid dimate, extreme evapo transpiration and rugged terrain does not support agriculture
- Scarcely populated density is lower than 100 % per sq km. hence job opportunities and economic activities are limited

- People mainly practice nomadic lifestyle (Farmer move with cattle in search of pasture)
- Canal irrigation is very difficult because of badland topography
- Transportation problems:
 - Connection by air or rail network (BachaKahan International Airport) is not present except few urban areas like Peshawer.
 - Only few areas are connected with metaled road rest have unmetaled road.
- Cost of supplying infrastructure e.g water supply, electricity etc. is much highr in these areas. As a consequences, mining projects, industries, education facilities are not being developed.
- Landslides disrupt road traffic by blocking the road.
- Life in these areas is very difficult because of the arid dimate and rocky terrain.

LOCATION OF MOUNTAINS / PLATEAUS / OTHER RANGES

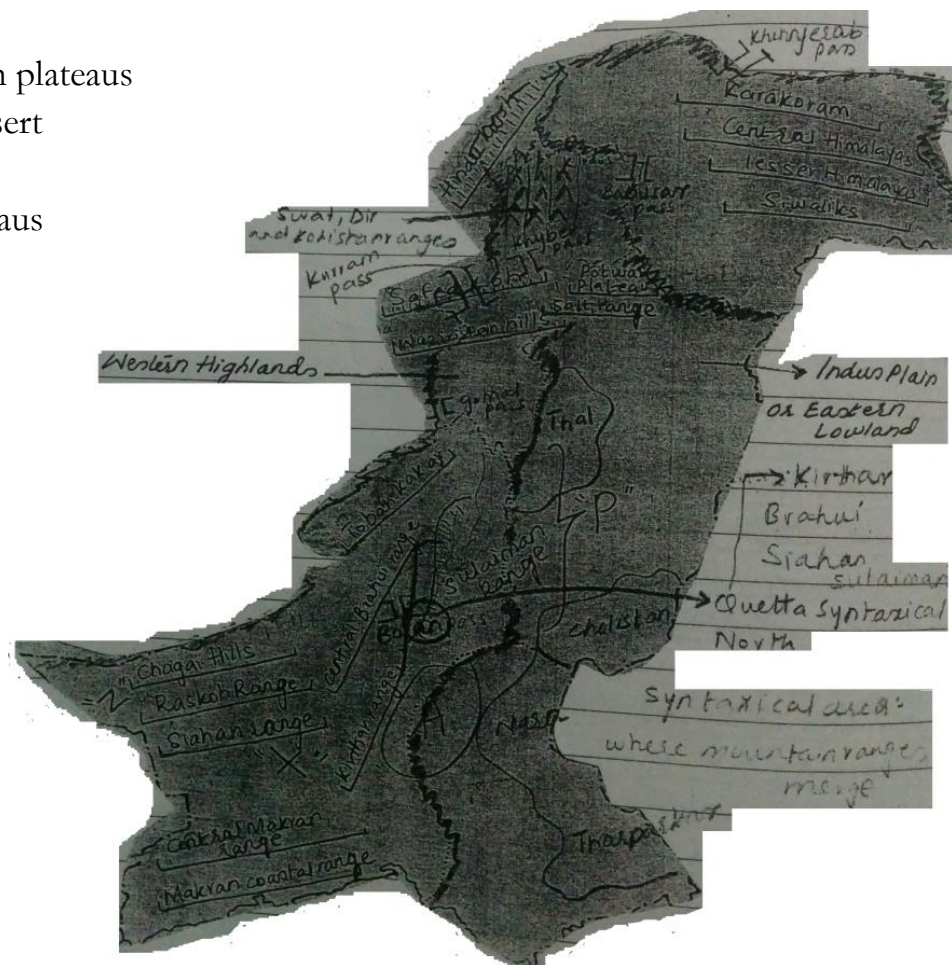
“X” = Balochistan plateaus

“Z” = Kharan desert

“P” = Indus Plain

“A” = Kalat Plateaus

- Himalayas don't touch northern border
- Above river Kabul are the Hindukash Mountains
- Karakaram touches the western border



BALUCHISTAN PLATEAU

Physical Feature

1. NORTHERN BASINS: (Zhoob and Loralai basins)

- Hamuns : Seasonal lakes
- Piedmont Plains : when rain occurs, rivers form narrow channels. Upon reaching the foothill these channels deposit gravel, silt and boulders i.e. alluvium. These sediments from alluvial fans and the active stream merge into a river.

2. WESTERN BASINS (b/w Rashkoh and Chagai hills)

- There is less rainfall so the temperature is high and dry. Hence, the water in the hamuns i.e. temporary lakes dries up. These dried up hamuns are called salt pans because when the water evaporates, it leaves behind salt crusts.
- There are no piedmont plains because no rainfall leads to no erosion since the streams are not activated.

3. MOUNTAIN RANGES

- Chaghi hills
- Raskoh Range
- Siahhan Range
- Brahui Range
- Makran Coastal Range
- Central Makran Coastal Range
- TobaKakar Range

4. COASTAL AREAS

- Omara
- PASni
- Gawader
- Jiwani

TOPOGRAPHY

- Barren range and rocky landscape
- Steep slopes and dry valley
- Same extent volcanic peaks (e.g. Koh-i-sultan) and some foot hills have sand dunes
- Rich in minerals like coal, natural gas, copper etc.
- Mountains are made up of sandstones and limestones
- Seasonal river flow through the mountain e.g. Dasht & Hingol which drain into the Arabian sea
- Makran Coastal Range has cliffs ending into the sea
- Deposition of alluvium and sand has formed sand dunes along the banks of Porali River.
- Kharaan desert is situated between these mountains
- Low lying basins are found

POTWAR PLATEAU SALT RANGE

- | | | |
|---------------------------------------|---|----------|
| 1. Salt range : Khewarah | } | BAD LAND |
| TOPOGRAPHY | | |
| 2. Potwar Plateau : Jehlum, Islamabad | | |

Bad-land Topography

1. Residual hills: those hills which are left behind after the erosion of soft rocks by water. They consist of hard / Resistant rocks.
2. Ravines : Small rivers erode the land and take away the alluvium leaving behind a deep in arid land.
3. Troughs / Depression : Soft rocks crack due to the upliftment of the northern mountains during the mountain building process. These are visible cracks on the surface.

Potwar Plateau	Salt Range
<ul style="list-style-type: none">• Bad land topography• Flat, undulating land in some areas• Rivers like Soan create alluvium plains• Soan river drains into Indus at Kalabagh	<ul style="list-style-type: none">• Inland drainage occurs• Seasonal rivers which have rocky beds• Flat topped hills. Dry valleys and basins• Bad land topography• Semi arid region

<ul style="list-style-type: none"> • Maximum rainfall is attained in summer from the monsoon so it mainly barani area 	<ul style="list-style-type: none"> • Salt hills (e.g. uchali, Khabeki, Kallar Kahar)
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ECONOMIC AND LIFESTYLE

- Road and rail networks are commonly found so the population is dense (many urban settlements)
- Because of the availability of minerals e.g. natural gas, oil, gypsum, limestone, clay, etc. many fertilizers, ceramics, oil, cement and chemical industries are found in these areas.
- ATTOCK oil refinery has been set up to refine the oil from the oilfields in Potwar Plateau.
- Farming take place on a limited scale because of the bad land topography and irrigation cannot be practiced so barrani farming is carried out.

TOPOGRAPHY OF PAKISTAN

Western Highlands

- Himalyas, Karakoram etc. (mountainous N↑)
- Sulaiman and Kirthar mountain range
- Balochistan plateau
- Potwar Plateau and salt range
- Safed Koh and wariztan

INDUS PLAINS

STAGE 1:

Lake Mansrover

China → Kashmir → Kalabagh (Pakistan) }

Upper course (only erosion)
it moves from mansrover to kalabagh through mountainous areas.

STAGE 2:

KAlabagh → Mithankot }

Moderate flow (no drawn hills)

Formation of Punjnad

Middle course (eroding + depositing)
Also known as the upper Indus Plain
At Kalabagh, Indus exits the mountainous areas and enters flat area.

STAGE 3:

Mithankot → Thatta }

Formation of Indus delta

No tributaries

Lower course (only depositng)
Also known as the lower Indus plain
River Indus joins the Arabian Sea at Thatta.

TOPOGRAPHICAL FEATURES

- Levees : These are small mud walls formed on the riverbanks due to the deposition alluvium
- Active flood plains
- Doabs
- Alluvial Terraces
- Meander : bends and curves in a river which occurs due to contact with hard rocks
- Oxbow lakes : Temporary feature (evaporates)
- Tidal deltas (Deltaic Plain)
- Cuestas : ridges made up of limestones
- Piedmont plains
- Rolling sand dunes

UPPER INDUS PLAIN	LOWER INDUS PLAIN
<ul style="list-style-type: none"> • Doesnot flow into Arabian sea • Boabs • Active flood plains • Old flood plain • Bas uplands / interfluves / alluvium terraces • Piedmont plains • Desert • No Indus delta • Hills made of quartzite • Both erosion and deposition • Northern Indus plain • Mainly corers Punjab 	<ul style="list-style-type: none"> • Follows into Arabian sea • No Doabs • Avtive flood plains • Old flood plains • No bar uplands because Indus flows alone • Piedmont plains • Deserts • Indus Delta (Deltaic plain) • Small hills made up of limestones (cuestas) • Only deposition • Southern Indus Plain • Mainly covers Sindh

DOABS

- Levees
- Scarp
- Safest for agriculture is alluvium terrace
- Rich in alluvium
- Irrigation possibility
- Less chance of crop failure by floods because it is from the flood plains
- Doabs are lands between rivers. Since river Indus flows alone in lower Indus plain, doabs are only found in upper Indus plain.

River Indus	→	Sindh Sagar Doabs	←	River Jhelum
River Chenab	→	Chaj Doab	←	River Jhelum
River Chenab	→	Rachna Doab	←	River Ravi
River Ravi	→	Bari Doab	←	River Sutlej
River Beas	→	Lower Bari Doab	←	River Sutlej

LIFE AND ECONOMY IN THAR DESERT

- Small area under cultivation (crops like millet, sesame, fodder crops etc.)
- Mostly agriculture depends on rainfall except for some areas where water is attained from kotri barrage
- Sandy but fertile soil
- Rain water is collected by traditional method i.e. ponds and tanks or by building small walls around rivers to hold some of the water from the river.
- Rainfall and groundwater is usually the only source of water
- Low groundwater table because no water seeps into the ground as most gets evaporated due to high temperature
- Droughts occurs (life threat for livestock)
- After rainfall, herbs, shrubs and grains grow providing fuel and food for the local people

ECONOMIC ACTIVITIES IN THE INDUS PLAIN

- Doabs are ideal for farming
- Construction of canals
- Availability of infrastructure especially in urban areas
- Many industries which provide employment

ROLLINGS AND PLAINS / DESERTS

- Sand dunes
- Sandy soil
- Days are hot and night are cool
- Lack of cloud cover
- Dust storms
- Extreme evaporation makes rainfall useless
- Very arid / rainfall less than 125 mm / year

CHAPTER # 2



CLIMAT

Climate : Temperature and rainfall

Winds always blow from high pressure to low pressure

Weather : Day to day condition of the atmosphere

FACTORS AFFECTING TEMPERATURE

Latitudinal affect: countries near the equator will have a hot temperature because the rate of insolation is high over there (near the sun so absolute a lot of heat). Africa is situated near the equator, hence it remains very hot. However, the further the countries are from the equator, the cooler they are.

Altitude: Altitude is the height of the earth. When sun gives out heat to the surface of the earth. It heats up and starts giving out heat, this is known as “Terrestrial radiation” as the height increases, the temperature decreases e.g. mountain areas mostly record low temperatures. Decrease in temp: $6^{\circ}\text{C} / 100\text{ m}$ (Adiabatic Lapse rate)

Deep valley: if a valley is deep and narrow, less sunlight will reach it. Hence causing the temperature to be low.

Albedo: This means the reflection of sunlight which is usually a higher rate as white surface and a lower rate surface. Hence, snowy areas (white) reflect more sun light so there temperature is low whereas dark surfaces such as roads reflect only 5 – 10% of the sunlight absorbed as compared to snow i.e. 80 – 95 % reflected.

Cloud covers: if there is a cloud cover \Rightarrow , the clouds will reflect the sun rays away from the earth, resulting in low temperature as land. This usually occurs in day time. At night when the earth lets out some of the heat it absorbed during the day, the clouds trap it and the temperature becomes warmer.

Maritime influence: in winters, when the sea is warm, the land is cool. In summer when the sea is cool, the land is warm.

Continental influence: lands which are land-locked i.e. no sea around, experience extreme summers and extreme winters.

TEMPERATURE KYE

Very hot	Above 40°C
Hot	30°C - 40°C
Warm	20°C - 30°C
Mild	13°C - 20°C
Cool	7°C - 13°C
Cold	3°C - 7°C
Very cold	-5°C - 3°C

RAINFALLS

Seasons : Early summers (April – May)
Summers (June, July, August, September)
Early winters (October – November)
Winters (December, January, February, March)

MONSOONS

- Seasons of monsoons (summers) June – September
- Formation:

Inter-tropical convergence Zone (1 TCZ) is a zone where winds of Southern and Northern hemisphere merge together. In early summers, the ITCZ is formed over Sindh and some parts of India. As a result, Sindh becomes the lowest pressure area in the region. Trade winds, while crossing the equator, are deflected towards the Bay of Bengal.

Primary monsoons: These winds enter Bangladesh and India from the Bay of Bengal. They enter Pakistan from the North East Punjab. These rainfalls are more in amount because they directly enter from India. Since there are no mountain ranges in this part of India, none of the moisture laden clouds are blocked.

Secondary monsoons: Some trade winds after crossing India, also enter from the south of Punjab and from Sindh. This type of monsoon passes a mountain range in India, hence there is less rainfall and dryer winds. (Loss of moisture in mountains as they hold back some moisture laden clouds)

Note:

Some of the monsoons also originate from the Arabian sea but these are very weak monsoons and only effect the coastal areas of Pakistan. This is because a temperature inversion layer present over there.

DISTRIBUTION OF MONSOON RAINFALL

The primary monsoon enters Pakistan from the Northern side of Punjab. These winds travel all the way to Peshawer before taking a South East turn towards Punjab. Then they pass through Central and Southern Punjab before entering Sindh and then pass through central part of Sindh such as Hyderabad and Sukher. Then they dissolve into the Arabian Sea. The secondary monsoons only take place in the South Eastern part of Sindh such as Thar Desert and Thatta. Balochistan receives very low or no rainfall because it does not fall in the path of monsoons.

EFFECTIVENESS

Monsoon rainfall is unreliable and cannot be predicted. It is variable in time, amount and location. As a result, farmers cannot depend on it. Floods may be caused because due to heavy showers, the ground does not absorb the water, wasting it as surface runoff.

WESTERN DEPRESSION

- Seasons (winter) December – March
- Formation

In early winters the Mediterranean Sea becomes the highest pressure area. As a result, winds start blowing into different directions. One of these systems of winds also blows towards Pakistan. After crossing through the land-locked countries of central Asia (Afghanistan and Iran), these winds enter Pakistan from the western side. The main western depression takes place in the Northern Western parts of Pakistan. The secondary take place in South Western parts.

DISTRIBUTION OF WESTERN DEPRESSIONS

These only take place in the western parts of Pakistan which include Chitral, Swat, Murree, Dir, Peshawer, FATA, Quetta and Gawader.

EFFECTIVENESS

The western depressions lose their moisture due to their long journey through the land-locked central Asian states. As a result, light rain fall takes places in frequent showers. This type of rainfall is beneficial because it can easily be absorbed by the soil and crops and no water is wasted as surface run-off. However, at times this rainfall maybe insufficient.

CONVECTIONAL RAINFALL

- Seasons (Early summer) April – May
- Formation: In early summers, hot air rises up, which contains a lot of moisture. Consequently soon condensation takes place, causing heavy rainfall and thunderstorms.

DISTRIBUTION

Convectional rainfall only takes place in the northern parts of Punjab such as Islamabad, Jehlum, Sialkot and Murree.

EFFECTIVENESS

Convectional rainfall is mainly of because it is sporadic and it is insufficient amount. Convectional rainfall only takes place in limited areas of Pakistan and at times it may cause flash floods.

Advantages of western depression	Disadvantages of western depression
<ul style="list-style-type: none">● Barani Farming● Supplies water for HEP generation● Moisture in soil increased so no soil erosion● Adds water to rivers.	<ul style="list-style-type: none">● At times insufficient for Barani farming● Health problems (asthma) due to severe cold● Formation of snow covers grazing lands● Transport facilities get blocked due to avalanches and landslides.

RELIEF RAINFALL

- Seasons (Early Winter + Early Summer) April, May , October, November
- Formation

When the hot air flows from the plain areas to the mountainous areas, their path is blocked by mountains which act as a barrier. As a result, the air is forced to rise and as the air rises, the altitude increases, gradually with this increase, the air cools down. As a result, condensation takes place. This happens on the windward side

and by the time the air reaches the leeward side it has lost its moisture. As a result, no rain fall will take place on the leewards side. The area on the leeward side is known as rain shadow area. For example: Gilgit and Chitral.

DISTRIBUTION: Relief rainfall only takes place in Northern mountains

EFFECTIVENESS: It is only effective in Northern Mountains. It is also only limited to the windward side. If an area is located on the leeward side, then no rainfall will take place.

TROPICAL CYCLONES

- Seasons (Early Winter + Early Summer) April, May, October, November
- Formation

When the sea becomes a low pressure area, all high pressure winds from its surroundings are attracted to it, from a cyclone on one specification. This cyclone then falls onto a land causing strong winds, high waves and heavy rainfall.

DISTRIBUTION: This only takes place in coastal areas e.g. Karachi, Pasni, Gwadhar

EFFECTIVENESS:

- Destruction of nature → Trees, poles, telephone lines uprooted
- Underpasses filled with water → Effect on infrastructure
- Urban flooding (streets submerged in water)
- kills people and livestock → Spread diseases like cholera
- waves disrupt fishing (loss of income)

FLOODS

CURATIVE MEASURES	BENEFITS
Enlarging rivers channel (increase capacity) Building embankment walls aside river bank Building extra channels for storage Building reservoir to control peak discharge Publicizing flood warning through TV, radio Evacuate flood areas and provide rehabilitation	Return nutrients to the soil (inc. of fertility) Refreshing / activation of dry streams Recharge ground supplies

CAUSES	DISADVANTAGES
Melting of snow Less dense capacities Heavy monsoon rainfall Cutting of trees increasing surface runoff No embankment around rivers	Destruction of crops / lack of food supplies Mud houses and huts severely damaged Spread of waterborne diseases Roads and railways tracks damaged Farmers have to wait for the water to drain away before using the land

THUNDERSTORMS

ADVANTAGES	EFFECTS
Water supply Reservoirs filled for HEP Small tanks filled for irrigation Canals are filled Ground water recharge Reduces drought conditions Inc. in moisture in soil Reduces soil erosion by wind	Destruction of crops (loss of raw materials for industries) Blockage of roads Winds damage trees and buildings Erosion of lands causes damage to infrastructure like roads Danger of lightning which can kill people No flight available (communication disruption) Loss of power supply Disruption of fishing / shipping (trade and income effected)

DROUGHTS

There are four types of droughts

Permanent : when crop cultivation is only possible with irrigation (zero dependence on Barani)

Seasonal : occurs in areas with well-defined rainy dry seasons

Invisible : water deficiency which reduces crop yields but does not severely destroy them

Unpredictable : abnormally low rainfall in an area with humid climate e.g. Murree.

CAUSES	EFFECTS
Unreliability of monsoons in Sindh and Punjab Deforestation reduces rainfall Loss of water by seepage in unlined canals Global warming / over use of ground water supply	Desertification Drying up of rivers, lakes and streams Reduction in water table Famine → malnutrition, starvation Migration (internal) Crop failure → no raw materials (dec economy)
CURATION MEASURES Water storage schemes, utilization of water when in need Use of sea water by desalinating Converting waste water into clean water Using draught resistant seeds (need less water) Lining of canals	

HIGH LAND ZONE (mountainous area)

- Severely cold winter and summers
- Grain is buried under snow and at some places
- During winter, farming is not possible
- People are usually involved in indoor activities
- Transhumance is practiced (most of the pathan tribes still live as nomadic herdsmen)
- Vale of Peshawar is the greenest of these areas (woodlands, orchards, irrigated fields)
- In the extreme North, many areas are not accessible due to landslides and heavy snow hampering transport links.
- Job opportunities and economic activities are difficult to carry out.
- Northern high lands are sparsely populated due to the severe cold and Balochistan highlands are sparsely populated due to harsh physical conditions.
- Annual rainfall is 150 – 250 mm which mainly occurs during winters.
- Lack of water supply and difficulty in crop cultivation discourages human settlements
- Apples, mangos, apricots and grapes are grown in the valleys of some highland cones.

- Sources of rainfall → relief, monsoons, western depressions and thunderstorms.

ARID ZONE (deserts)

- Kharaan desert and South Eastern desert (tharparkar, Nara, Cholistan), Southern Punjab
- Low annual rainfall, cool-mild winters and hot summers (100 mm rainfall, over 38°C in summer)
- Mostly nomadic people (Balochis, Pathans, Brahuis). Move with their animals in search of pasture.
- Scanty rainfall and excessive evapo-transpiration has led to the development of Karez system.
- In South West Punjab and both sides of River Indus in Sindh, perennial canals have been constructed enabling the arid land to be used for crop cultivation.
- People in desert areas like Thar, wear rough thick cloths and turbans to protect themselves from hot winds (practice nomadic farming)

ARID ZONE

- Hot dusty from mid-May to mid-September
- South Western Balochistan → W. Depression in winter
- South Eastern deserts → monsoons in summers
- Extreme heat, dryness and dust storm

LOW LAND ZONE (fertile plain of Punjab)

- Arid to semi-arid region
- Drained by river Indus and 4 of its tributaries.
- It is the most productive agricultural region of Pakistan
- Well-developed canal irrigation
- Monsoon rainfall
- Crops like wheat, cotton, millet and sugarcane are grown
- This area is the most densely populated area of Pakistan because of its alluvial plains, moderate rainfall and tolerable summer summer and winter temperature (Doabs)
- Indus Plain → hot summers, cool winters and summer monsoon rainfall.

COASTAL ZONE

1. Delta Coastline of Sindh: (Karachi, Thatta and Badin)

- Karachi : mild climate with annual rainfall of about 250 mm (monsoon, July – August)
- Mild winter and hot summer
- Cool sea breezes relieve the heat of summer months
- Most social events and tourism in Karachi take place in winter months
- Farming is possible (depending on the availability of water from irrigation channels)
- Economic activities:
 - Sea ports for international trade
 - roads and railways links to inland areas for business (CBD's)
 - cottage industries as well as large scale industries
- In summer, tropical cyclones cause coastal flooding causing damage to infrastructure, homes and farming land of Indus Delta.
- Fishing is impossible when the sea is wild, fishing communities suffer economic losses due to tropical cyclones.

- Maritime influence keeps temperature low (mostly 32°C)
- May, June and October are the hottest (Sindh → monsoons)

2. Makran Coast: (Gawadar - 150 km)

- Ocean influence keeps temperature higher in summers and lower in winters than the inland areas. (moderate temperature range)
- Annual rainfall is usually below 250 mm (western depression)
- Economic activity: → Development of Gawadar sea port as the moderate climate would make it operational throughout the year
- Amount of rainfall affects the supply of drinking water as most of it is gained from reservoirs which are rain dependent.

Plain areas: high temperature because of 0 m altitude.

CHAPTER # 3

WATER RESOURCES

Water is a renewable resource which occurs in a flow of nature during which it keeps on adding and subtracting from the atmosphere. This is known as the hydrological cycle.

STORAGE OF WATER	OUTPUTS
<ol style="list-style-type: none"> 1. Cloud cover 2. Glaciers and snowfields 3. Surface runoff 4. Storage by plants (absorb water) 5. Ground water (water seepage) 6. River, lakes, seas, rainfall 7. Through flow : flow of water through soil adding up to rivers, seas or oceans 	<ol style="list-style-type: none"> 1. Due to increase in temperature, water is lost through evaporation from rivers, seas, lakes etc. 2. Water evaporates through plants i.e. transpiration 3. Water will be lost when vapors will rise from ice and glaciers and will undergo sublimation <p>Note: All these vapors will condense into water droplets and will form cloud cover or storage and will soon be converted into INPUT i.e precipitation (rainfall and snowfall)</p>

CAUSES OF DISRUPTION IN THE HYDROLOGICAL CYCLE

- Air pollution
- Global warming
- Depletion of ozone layer
- In Pakistan, in the last few years, 10 – 15 % of the monsoons have decreased
- In Karachi, there is no clouds covers in the months of June, July and August any more
- In Karachi, most temperature would usually be 35°C, now it can frequently reach 40°C

SOLUTION TO THESE DISRUPTIONS

- Building of dams
- Use modern methods of irrigation like sprinklers to avoid wastage of water
- Growing more trees, so that more evapotranspiration takes place resulting in more rainfall
- Less dependence on agriculture to build our economy and focus more on cottage industries avoid water consumption through irrigation.

- Lining of canals (to prevent water wastage through seepage)
- Industries should have their waste treated before being dumped.
- Desalination plants construction in to convert sea water to fresh water
- Water storage schemes

PAKISTAN'S WATER RESOURCES

1. Rainfall
2. Ground water
3. Lakes / Springs
4. Rivers – most reliable sources

RAINFALL

- Monsoon : variable in time, amount and location
- Western Depression : only takes place on the western side of Pakistan
- Relief rainfall : only takes place in the Northern mountains and only on the iceward side.
- Convectional : Sporadic and insufficient in amount
- Tropical cyclones : extremely destructive water is not absorbed and is wasted as surface run-off. Floods take place.

GROUNDWATER

Aquifer : Natural storage of water

There are two ways to obtain ground water

1. Well : Extracting water from a shorter distance
2. Tube well : Extracting water from deeper water table using a diesel-motor to pump water

KPK and Gilgit Baltistan:

Due to rugged topography and rocky surfaces, digging through the land to obtain ground water is very difficult, usually impossible. (some areas are also covered monsoon and hence ground water is usually frozen)

PUNJAB

Water table in Punjab is very high due to the presence of 5 rivers. Hence, Punjab is the leading user of groundwater → Plain area (easy to build)

SINDH

Desert areas are arid and dry so water table is low. Due to high temperature there is a lot of evapotranspiration so a very small amount of water is absorbed by the ground. In lower Indus plain, its usage is possible but in a very small proportion. In coastal areas, water is available but it is salty and saline so it cannot be consumed and is inconvenient. Most areas of Sindh are unsuitable for ground water.

BALUCHISTAN

In Northern parts, mountains do not enable the access to ground water (digging through rocky surface is difficult). Plain areas are suitable. Desert areas are not suitable. Coastal areas have a high water table but the water is salty.

LAKES AND SPRINGS

Springs and lakes are only found in Northern provinces i.e. KPK and Gilgit Balochistan and are in less numbers in Sindh, Balochistan and Punjab.

Balochistan : Hanna Lake

Sindh : Haleji, Keenjhar, Balri lakes

Punjab : no lake

Northern Provinces : Jheel Saif-ul-Mulook (Kaghan)

RIVERS

River system : More than two rivers flowing in one area

INDUS RIVER SYSTEM

Eastern Tributaries

→ Jhelum
→ Chenab
→ Ravi
→ Sutlej
→ Beas

} Merge to form "Punjab" which joins Indus at Mithankot

Western Tributaries

→ Swat
→ Kabul
→ Kurram
→ Zhob
→ Jochi

BALUCHISTAN RIVER SYSTEM

Hab
Hingol } Flow into Arabian sea

Porali
Zhob } Dry up (seasonally)

Loralai
Moshkel } End up in hamuns

DISADVANTAGE

1. Some are seasonal
2. Some dry up
3. Balochistan is an arid area and low rainfall takes place. Majority rivers get evaporated or absorbed due to the dryland.

USES OF WATER

1. Domestic Use: cooking, drinking, sanitation, washing (households)
2. Industrial: Food processing industries (water/soft drinks), steel industries, chemical industries (insecticides), Pharmaceutical industries (medicines)
3. Power generation: HEP (Hydro Electric Power)
4. Agriculture: Irrigation, artificial supply of water to farmland where rainfall is insufficient for growing crops.

Importance of Rivers

1. Provides power to areas where rainfall is very low
2. It helps to generate HEP in mountainous areas
3. Increases the fertility of the land by carrying alluvium and organic matter
4. Fishing is practiced
5. Provides water for domestic industrial purposes
6. Supplies water for irrigation through canals leading out from dams and barrages
7. They are fed by the melting glaciers
8. Add to scenic beauty of Pakistan

SOLUTION FOR EARLY ARRIVAL RAINFALL

- Build dams to store excessive water
- Build drainage canals to remove excess water
- Wide river channels to control flooding
- Install field drainage system to remove excess water from farms avoiding flooding
- Install tubewells to remove water

SOLUTION FOR LATE ARRIVAL OF RAINFALL

- Increase storage capacity of dams, tanks, ponds etc.
- Poor farmers can use traditional methods of irrigation instead of depending on Barani farming
- Build new canals into Barani areas
- Manage irrigation in such a way that every province gets its fair share of water
- Use drought-resistant seeds to avoid crop failure in the absence of rainfall.

SOLUTION FOR UNEVEN DISTRIBUTION OF RAINFALL

- Storage in reservoirs, ponds, tanks etc.
- Storage of water in canals
- Use of underground supplies in dry seasons

STORAGE FOR FLOODING (solutions)

Flooding: When the river is unable to hold the volume of water in it so the water invades surround areas.

- Build reservoirs, dams, barrages
- Build river embankments
- Build diversion canals to divert extra water
- A forestation in mountainous areas
- Weather forecast can help planning.

IRRIGATION

To grow crops naturally, rainfall is required. Since rainfall is variable in time, amount and location, irrigation is required to grow crops. Heavy showers do take place but water is wasted as surface run off. In waters, we need water to irrigate crops since rainfall is very insufficient.

TRADITIONAL METHODS

Shaderf: It consist of a bucket suspended by a type from one end of a pole and on the other end of the pole, a weight is placed. The pole is suspended on a Y-shaped pose at a well or a riverbank. The bucket is dipped into the water by h and the weight on the other end of the pole helps to lift up. (lift irrigation)

Charsa: This method is similar to shaderf except that in this method animal power is used at one end of the pole instead of a weight (lift irrigation).

Persian wheel: In this metod, a number of buckets are attached to a wheel and the wheel rotates causing the buckets to go in the well. Once they go in the well, they are filled with water then, the rotation of the wheel causes the buckets to up-side down. All the water is emptied into channel leading to filed where crops are grown. The wheel is powered by animals such as bull ox, horses ox donkey or mules.

Karez: It is an underground tunnel which starts from the foothill of a mountain and exists at the fields. A tunnel is used so that the water doesnot get evaporated or absorbed by the ground. Mother well is the part near the watertable (Aquifer) and this is from where karez system starts. Throughout its length, the karez system is donated with vertical shafts which are used to clean and repair the tunnels (maintenance so that these tunnels donot getblocked). This method is mainly practiced in Balochistan because due to high temperature and dry surface, if the water flows above the surface, if may get evaporated or absorbed.

MODERN METHODS

Canal irrigation

INUNDATION CANALS: They are seasonal canals which only contain water in the summer season when the river discharge is high due to monsoon rainfall and melting of glaciers.

PERENNIAL CANALS: These canals contain water throughout the year. In the water season when the river discharge is low, water is obtained from dams and barrages. These types of canals are beneficial for both Rabi and Kharif crops.

Link Canals: These canals are used to transport water from the western rivers (Indus/Jhelum/Chenab) to the Eastern rivers (Ravi/Sutlej). E.g. of link canals:
→ Chashma Jhelum
→ Indus Water Treaty

DIVERSION CANALS: This type of canal branches off from the main canal and supplies water to those areas which are located far from the main canals. These are mostly found in the Northern Mountains to divert water from river to narrow channels leading to terrace fields.

DAMS

Dams are huge concrete walls which control the storage of water

There are 2 types of dams

- a) Large / multi-purpose dams
- b) Small dams

Factors affecting Location of Dams

- Dams can only be constructed in mountainous areas
- Narrow, deep, steep valleys are required
- A gorge must be present
- Solid rock foundation should be present to provide a firm base for the dam in order to manage the weight and pressure of the water
- Impermeable or non-porous rock should be present to prevent water seepage in the ground.

- (rocks through which liquid or gas cannot pass through, preventing earthquakes)
- A fast flowing river must be present
- High catchment area of rainfall
- It should be located away from populated areas because water may rise and cause floods
- Mountain slopes should be forested in order to prevent soil erosion which may lead to siltation in dams and to attract rainfall through transpiration.

BARRAGES	DAMS
<ul style="list-style-type: none"> ● Built on plains ● Longer length as it depends on width of the river ● Less height (wide) ● Cannot provide HEP ● Less important for flood control ● Both divert water into link canals and perennial canals for irrigation, industrial and domestic use ● Both can be used to cultivate or reclaim large areas ● Both cause waterlogging and salinity. 	<ul style="list-style-type: none"> ● Built on mountainous areas (fast flow of water) ● Shorter length than barrages ● More height (less width) ● Can produce HEP ● More capacity so important for flow control

Barrages

When the gates barrages are closed the water is hold back. So, the level of the water rises. When the level of the water rises, then the water is diverted into the canals.

Tubewells

Electric / diesel motors are used to pump from great depths of the ground.

Thubewells extract more water than a standard well. It can irrigate large areas but not as large as compared to canals. Punjab is the leading user of tubewells followed by Balochistan and then Sindh.

ADVANTAGES	DISADVANTAGES
<ul style="list-style-type: none"> • Can irrigate large areas • Continuous supply of water (intensive cropping) • Controls waterlogging & salinity • So labor is required • Water is available throughout the year as it does not depend on weather • Can be installed in those areas where canals cannot be built e.g. mountains • Tail end users are farmers at end of the river where water is always less as most of the water has been used up so tubewells are beneficial. 	<ul style="list-style-type: none"> • High installation cost • High cost of maintenance • Requires fuel or electricity • Lack of electricity so they don't function properly • Depletes groundwater. If the water is pumped more than requirements, the groundwater can dry up, resulting in permanent droughts • It cannot irrigate very large areas as compared to canal irrigation • It is not used by large scale commercial farms as it is too expensive.

Sprinklers

Sprinklers are a network of pipes installed throughout the fields which spray water evenly in all parts of the fields.

ADVANTAGES

- Reduces water wastage and ensure efficient use of water. (no surface runoff)
- Can be automatically controlled, hence , reducing the dependency on manual labour.
- Evenly supply water, hence it prevents waterlogging and salinity.

Disadvantages

- Expensive to install
- Hence repair and maintenance most

Advantages and disadvantages of perennial canals (ones which flow throughout the year)

Advantages	Disadvantages
<ul style="list-style-type: none"> • They are reliable as they donot depend on weather • Increase the yield • Tills the rainfall gaps • Can irrigate very large areas • No few cost • Cheap to use 	<ul style="list-style-type: none"> • Evaporation losses due to high tempreatures • Seepage losses if the canal is unlined (no coment) • High construction cost • Deposition of still on the bed of the canal which reduces flow and capacity (requires dredging) • Tail end users receive less water • Expensive to treat algae growth • Unlined canals may cause waterlogging & salinity

ADVANTAGES OF IRRIGATION

- It provides food and increasing cropping intensity (output increases)
- Irrigation enables the cultivation of cultivable was teland and increases value of land.
- It reduces the risk of crop failures due to failure of rains (bridges the gap in rainfall)
- It enables intensive cropping and provides increased employment to agricultural labour
- It increases the atilization efficiency of inputs like seeds, fertilizers and pesticides.
- As a result, crop yield increases, elevating a farmers income.
- Some of the large irrigation projects also serve as a source of water supply to towns & cities.
- Irrigation permits farm forestry (man-made forests) and growing of trees along canals increases timber and fuel supply.
- Canals are sometimes the only souce of water few domestic purposes in areas where ground water is salty.
- Irrigation ensures huge production of cotton, sugarcane and other valuable crops which cannot be grown through barani farming. These valuable crops provide raw materials for industries and also contribute to the GDP of the country.

DISADVANTAGES OF IRRIGATION

- Use of modern methods of irrigation can cause problems such as waterlogging and salinity.
- Irrigation water is supply –based and not demand based. (shortage of water if demand is more and supply is less or vice versa)
- The lands located near the tail-end of the canal sometimes receive less water.
- Over use of tubewells can deplete the ground water supply.

Water-LOGGING AND SALINITY

An irrigated area is said to be waterlogging when the water table rises and saturates the root zone of the crops. As a result, the circulation of air is effected and therefore crop growth is increased. The roots are not able to absorb nitrogen/air and will die.

If the watertable continues to rise and reaches the surface, it may cause salinity. This is because the salts in the sub-soil rise along the waterable and reached the surface. The water at the surface gets evaporated leaving behind the salts and as a result, salty patches are formed. This is known as salinity.

Causes:

- Due to evaporation, salt crusts are formed.
- Over-waterlogging of the crops (no field drainage system)
- Inadequate drainage causes watertable to rise seepage of unlined canals.
- Farmers don't flush salts frequently due to lack of knowledge.

MEASURES TO CONTROL

- Closing down canals on temporary basis
- Lining of canals to prevent seepage
- Planting eucalyptus trees because they have deep roots which absorb lots of water
- Flushing salts
- Installing tubewells (lower down watertable)
- Use of gypsum (reduces alkalinity level of soil)
- Surface drain is divert excess water is nearby rivers or lakes

SILTATION

When rivers leave the foothills, they carry a large quantity of silt. When this water enters dams, barrages or canals it causes this silts to deposit on the beds.

CAUSES

- Deforestation
- Fast-flowing rivers

EFFECTS

- Blockage of canals / choking of canals
- Weakness the foundation of dam
- Affects HEP (halt turbine movement)

CONTROL

- Afforestation in mountainous areas .Dredging annually
- embankments around canals
- Silt trap installations before water enters into dams.
- Raising height of the increase capacity.

SURFACE WATER POLLUTION

It is caused by the dumping at industrial and agricultural waste and agricultural waste and inadequate sewage disposals. It is more common in developed cities like Karachi, Lahore and Faisalabad. In Lahore, oil seepage from ships is another cause.

CHAPTER # 4



FOREST

Forests have 2 types

PRODUCTIVE

- Natural vegetation which grows in a haphazard manner
- Tree density is high and canopy is close together
- Different species, vary in height and are not equally spaced
- Great commercial value (valuable species like Babul, Sheesham, Deodar, oak)
- Protect the environment by preventing soil erosion and acting as carbon sinks
- Provide wildlife habitat / found in desert areas, mountains etc.
- Promotes tourism
- Lower the temperature of the surrounding

POTECTIVE

- Vegetation is grown by man
- Linear plantations (grown in rows)
- Tree density is moderate and canopy is further apart.
- Consist of a single type of specie which is usually fast growing
- They have the same height
- They do not have much commercial value
- Promote tourism as they add to scenic beauty
- Prevent soil erosion an act as carbon sinks
- Provide wildlife habitat
- Trees lower the temperature of the surrounding
- Found along canals \, roads, railways, boundaries of fields etc.

IMPORTANCE OF FORESTS

- Controls air pollution as they act as carbon sinks i.e. they absorb CO₂ and give out oxygen
- Prevent soil erosion an provide habitats for wildlife
- Protect coastal areas from earthquakes, tsunamis, cyclones etc.
- Wood can be used to obtain pulp which can be further processed into paper
- Rich in substances which can be used as a raw material in pharmaceutical industry
- Provides timber for commercial use and firewood for fuel

- It provides fruits and encourages tourism
- Attract rainfall through transpiration
- Enhance scenic beauty
- Wood can be used for making agricultural implements like woods plough, etc.
- Used in transport facilities e.g. donkey cars, railway carriages, railway sleepers and boats

ALPINE FORESTS

→ Northern Areas (Hindukush, Himalayas, Karakoram)

- Found at an altitude of 4000 – 4500 m
- Tree density is low because they have a short growing season
- Roots grow laterally to have a good grip. Since most of the soil is frozen, very less nutrients are obtain so growing sideway allows them to obtain nutrients from further away
- Branches of trees are upwards sloping to absorb maximum sunlight
- Mainly used to obtain firewood for fuel

CONIFEROUS FORESTS

→ Northern areas (KPK, Islamabad, Quetta)

- Conical shaped so the sloping branches of the trees prevent snow accumulation
- Tall and straight so they obtain a lot of sun light
- They have needle tip leaves to prevent transpiration and can survive in low temperatures
- Thick trunk is protected by hard wood bark from cold winds
- Sources of timber to make furniture

TROPICAL THORN / RAKH FORESTS

→ Punjab plains, Sindh plains, Southern and Western Balochistan

- Have thorny hardwood and long roots to search for water
- They have small leaves to reduce transpiration and small trunk which can not store much water
- They have long thin branches called Juniper
- They have flexible stems for survival from strong winds
- They are used as firewood

SUB TROPICAL SCRUB FORESTS

→ Himalayas, Sulaiman Kirthar ranges, Waziristan hills (Peshawer, Waziristan etc.)

- Long roots which spread out absorb more water
- They are round, leafless, thorny bushes
- Stunted growth (slow) and are very scanty due to less water
- Provide hardwood and firewood

DESERT VEGETATION

→Thar, Nara, Cholistan

- Long spaced roots to gather moisture from ground
- Waxy, needle shaped leathery leaves to reduce transpiration / short height
- Provide firewood and used for canal grazing

RIVERAIN / BELA FORESTS

- Found along river Indus and its tributaries
- Linear plantations (equally spaced apart)
- Take water from the rivers have are tall and evergreen
- Hardwood like Babul and sheesham

IRRIGATED FORESTS

- Change Manga (Lahore)
- Important species like Babul, sheesham and Eucalyptus (economic importance)
- Man-made / linear plantation and provide shade
- Important sources of timber and firewood

MANGROVE FORESTS

- Coastal areas (Indus Delta, Hub delta etc.)
- Broad, waxy, leathery leaves to reduce transpiration
- Due to pollution they donot grow too much
- Known as halophytes as they survive in salty conditions
- Roots are below and above the surface, part above the surface intake oxygen
- Leaves excrete extra salt (drip tip)
- Roots filter salt while absorbing water (knobby roots) transfer oxygen to the deep roots.

IMPORTANCE

- Breeding ground for fish and shrimps
- Protect young saplings from high tides and predator fish
- Silt deposited provides nutrients for fish growth
- Leaves act as a source of food for fish and shimps
- Grazing ground for canals (leaves are the source of food)
- Protect coastal areas from tsunamis and tropical and heating purposes

- Provide firewood which act as a fuel for cooking and heating purposes

THREATS TO MANAGROVES

- Conversion of coastal areas into beaches
- Excessive cutting for firewood
- Water pollution
- Construction of barrages have blocked silt from being deposited (reduction of nutrients)
- Overgrazing done by livestock

DISADVANTAGES OF PROTECTING FORESTS	ADVANTAGES OF PROTECTING FORESTS
<ul style="list-style-type: none"> • Less place for construction of buildings • Expensive to protect • Difficult to manage • Long term planning • Deep roots can disrupt pipelines, sewage lines etc. 	<ul style="list-style-type: none"> • Local income will increase • Increased employment • Promote tourism

DEFORRESTATION

CAUSES

- Urbanization
- Overgrazing done by cattle
- Increased demand for timber to obtain raw material for paper, railway sleepers, furniture etc.
- Contribution of dams, barrages and roads
- Mining (extraction of minerals like coal from the ground)
- Demand for land for farming as Pakistan is an agro-based country
- Residential purpose due to increasing population

EFFECTS

- Trees act as carbon sinks in their absence there will be less consumption of carbon dioxide, resulting in increased air pollution
- Due to leaf fall, there will be no formation, making the soil loose and easy to be eroded by wind. This can result in dust storms affecting transport and communication.
- During rainfalls, there will be a greater splash leading to large surface runoff which cannot be controlled in the absence of roots. This may cause flash floods and siltation in dams + barrages
- Eroded material on entering a river makes it muddy
- Forests add to the scenic beauty. Deforestation may result in a lack of tourism as well as wildlife habitat.
- The eroded infertile silt is deposited into farmland, it may ruin the soil.
- Soil erosion can cause destructive landslides.
- Due to no transpiration, there can be a lack of rainfall in the area.
- Soil may become infertile due to excessive leeching (water absorbs all the nutrients so all the nutrients will be washed out from the soil).
- Forests lower the temperature of surroundings. Temperature may remain high in their absence
- Secondary Forests: When natural forests are burned by fire or deforested by humans and eventually, the vegetation regenerates after a large number of years.

SOLUTION TO DEFORESTATION

- Selective cutting (harvesting a group of trees of the same species)
- Replant fast-growing species e.g. Eucalyptus
- Replace every cut down tree with a sapling.
- Creating awareness of deforestation, through social media.
- Strict law enforcement on cutting trees, restricting heavy machinery & sustainable forestry.
- Afforestation and reforestation projects.
- Supplying irrigation to defrosted areas so that new trees can be planted easily.
- Teaching: cut down steps on mountain slopes to reduce soil erosion by hindering
Water velocity (maintain fertile soil to plant new trees)
- Enforcement of village and urban forestry programs.
- Contour ploughing (perpendicular to the mountain slope) and strip farming (growing plants under the shade of trees)

AFFORESTATION IN PAKISATN

- Control soil erosion
- Provide oxygen and fuel
- Promote tourism
- Reduce siltation
- Season behind afforestation
- Type of forest
- When / which season to be carried out
- Management (train locals regarding the projects)
- Mangla Dam
- Tarbela Dam
- Northern areas i.e. Gilgit Baltistan

FACTORS AFFECTING LOCATION FORESTS

Altitude: No forests can be found at an altitude above 4500m. (Above this there is a snow line and is permanently covered with snow. Between 3500m and 4500m only Alpine forests can be found. 1000m to 3500m coniferous.

Precipitation: Humid / semi-arid areas & Coniferous, arid areas

Soil: some forests such as coniferous and tropical scrub forests grow in fertile soil.

Tropical thorn forest only grows in fertile soil or in desert areas.

Mangrove forests grow in saline soil. (halophytes).

CHAPTER # 5

AGRICULTURE

MAJORITY PEOPLE WORKING IN AGRICULTURE

- Tradition / inheritance
- 68% of the population in rural areas where farming is the main occupation.
- Large areas suitable for farming
- Presence of irrigation schemes
- Less money to purchase farm machinery, so manual labor is required
- Pakistan has an agro-based economy
- Agro-based industries promote farming
- Lack of other jobs available
- Cotton is a major export

LAND NOT USED FOR AGRICULTURE (65%)

- Rugged terrain
- Ice-covered areas throughout the year
- Arid area or desert, very low rainfall / unreliable rainfall
- High evaporation due to high temperature
- Water logged and saline areas
- Areas occupied by forests
- Land occupied by industries / roads / building / houses / airports
- Landlord does not use most of their land which is suitable for agriculture

SMALL – SIZE FARM

- Land divided among its sons
- Majority of farmers are too poor
- Traditional methods of farming
- Unsuccessful land consolidation policy
- Little mechanization, manual labor used for cultivation

PEOPLE LEAVING AGRICULTURE

- Not enough farmland for increasing population
- Problems for tenants from landlords
- Increase in tertiary sector
- High wages in other occupation
- Rural to urban migration

INCREASE IN AGRICULTURAL PRODUCTION

- Loans provided by government

- Imported chemical fertilizers
- Training of farmers
- Reliable irrigation like tubewells / canals
- Mechanization

REASONS FOR LACK OF TECHNOLOGY

- Lack of money
- Lack of knowledge / education
- Machinery has to be imported (too expensive) UK, USA (capital goods)
- Fear that machines may cause unemployment
- Landlords want to adhere to their traditional methods of farming
- Plentiful and cheap labor available

BARANI FARMING

- No control of water supply
- Small size farm
- Farmers are too poor to earn and spend on tractors
- Family labor
- Source of food and income
- Use of animal dung
- Heavy rainfall may destroy seedling
- Continuous cropping is rarely possible

GENERAL REQUIREMENTS FOR CROPPING

Warm temperature: ripening (Rabi crop)

Dry Temperature: Harvesting time

Arid Temperature: discourage pests and other diseases

Rainfall: germination, growing and swelling of grains

Flat land: canal irrigation / use of machines / less soil erosion / equal distribution of water

Alluvial Soil: for good growth / moisture retentive / contains potash, phosphate and nitrate

HYV seeds: genetically modified to increase output / pestresistent / drought resistant

Disadv. → Expensive to use, more irrigation to function, have to be imported

Irrigation: bridge gap in rainfall/water for photosynthesis/increasing size of crops
Disadv.→ expensive, canal water is supply based, requires maintenance, run on diesel, can cause water logging + salinity / can leach the soils nutrients/excess → soil acidity.

Chemical fertilizers: better then during/ increases growth/ provides nutrients (costly)

Pesticides: kill insects, viruses and lowests/ to prevent failure of crops by pest attack.

Disadv. →can contaminate if added to ground water / if contacted by humans, can cause tuber culosis affecting human immune system.

Machines: To make work faster/ deep ploughing / less labour / aeration (to reduce pest attack)

Disadv. →Expensive / cost of fuel / difficult to repair / unemployment / skilled labour needed can only be used on flat land / no back if break down occurs make freous in land / deep ploughing may expose soil to erosion.

Subsistence Agriculture: When the farmer grow crops for the consumption by his own family and if in a particular year the farmer experiences a bumper crop then the surplus will be sold in the market and the income earned will be used to buy basic medicates of life such as medicine and clothes. Natural and manual inputs are used.

Commercial Agriculture: In this method, the farmers grow crops with the intention of selling in a market chemical market chemical inputs and machinery to used.

PROCES OF CULTIVATION

Weeding: When crops are harvested, wild plants grow on the field which are to be removed through machinery in commercial farming but using a tool / called “sickle” in subsistence.

Ploughing: Making a soil soft by turning it upside-down. Subsistence would use a wooden plough powered by animals such as Bull ox and horses. Commercial would use metal plough powered by a tractor.

Seeding: The process of sowing seeds. In Subsistence it is done manually. In commercial, by machinery.

Harvesting: When the crops are reaped. Subsistence, manually by women and children. Commercial by harvesters.

Threshing: All of the grain crops are separated from the husk. In commercial, thresher. In subsistence manually or animal power machines.

WHEAT

CULTIVATION:

What is a Rabi crop? Wheat seeds are directly sown into an already prepared field. Soft irrigation takes place in order to cover the seeds for the process of germinations. Weeding is either done by using manual labour or by spreading / spraying herbicides in order to get high yield per acre because weeds use the water, sunlight and nutrients which are required for the main crop. First proper irrigation takes place one month after sowing. Nitrogenous fertilizers cow dung (in some cases both) are used to get high yield per acre. Second irrigation takes place one month before harvesting. A little rain before the harvest swells the grains to increase yield. A lot of labour is required for harvesting or combine harvesters are used by some wealthy farmers. For threshing, either manual labour or threshers are used. (chaff separated from grain)

TEMPERATURE: 10°C-30°C throughout (showing 10°C→20°C, ripening 25°C→30°C)

RAINFALL: Moderate rainfall (mostly depends on irrigation)

SOIL: Loamy soil. However, it doesn't grow if there is stagnant water. **LAND:** Flatland

AREAS: 1. Multan 2. Peshawar 3. Rahimyarkhan 4. Sialkot

BARANI CULTIVATION: Potwar Plateau and Upper Indus Plain. Sowing in Oct-Dec because rainfall provides sufficient moisture to seeds for germination. Light showers from Western depression, enhance growth and the water is easily absorbed by the soil. A little rainfall before harvesting swells the wheat grains.

OUTPUT: Flour→ ROH (staple diet in Pakistan)

RICE

CULTIVATION:

Rice normally grown on a large scale for commercial purposes in Punjab and Sindh. In the Northern hilly regions, small-scale subsistence rice farming is practiced on terrace fields. In the growing season, rice is planted in beds or nurseries. In the meantime, the fields are weeded, ploughed, fertilized and flooded with the water up to 30-37 inches. When the rice plant in nursery, reaches a height of about 9 cm, it is transplanted into the prepared fields surrounded by small muddy embankment walls. Throughout the growing season, the level of the water has to be maintenance in case of excessive evaporation; the fields have to be refilled. In the harvesting period, the water is drained so that the rice becomes ripe. After threshing, rice is sent to mills for polishing and packing. Rice thrush is used for making cardboard or roofs after mixing it with mud and water. (Rice is staple diet in Pakistan)

TEMPREATURE: 20°C-30°C (no cold season), warm dry period required for harvesting.

RAINFALL: Over 2000mm is deal (mimimum→1270mm), plentyof rain required for growing

SOIL: Loamy or clayey, should be impervious/ water-retensive

LAND: Flat land

AREAS: 1. Faislabad 2. Larkana 3. Sialkot 4 Badin

HYV'S: Irripak and Basmati.

COTTON

CULYIVATION:

Seeds are directly sown into an already weeded, ploughed and irrigated field on a distance of about 30cm-45cm. Soft irrigation takes place right after sowing for the process of germination. Weeding is then done by manual labor. Herbicides can be used as cotton not being a food crop cannot be poisonous after the use. First proper irrigation takes place one month after sowing and seemed irrigation after thrushes two months. Nitrogenous fertilizers (for proteins) along with cow dung

are used to increase the yield per acre. Some of the wealthy farmers also use potash (starch for root growth) fertilizers one month before harvesting. Cotton balls ripen in the dry months of October and November. The plant reaches a height of upto 135cm-150cm. the size of the ball depends on the seeds and applications of fertilizers. After picking, cotton balls are loaded onto trucks immediately and transported ginning mills where lint is separated from cotton seeds and other impurities. Cotton seeds are used as animal feed and for the extraction of oil. Cotton lint is tied up in balls for further processing. If locust's don't attack the crop and the soil is ensured with fertilizers, then a large yield can be expected.

TEMPREATURE: 25°C - 35°C (sensitive to frost)

Note: Cotton is the “King of Fiber”. It is used as a textile fiber and for making clothe, furnishing fabrics, bed lines & industrial fabrics.

RAINFALL: 1000mm throughout cultivation period. If moisture in less than 500mm, irrigation in necessary. Pre monsoon may destroy baby plants and post-monsoon may destroy cotton balls.

SOIL: Medium loamy soil.

LAND: Flat land with a good drainage system.

HYV's: 1. Nayyab 78 2. B557

AREAS: 1 Faislabad 2 Multan 3 Bahawalpur 4 Rahimyar khan 5 Nawabshah 6 Mirpurkhas

Note. Cotton is volenerableto pest and disease attacks e.g leave curted virus so inseccticides and pesticides are imporatan to protect the crop.

Phosphate is also used for strong roots, stem and elevete speed of growth by HYV's

SUGARCANE

CULTIVATION:

Sugarcane stalks, about 30cm high are planted horizontally into an already prepared field. A distance of 30 cm is kept between each stalk. These stalks are then covered with soil using scrappers (pieces of wood). It requires large amount of fertilizers, especially potash (starch for root growth along with cow dung because it extracts nutrients in heavy quantity. A frequency of irrigation after 15-20days is ideal throughout the cultivation period. In Sindh, the sugarcane crop can reach a height of 6-7 feet whereas in Punjab where water supply is sufficient and

nutrients are in heavy quantity, crops may reach a height of 7-8 feet. Water increases the juice content whereas potash increases the sweetness. Sugarcane is harvested by manual labor. After its harvest, new spouts called “satoons” grow which are the basis of future sugarcane cultivation. Immediately after harvest, it is transported to sugar mills usually located near the sugar-cane field. This is because the sugarcane will lose its sugar content if it keeps lying in the open air. The loss of sugar content will result in loss of weight and that can cause loss of income for the farmers. On reaching the mill, the cane is rubbed with chalk to remove the smell and dirt. After extracting the juice by crushing the cane through heavy rollers, the juice is further processed to produce white sugar, brown sugar and jaggery (gur). Two by-products

1. Molasses: liquid left over after the crystallization of sugar. They are used for the production of citric acid, cattle feed, baker's yeast etc.
2. Bagasse: Fiber left over the crushing of sugarcane. They are used to make paper, chipboards and animal feed.

TEMPERATURE: 25°C - 35°C

RAINFALL: More than 1500 mm

SOIL: Loamy and clayey soil

FERTILIZERS: Potash (starch for roots) , Nitrogen (proteins), phosphorous (strong, roots & stems)

AREAS: Peshawar, Nawabshah, Charsada, Khairpur, Jacobabad.

MAIZE (corn)

- It is a kharif crop required 25°C - 35°C temperature and about 900 mm rainfall along with irrigation.
- It cannot tolerate frost and is often grown through barani farming
- Areas : Lahore, Sukkur, Larkana, part of Thar desert
- Output: corn flour used for baking and cooking

MILLETS

- 3 types : Barley (Rabi), Jawar and Bajra (Kharif)
- Require greater than 25°C (once established, can tolerate drought and high evaporation)
- 300 – 400 of rainfall and can grow in poor sandy soil.
- Areas: Thar desert. South East Punjab, North-West Balochistan
- Outputs: Jowar, Bajra, Barley } used for animal food and to obtain flour.

PULSES

- Grans, mung, masoor (Rabi crops)
- Rich in proteins, fix nitrogen in the soil which helps to fertilize following crops
- These are low value crops to farmer gives them little attention. Seeds are scattered on the land and no care is taken as cash return are low.
- Inputs are minimal as well
- Areas: Desert areas of Punjab and Sindh, Potwor Plateau

TOBACCO

- Kharif crop
- KPK accounts for 65% of its production (especially Mardan and Peshawar)
- It can grow in poor soil types.

OIL SEEDS

- Sunflower, soya bean, rape seed, mustard, sarsoon, rai, acsames, castor and linseed are used to extract edible oil.
- Require alluvium rich soil and can be grown through barrani farming.

DIFFERENCE b/w SUBSISTENCE AND COMMERCIAL AGRICULTURE

SUBSISTENCE	COMMERCIAL
<ul style="list-style-type: none">• Small scale farming• Wooden plough and animals• Desi varieties of seeds• Natural fertilizers (cow dung)• Traditional methods of irrigation• Manual labour for weeding• No pesticides / insecticides	<ul style="list-style-type: none">• Large scale farming• Tractor for ploughing• HYV's (Mexi Pak)• Artificial fertilizers• Modern methods of irrigation• Herbicides for weeding• Use of pesticides / insecticides

FRUIT FARMING

Tropical fruits: Hot areas, upper and lower Indus plain

- Mangoes: Bahawalpur, Hyderabad, Sukkur
- Oranges: Rawalpindi, Multan, Gujranwala
- Dates: Makran coast, Pasni, Thar desert
- Bananas: Hyderabad, Thatta, Badin

Temperate Fruits: Colder areas: Northern areas, hills of Balochistan

- Apples: Dishin valley, swat, Dir
- Apricot: Quetta
- Almonds: Pishin Valley, swat, Dir
- Grapes: Pishin Valley, Quetta

LAND REFORMS

In 1962, during Ayub Khan's rule natural land were subjected to land reforms. This meant that a minimum size of 250 acres was defined for as agricultural land. The maximum size for irrigation land was 500 areas and unirrigated land was 1000 acres.

Main aim was to redistribute land among poor and wealthy farmers equally. Abolish, "Zamidari" system

Q. Why is Multan a suitable area for growing wheat?

A. Multan does not experience extreme winters. Thus mild warm weather in winters. In April to May there is no rainfall thus warm and dry climate. No rainfall takes place. Since Multan is located in the upper Indus plain which has a large network of canals, wheat can easily be grown through irrigation.

Multan also falls in both the paths of monsoons i.e. primary and secondary

Q. What is crop rotation?

A. Potatoes require potash but do not exhaust nitrates. Thus they can be rotated with wheat which uses the nitrates in the soil. (Growing two crops one after another)

LIVESTOCK FARMING

Livestock farming livestock include goats, poultry, sheep, buffaloes, cattle and camels

Subsistence livestock Farming

NOMADIC FARMING: when the farmer keeps moving along with the livestock in search of food, water and pasture.

TRANSHUMANCE: Farmers move along with livestock to summer pastures located on mountains top and moves back to valleys / plains in winters. (Northern Mountains)

SEMPLED: The farmer breeds livestock along with his main agricultural activity (upper and lower Indus plain)

Commercial Farming

It is practiced on large scale lands owned by the government or military farms.

Most of the livestock products are supplied by small scale private owners despite of them not using scientific methods. In urban areas, milk supplies come from buffalo herds in dairy farms kept on vacant plots. Fodder has to be brought in from the nearest crop growing areas, mostly using lorries. Cow-dung, a valuable by-product is caked on walls to be dried. Then they are sold to the market to be used as domestic fuel. To boost livestock production cross-breeding and nutritional diets must be used.

IMPORTANCE OF LIVESTOCK

- Animals are used in processes to help in ploughing, threshing and harvesting the crops. They also transport materials from one place to another and are used for turning of Persian Wheel. (Draft Power)
- Animals are a source of food. Cows and buffaloes provide milk which is also processed into the butter and ghee. Cattle are slaughtered for meat and their dung is used as manure and fertilizer. Eggs and chicken are high quality foods.
- Livestock provides raw materials to domestic industries such as skins, wool etc. which are used in carpet, leather, footwear, rugs industries after tanning
- Products associated with cottage industries have great demand in market and contribute to 13 % of share of export.
- It contributes about 10% to the GDP (Leather export to Germany)

CATTLE BREEDS

- Bhagnari: Indus Plain
 - Dhani: Northern Mountains
- }
- DRAUGHT / DRAFT (used for work)
-
- Red Sindhi: Lower Sindh
 - Sahiwal: Upper Indus Plain
 - Thari: Thar for draft
- }
- MILK

BUFFALOES

3 types:

Nilibar food in Indus plain

Kundi used for milk (produced 10% of the milk supply)

Ravi are slaughtered for meat when they get old and stop producing milk

- Buffaloes stay in water bodies (canals, small lakes etc)
- Not found in rugged landscapes as they are bulky and move at a slow pace.