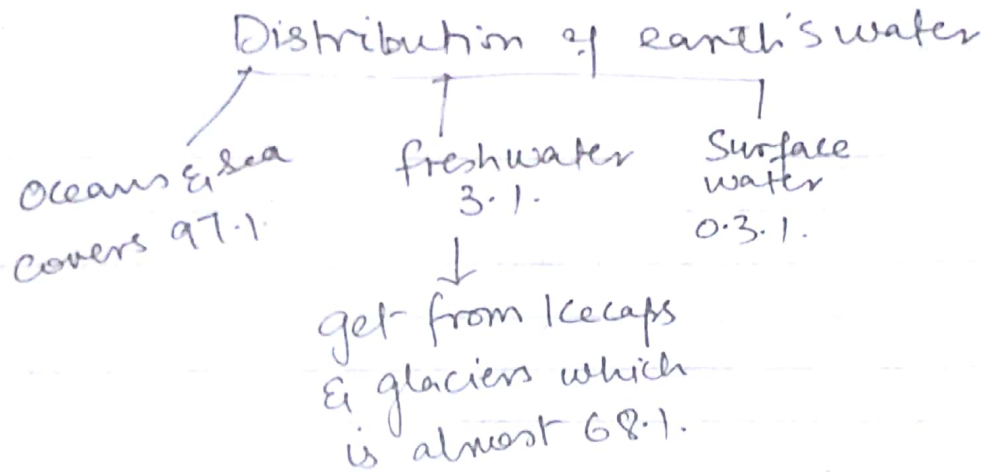


Unit-2 Hydrosphere

Hydrosphere: Surface is partly covered by water.

Fresh water is the main resource on Earth. There would be no plants, humans & animals without it. It is difficult to operate land ecosystem without water. Human beings require water not only to drink, but to grow food, operate industries & provide energy. Ecosystems in salty water of seas & oceans support diverse species, which are additional sources of food.

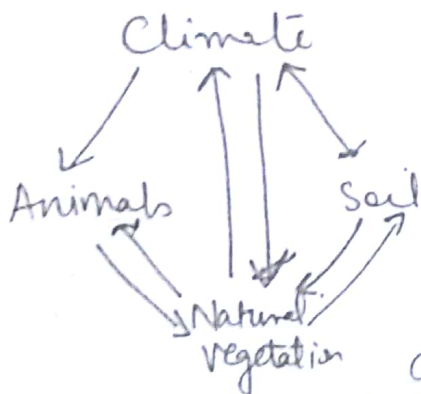


The water cycle:-

Evaporation takes place due to heat. Water from oceans, sea, lake changed from water <sup>droplet</sup> vapour to water vapour in the atmosphere. When water is also lost from trees & plants, mainly from their leaves. This is transpiration. It is difficult to separate out amounts lost between water & vegetation covered surfaces, Evapotranspiration is used to cover all water losses from land surfaces. Air temperature decreases with height. Water vapour is carried upwards by air currents, as it is cooled, leading to condensation. Clouds in the atmosphere

is the result of condensation. Further cooling leads to precipitation. It is in the form of rain, snow & hail. Some of the precipitation is prevented from falling directly on to the ground by trees & plants. This is interception. Some flows over the ground surface, finding its way into streams & rivers. This is run off. From both surfaces there is some immediate water loss back to the atmosphere especially on hot days, by evapo-transpiration. The remainder seeps underground down wards by infiltration and side ways by groundwater flow.

Ecosystem is composed of biotic elements (plants, animals & other organisms) and abiotic elements (climate & soil). All <sup>elements</sup> are interlinked.



What is needed for life on earth?

All plants need water to survive. Light from the sun is the primary source of energy. Light energy is captured by green plants and transformed into chemical energy by the life-essential process of photosynthesis. Energy from the sun is trapped by chlorophyll. The carbohydrate is food for the plant.

Cells in the plant have shapes & structures which help them to survive in different environmental conditions. Some plants adapted to grow in climates where water is

available at certain times of the year.

Within the tropics light and warmth are more than adequate for tree growth throughout the year. Therefore changes in natural vegetation cover from tropical rainforests around the Equator to desert scrub around the tropics, are mainly a reflection of reduced rainfall.

Precipitation varies from place to place. Many of the world's wettest & driest places are in tropical latitudes. Deserts are located at the northern & southern edges of the tropics, in the interior of the continents & towards their western side. (average rainfall in deserts are less than 250mm per year)

### Water Rich Countries:

The world's top 10 large countries have plenty of land for the rain to fall on. Russia is the biggest followed by Canada, China, U.S.A & Brazil.

- Brazil, Russia, Canada, China, Indonesia, U.S.A, India, Bangladesh, Myanmar & Colombia are water rich countries.

The world's great rivers flow through these countries:

River Amazon

" Yangtze

" Mississippi

" Ob

" Mekong

" Ganges

Brazil

China

U.S.A

Russia

Majority of world water rich countries are located in the hot wet tropics.

flows through China, Burma & Thailand

flows through India & Bangladesh.

## Water Poor Countries:-

The 9 most water-poor countries are dominated by desert countries (only 2 are exceptions: Singapore, Mauritius)

Water Poor countries are Saudi Arabia, Mauritius, Oman, Jordan, Singapore, Libya, Mauritania, UAG & Kuwait.

These countries suffer from water stress. The (worries over present & future water supplies). Some South Asian countries like Turkey, Afghanistan, Iran & Pakistan fall in the lower range for availability of water per head per year.

All the water-poor countries are located in the desert lands in the Middle East & the Northern half of Africa.

## How do water-poor countries obtain their water supplies?

They set up desalination plants in which sea water is changed into fresh water by taking out the salts. A great amount of energy is required. Only few countries characterized by plentiful energy supplies & a desperate need for water, use desalination. The top 4 are located in the Gulf. Algeria in the Mediterranean is also an oil producer. Fresh water sources are non-existent in UAG, Kuwait & Oman.

Many water-poor countries pump up water to the surface from natural underground stores called aquifers. Rain water

that has accumulated during hundreds or thousands of years is used to satisfy people's present water needs.

Many countries are taking out more water each year than is being naturally replaced by precipitation. In the long term, reducing the size of ground water reserves is unsustainable.

Saudia Arabia is an extreme example of this.

Some countries are fortunate in having large rivers which have captured water from other countries with a wetter climate. Example is Egypt & the River Nile. The Nile begins in the mountains of Ethiopia where heavy monsoon rainfalls in Summer. It is called as "The Gift of the Nile". (called as ancient Greeks). The Nile water stored in Aswan Dam. (feed 70 million people).

As competition increases for water resources, so too does the risk of water wars between countries.

'The head waters of the Tigris & the Euphrates' are in Turkey, which has ambitious plans for new dams such as Ilisu dam. Turkey's neighbour to the south such as Syria object strongly because they fear further loss of a very scarce resource in the Middle East.

## Unit-2

Uses of fresh water & water supply

\* Reasons for increased demand for fresh water  
 → Rising world population → Improved living standards → More irrigation water used for food production → More water used in homes

World organizations like U.N. subdivide water use into 3 sections 1- Domestic (in the home & for waste disposal) 2- Industrial (factories, Power) 3- Agricultural (irrigation)

In Africa & in Asia farming is still the main activity of countries because many people grow their own food. Population are still rising so that higher food output is demanded. Irrigation helps to  
 → boost up the crop yield  
 → allow crops to be grown in dry periods between rainfall.  
 → reclaim new land from the desert and extend the area used for farming

In North America and in Europe high percentage of water is used in factories and industries. (as in Power stations, steel works) mixing & making products like dyes & paints in chemical works and for bottling & canning in food.

In Africa 88% of water is used for Agriculture where as in Asia 85% of water is used for Agriculture & very less use in industries & for domestic purposes.

## Variation in amount of water use

Africa is a dry continent and majority of the people in Africa live in the rural areas. They must seek out their daily supplies. This can involve a long walk to the nearest stream or hours in a queue to await their turn to use the well because water is a scarce resource.

In contrast, European countries taps & flushing toilets are standard fittings in houses, electrical items, such as automatic dish-washing and laundry machines, consume a lot more water compared to washing by hand.

## Water supply from natural stores

People make use of natural water where available. There are three main reasons, most of them are near mountainous regions.

- ~~For~~ Precipitation are usually higher in surrounding lowlands because air saturated with water vapour is forced to rise more strongly over high land.
- Summer heating melts ice & snow in the mountains & releases fresh water.
- Many lakes are found at the bottom of steep-sided mountain valleys.

Few people live in mountainous areas where water availability is greatest. Rivers

Rivers provide surface transfers of water to lowland areas to farms, villages, towns & cities.

Drawing water from rivers is the easiest & the cheapest way. Yangtze and Huang-Ho in China

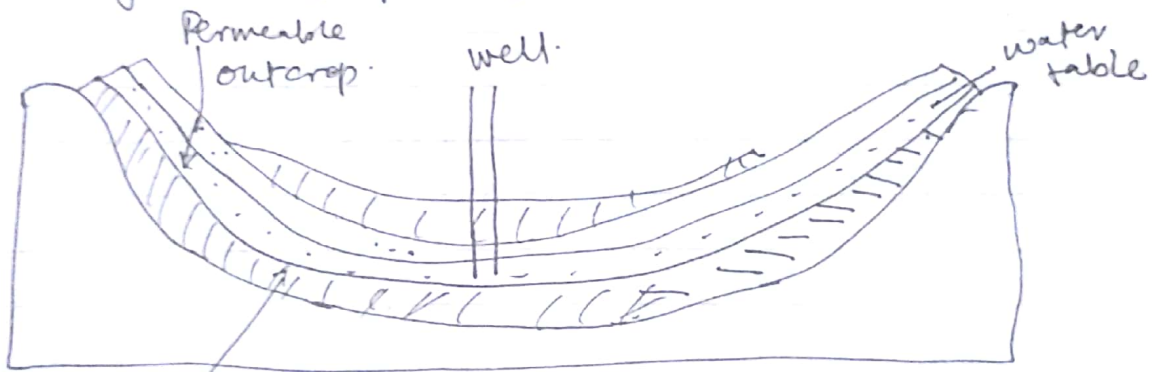
and Ganges in India are along the banks of big rivers.

Another source of fresh water is stored underground. It is widely dispersed within the many holes in the permeable rocks.

Another suitable site for water supply are aquifers. (underground store of water)  
→ Spring water emerges naturally on the surface

→ Mechanical pumps or human labour are used to raise water to the surface.

A well has to be dug to reach the water bearing rock (aquifers).



Impermeable rock :- It does not allow water to pass through it.

Permeable rock with spaces or gaps so that water can pass through it.

Favourable Geological Conditions:-

- Alternate layers of permeable & impermeable rocks
- folded layer of rock accumulate most water.
- Permeable rock outcrops new supplies of water



## Transfer of water to places of need:

- Through rivers, lakes or aquifers
- Through pipelines e.g. in U.S.A (state of California)
- Another example <sup>is</sup> in the Snowy Mountains in Australia (16 major dams, 7 power stations, 2 underground pumping stations & trans-mountain tunnels e.g. released into Murray & Murrumbidgee rivers for irrigation).
- Indian govt has put forward the India Rivers Inter-linking plan which it claims to solve the country's water problems. The plan is to transfer excess water from the north to areas short of water in the south.

## Dams are the human stores for water supply.

→ During the times of low rainfall and periods of high demand <sup>these</sup> (reservoir), these reservoir water is being pumped to homes & factories.

Requirements for dam construction: Precipitation is higher → low rate of evaporation  
→ valleys are deeper for easier dam building

The most active world regions for dam building today is Asia, where the giant three Gorges scheme along the Yangtze river in central China dwarfs the rest.

Facts, benefits & drawbacks of three Gorges dam on bk pg 73 :

38

## Why access to safe water is higher in urban areas:-

- Water pipes are easier and cheaper to build when a lot of people live close together.
- On average, people's incomes are higher.
- Cities are more wealthy places with factories and offices.
- Easier to put pressure on leaders to make improvements.
- Wealthy are likely to live in cities

## Contrasts in availability of water between places:-

- Developed countries like Europe and North America — 100% access to piped supplies of water.
- In developing countries — 71% of the population has easy access to safe water.
- Sub-Saharan Africa has the lowest access i.e. 51% — 7 out of 10 countries like Chad, Ethiopia, Zambia, Haiti, have very low access to safe water.

## Flooding & Drought → Causes & effects

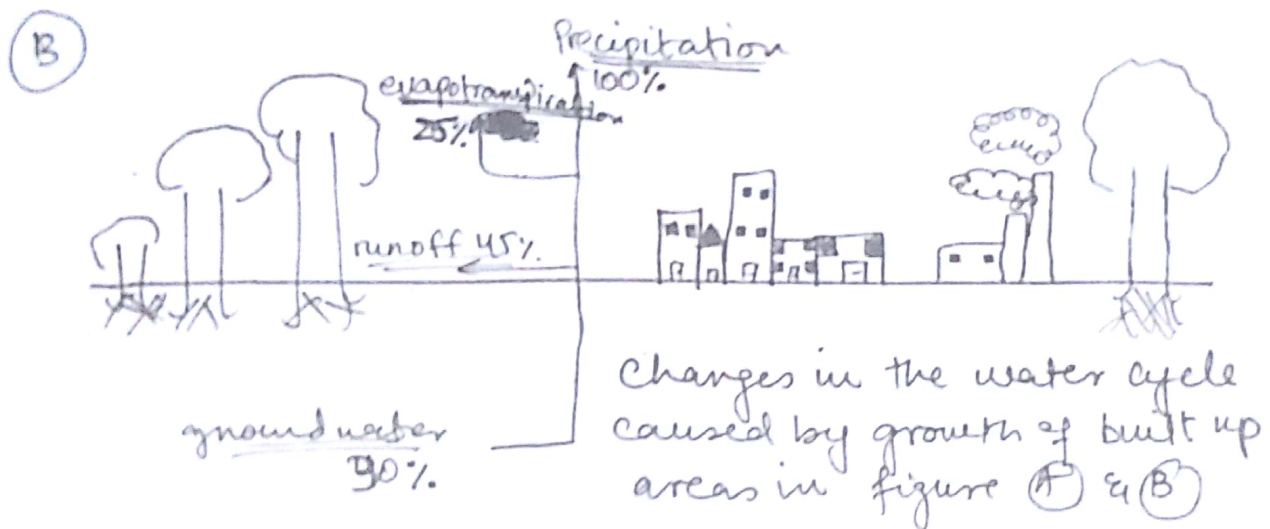
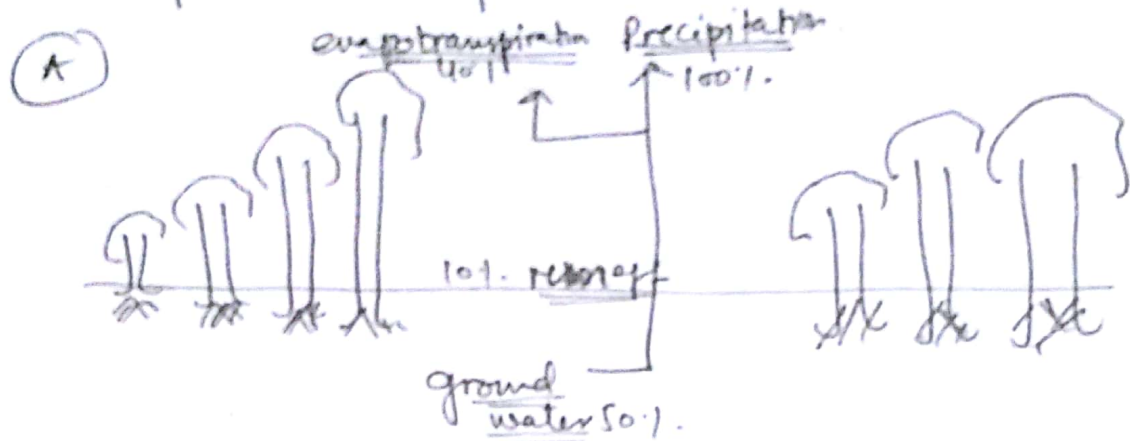
Causes of Floods: Heavy rainfall & clearing of forests

Human activity can increase the risk of flooding and make it worse.

In water cycle, the percentage for run-off increases at the expense of the percentages for

★ Interception refers to precipitation that doesn't reach the soil but intercepted by the leaves & branches of plants & the forest floor (occurs in the canopy).

### interception and infiltration



### Effects of flooding.

loss of human life, houses destroyed, offices factories & work places flooded out, livestock carried away, crops ruined, road & rail bridges washed away, communications disrupted.

**Drought:** It is a period of dry weather longer or worse than normally expected.

It occurs when wind & pressure patterns are different from normal, so that expected rains do not fall. It is common in Northern India.

## Effects of drought:

- Lack of water in farming areas
- Crops wither & die / less production
- Live stock may die → less food for the people leads to malnutrition
- Desertification

## Case-Study: Flooding in Bangladesh.

The Flood risk in Bangladesh is one of the highest in the world

Physical factors favourable for flooding  
come in Bangladesh:-

- 1- Tropical Monsoon climate
- 2- Tropical cyclones
- 3- Relief
- 4- Drainage

- Severe flooding in Bangladesh in 1978
- Floods in 2004 affected 30 million people
- In May, 2009, tropical storm left 200 people dead.

An action plan drawn up in 1987 known as Solutions:- <sup>hard engineering</sup>

- Construction of dams
- Coastal embankments to keep the sea water out
- Increase the height of embankments
- Improved warning schemes
- More flood shelters & better prepared emergency services.

(4)

Consequences & improvements

Many of the world's people live close to rivers. River water quality can undergo major changes due to human activities. Rivers which flow through well-populated areas, water can be taken from them several times and used for agriculture and industrial purposes.

Major causes of water pollution

- Surplus of phosphorus & nitrogen not absorbed by the plants are washed from the land
- Synthetic fertilizers & chemical pesticides are the main sources
- Domestic wastes includes detergents, metals and many other manufactured products containing traces of toxic chemicals.
- Industrial waste (mercury, copper, manganese, nickel, chromium, lead & arsenic)

How Eutrophication affects natural water ecosystems:

- Fertilizers & animal waste from farms
- Enriched nutrient content in rivers & lakes (Eutrophication)
- Algae grow fast & multiply
- When algae decay & die they are broken up by decomposers
- Decomposition of dead bodies uses up oxygen
- Fish die due to lack of oxygen.

## Ways of improving water quality & supply

The decline and recovery of the River Clyde, which flows through the centre of Glasgow, the main centre for industry in Scotland during the Industrial Revolution.

### Time line for Pollution on the River Clyde in Glasgow.

- 1800 River reasonably clean
- 1800-1850 Rapid growth industry & population, river becomes an open sewer for domestic & industrial waste.
- 1850 Last fish recorded.
- 1850-1900 described as 'foul & stinking' the most polluted river in Scotland.
- 1900-1950 River poisoned from sewage & waste of every kind, from dye works, chemical works, metal works etc
- 1965 Laws passed for a clean up - clean up begun
- 1968 Biological survey done, no fish found due to poor oxygen levels
- 1972 first fish found in river
- 1978 18 species of fish counted
- 1992 42 species of fish counted, much river flora & fauna restored.

It shows, what can be done when regulations against pollution are passed & enforced, although the clean up was helped.

(43)

## Water Related diseases

Many of the diseases that people catch in the tropics are associated with water. Hot, wet climates not only provide the best condition for growing plants but also provide ideal environments for a great number of insects, bacteria & viruses to thrive.

There are three main types of environmental diseases related to water.

- 1- Water based: The carrier lives in water. Bilharzia, carried by water snails, is one example. Another is Guinea worm, the worm infection is caught by people drinking water contaminated with tiny water fleas carrying Guinea worm larvae.
- 2- Water Borne: These diseases are spread by drinking contaminated water. Examples include typhoid, Cholera, dysentery & diarrhoea. They can also be caught by washing food, pots, pans or hands & face in dirty water.
- Water-bred: The carrier breeds in water and spreads disease by biting its victims. The disease of this type which affects most people worldwide is malaria, transmitted by mosquitoes. Dengue fever is another fatal disease caused by mosquito bites. Another disease of this type, is Sleeping Sickness for which the tsetse fly is the carrier.

Bilharzia — A water based disease:  
The bilharzia snail lives in still, shallow waters

in tropical lands. Larvae grow and multiply inside the snail. Worm emerges after 3 to 7 weeks - then enter human bodies through the soles of people's feet. Fishermen & farmers working in paddy fields are most at risk.

People suffering from bilharzia become weak & anaemic, leads to kidney & bladder infections.

**Cholera:** A water borne disease.

It is an intestinal infection can cause severe diarrhoea, which may lead to dehydration & eventually death. It is caught from the consumption of contaminated water & food.

It is common in South America, Africa, the Middle East & Asia. Epidemics occur after natural disasters.

**Malaria:** A water based disease.

The female anopheles mosquito is the (carrier) for malaria. Only the females drink blood, the males are vegetarians. Mosquitoes breed in stagnant fresh water in swamps, ponds & lakes which are plentiful in the wet season.

To transfer the disease, the mosquito must bite a person whose blood already contains the malaria parasite called plasmodium. When the next person is bitten, the mosquito injects her saliva into the blood stream & thousands of parasites thread their way through the blood stream to the human liver.

**Symptoms:** High fever keep coming back from 48-72 hours / diarrhoea, dehydration / feeling very weak & unwell.



## Impact on Human activities & development.

→ Infants are the group most at risk from water related diseases. Every day nearly 25,000 children die from diseases caused by drinking unsafe water. If mothers are forced to make up dried milk with dirty water, their children <sup>suffer</sup> from repeated stomach upsets. Eventually become so weak that they can die of starvation.

## Strategies of control & eradication:

- 1- Give every one easy access to supplies of safe, clean water. Water needs to pass through a water treatment plant
- 2- Improve sanitation systems
- 3- Destroy the breeding grounds for the carriers or eradicate them completely.
- 4- Take personal precautions to reduce the chances of being infected or bitten.

2014

# Environmental Management

## Unit-2

Assignment

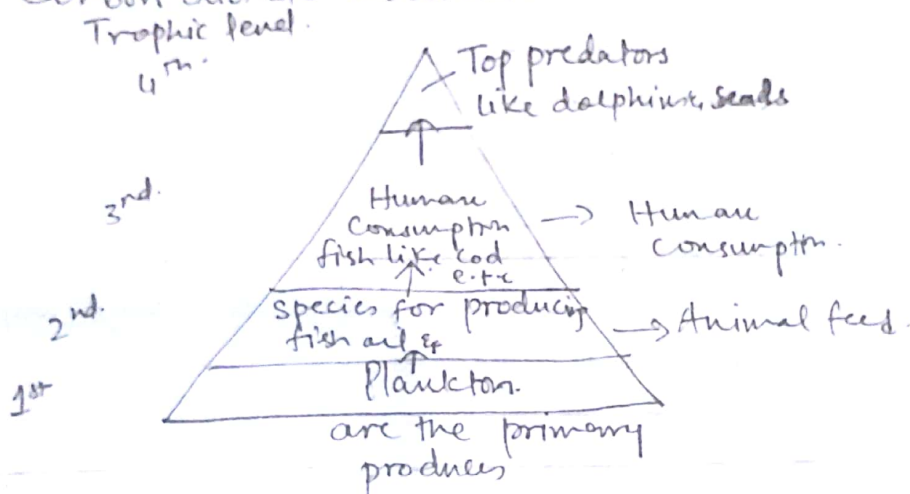
196

### Unit 2.6

### The Oceans

Oceans occupy 70% of the earth's surface. Of all the water on earth 97% is in the oceans. They stabilize temperature on land & also exert a great influence over the planet's weather & climate.

- They yield moisture back into the atmosphere by evaporation, which replaces the earth's fresh water supplies in rivers & lakes.
- In the life-filled oceans, oxygen is generated & carbon dioxide absorbed.



### Life in the oceans:

The primary producers, upon which all other ocean life depends are the phytoplankton, simple single celled organisms of the sea. They only exist in the upper layers of water because they depend upon sunlight and for the production of organic matter through the process of photosynthesis.

Work upwards through the trophic level. Of the 100% of energy available from the phytoplankton only about 2 percent is left from the fish layer and potentially available for human use. The rest has been lost to respiration & waste.

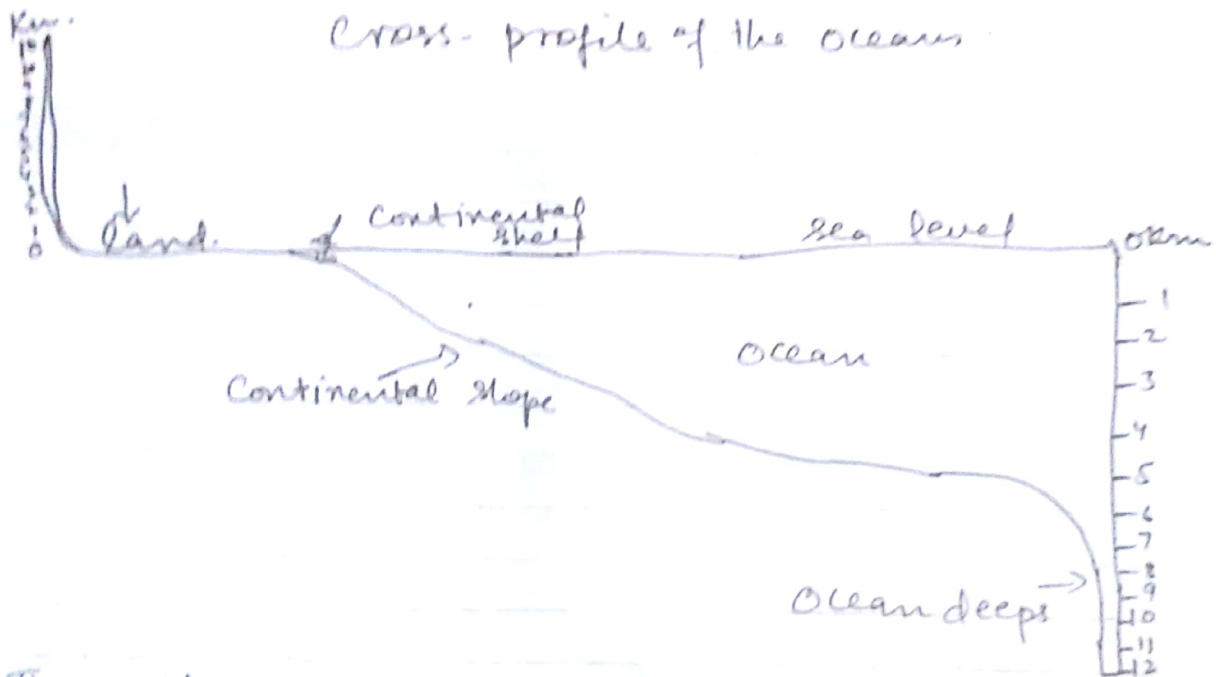
The key feature in all ecosystems is

(47)

interdependence, each part of the chain depends upon another.

## The Resource Potential of the Oceans.

Resources that people can use are concentrated on the continental shelf. This is the platform of level land no more than 200 meters under the ocean surface, between the low tide mark and the continental slope. Beyond are ocean deeps, about which much less is known because of problems of access.



The width of the continental shelf varies from place to place. Fish is the important ocean resource for humans. The world's most important fishing grounds are located on the continental shelves. More light can penetrate here than in deeper waters, and more oxygen is present. They are

also the most nutrient rich parts of the oceans with nutrients carried from the nearby land by rivers, which encourages an abundance of Phytoplankton.

→ Oil and natural gas are the examples of natural resource under the sea floor that are exploited by people. certain areas of shallow water, such as the Gulf in the Middle East, the Gulf of Mexico and the North Sea, have hundreds of drilling platforms and rigs. These are commercially valuable resource because of the high world demand.

→ Within the tropical waters, Coral reefs attract tourists because of their natural beauty and teeming life of brightly coloured fish. Resorts in the Caribbean, around the Red sea and Indian ocean and on Great Barrier Reef in Australia attract visitors fascinated by diving and Snorkelling possibilities among the reefs.

Consequence of human use:--

→ Earth population increased → Removed billions of tonnes of living creatures from the sea → Added billions of tonnes of toxic substances → There needs to be more awareness that people need healthy oceans for a healthy earth.

Ocean currents:

They are of two types warm and cold. This does not mean that the water

in a warm ocean current is always warmer than that in a cold current. Warm & cold are relative terms.

- In a warm ocean current, the water is warmer than would be expected at the latitude where it is flowing because it is moving warm water from the tropics towards the poles.
- Cold ocean current flow towards the equator, since they are moving water from the colder areas of oceans, they are cold bodies of water.

### Effects of ocean currents:

#### Warm ocean currents

- Western European countries such as UK, Norway, very cold in winter — lie in high latitude above 50° N.

#### Cold ocean currents

- reduce amount of rain, a lot of mist & fog —
- The world's driest desert in Southern Peru
- Economic activities on land are limited due to less rain

#### Advantage of ocean currents

- Support world's richest fishing grounds.
- Currents carry nutrients → support great amounts of phytoplankton

197

## EL Nino & its effects:

El nino means christ child.

→ Surface current flow reversed meaning SE winds weaken & warm water flow towards Peru happen after every 3-8 years around Christmas. (Peruvian fishermen, gave it the name).

Effect: → Warm ocean water kills plankton & fish because its currents are low in oxygen & nutrients.

→ Beaches become littered with washed up dead fish & sea birds

→ The large fish shoals move further offshore into colder waters, out of range of fishermen with only small boats.

### Effects of the 1997-98 Nino effect:...

→ Very strong EL Nino devastated coastal Peru.

→ up to 350 people died.

→ up to 250,000 were made homeless by heavy rains

→ Peru's economy declined to 5.1.

It was blamed for up setting world's pattern of rainfall & drought like in Asia, Africa & America → Hurricanes hit the Caribbean & higher rainfall in Los Angeles

51

## Unit 27 World Ocean Fisheries

- ▶ Fish → Major source of food → source of protein
- ▶ give job opportunities full time / part time such as in processing industry like canning, curing & freezing
- ▶ Pet food for smaller fish krill processed in factories to make animal feed & fertilizers.
- ▶ fish related industries - boat & net making fishing tackle & ice production.

Traditional fishing grounds are located in the temperate zone of the northern hemisphere due to natural factors

Continental shelf

rich in plankton because of their shallow water

Mineral transporting ocean currents

- Shoal fish such as herring, mackerel, cod and haddock prefer cooler temperate waters.
- In warmer tropical waters, the nutrient cycle doesn't function because a thermo-layer occurs because of the lack of mixing between the warm surface waters & the cold deeps.
- Fish is the important part of the diet in Japan & and in Scandinavian countries like Norway & Denmark, great quantities of fish eaten
- in South-east Asian countries - fish usually comes from fresh water sources & fish farming.
- Demand of fishing has increased due to new fishing grounds and the increasing size of fishing boats & development of factory ships.

(52)

→ Commercial fishing is common in <sup>the</sup> cold waters of the South Atlantic and Antarctic. Many Russian & Japanese boats operate here.

→ The sea fish caught in two groups.

### Pelagic

• fish live near the ocean surface like herring, mackerel & sardine

### demersal

• They are bottom dwellers living closer to the floor of continental shelf.  
like cod, haddock, plaice & sole.

→ other marine animals of commercial value are

- Crustacea: crabs, lobsters & crayfish
- molluscs: oysters, cockles & mussels
- other species such as dolphins, seals, turtles & whales.

## Overfishing & its consequences

Overfishing: It means that there are insufficient fish left to carry on the reproductive cycle.

Major fishing grounds are considered to be at risk. It is estimated that 70% of all world fish stocks have reached the point where commercial fishing is no longer sustainable.

Causes of Overfishing:  
Use of new technology like

(33)



new and modern boats → specialised vessels to locate fish  
about 1000 miles off the coast which detects the where  
they scoop up every thing in the sea including  
small & immature fish (Sonars) → (Drift nets)  
→ satellites for weather data, can also track  
to used by policing agencies to monitor trawlers

### Consequences of overfishing

→ low levels of fishing stocks lead to <sup>loss</sup> boat  
in fishing related industries, unemployment  
in small port communities

### Strategies for the harvesting of Sustainable fisheries

→ Law of the Sea conference in 1974

→ According to it " 200 mile wide zone is  
known as an Economic Exclusion Zone' Countries  
are responsible for marine resources in their  
own territorial waters.

→ Countries manage it through 'quotas'

→ once the limit or 'quotas' has been  
reached further fishing is forbidden.

Other quotas management policies are

→ Closed season: breeding time during the year

→ restricted areas: no fishing allowed until breeding can  
take place & stocks recovered.

→ limits on net types & sizes: so if that young  
fish can swim through the net

★ Peru → manage its fishing grounds

# Why have these strategies had only limited success?

- Many local fishermen do not believe in quotas & restrictions
- They are not convinced that scientific evidence is correct.
- Many boat owners will engage in activities that are illegal, such as → catching more than allowed → fishing in restricted areas → using nets that are not allowed.

## Unit 2.8: Marine Pollution: Causes & Impacts.

Causes → 75% of the marine pollution comes from the land → Rest comes from the dumping by ships and from offshore mining & oil production.

### Marine pollution

Types	Sources	Impacts
1- Nutrients	• 30% Sewage, 50% farming	• decomposing algae • lower water oxygen level
2- Sediments	• deforestation, soil erosion	• blocks water flows
3- Pathogenic organisms	• Sewage & livestock wastes	• Contaminates sea food & spread disease
4- Litter specially plastics	• Disposal by ppl	• Unightly beaches with plastic bags.
5- Oil	• 50% from land sources • 33% from oil tanker operations	• oil slicks kill sea life
6- Radioactive waste	• discharges from nuclear power stations	• Causes disease in marine life • Endangers human life if it enters in food chain.
7- Toxic waste like lead & cadmium	• Metals from mining & industry (55)	• Poisons marine life

## Which areas are most at risk?

- Sheltered bays & river estuaries
- Narrow or enclosed sea & gulfs are at high risk
- Mediterranean sea & Arabian Gulf are examples.

★ Mediterranean basin is highly populated & receive great numbers of tourists

- Large rivers such as The Nile & Rhone empty pollutants
- Important shipping routes between Suez Canal & straits of Gibraltar.

★ Arabian Gulf is the largest oil producing region → oil rigs & tanker terminals → sources of marine pollution.

★ Political instability

★ deliberate sabotage of Kuwaiti oil fields by Iraq during the Gulf war in 1991 (Gulf region is a major pollution disaster).

## Marine Pollution: Controls & Remedies

→ Global problem → All oceans are linked together and ocean currents transfer water between them.

→ United Nations tried to achieve co-operation between governments → 1982 dumping of radioactive waste at sea was banned.

Methods: - (Dealing with oil spills)

(56)