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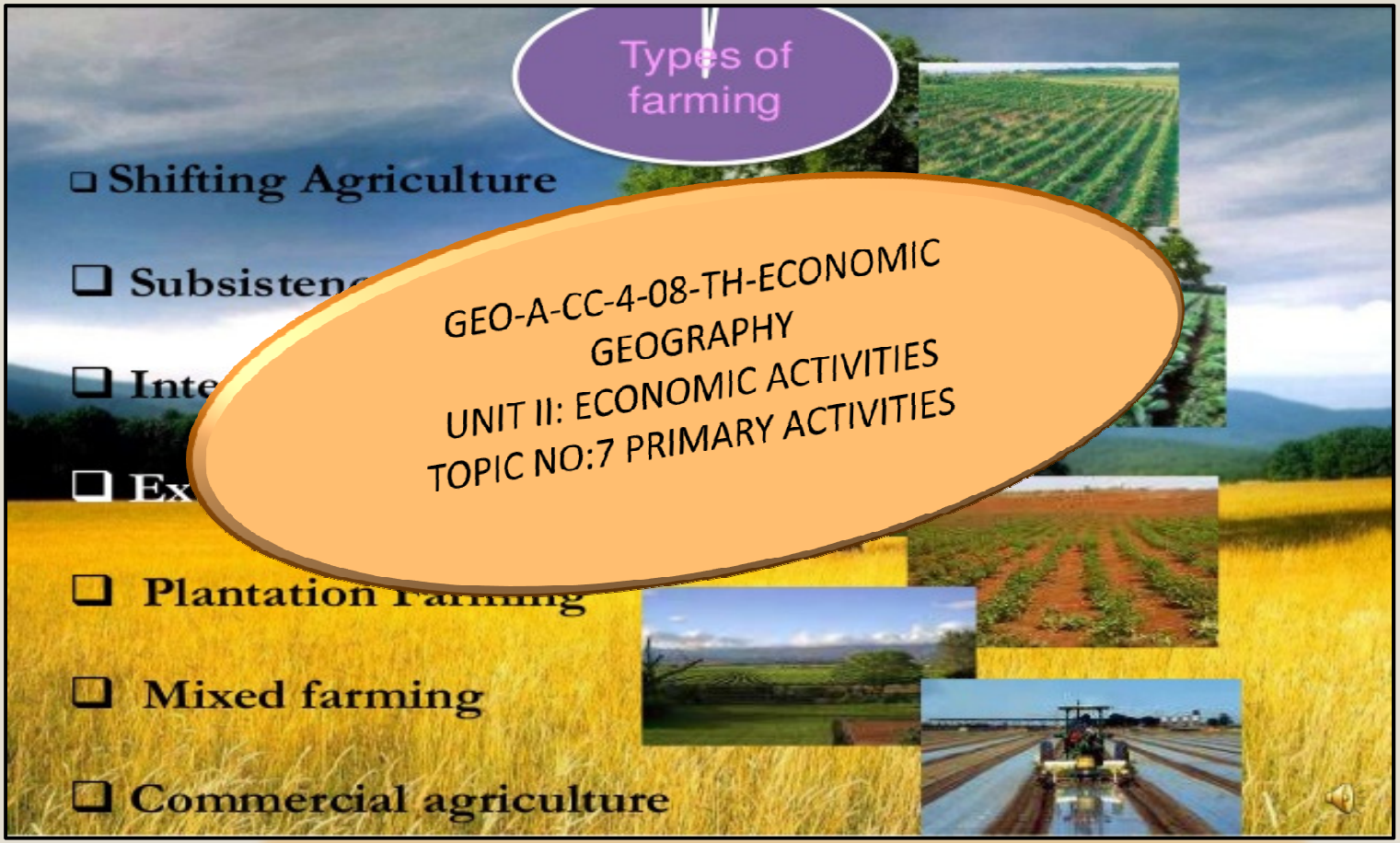

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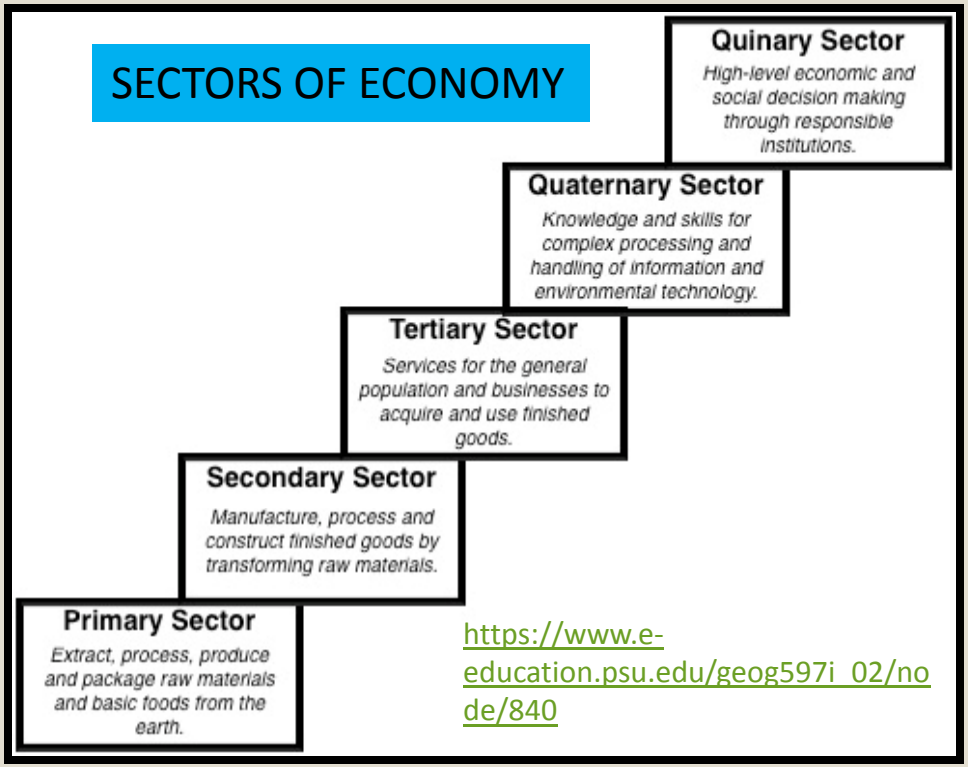

https://www.e-education.psu.edu/geog597i_02/node/840

TYPES OF WORKER

PRIMARY SECTOR → RED COLLAR
SECONDARY SECTOR → BLUE COLLAR
TERTIARY SECTOR → PINK COLLAR
QUATERNARY SECTOR → WHITE COLLAR
QUINARY SECTOR → GOLD COLLAR

Primary: Primary sector is that sector of the economy which extracts or harvests products from the earth. The primary sector includes the productionof raw material and basic foods. Activities associated with the primary sector include agriculture (both subsistence and commercial), mining, forestry, farming, grazing, hunting and gathering, fishing, and quarrying

https://www.padmad.org/2018/02/primary-secondary-tertiary-quaternary.html

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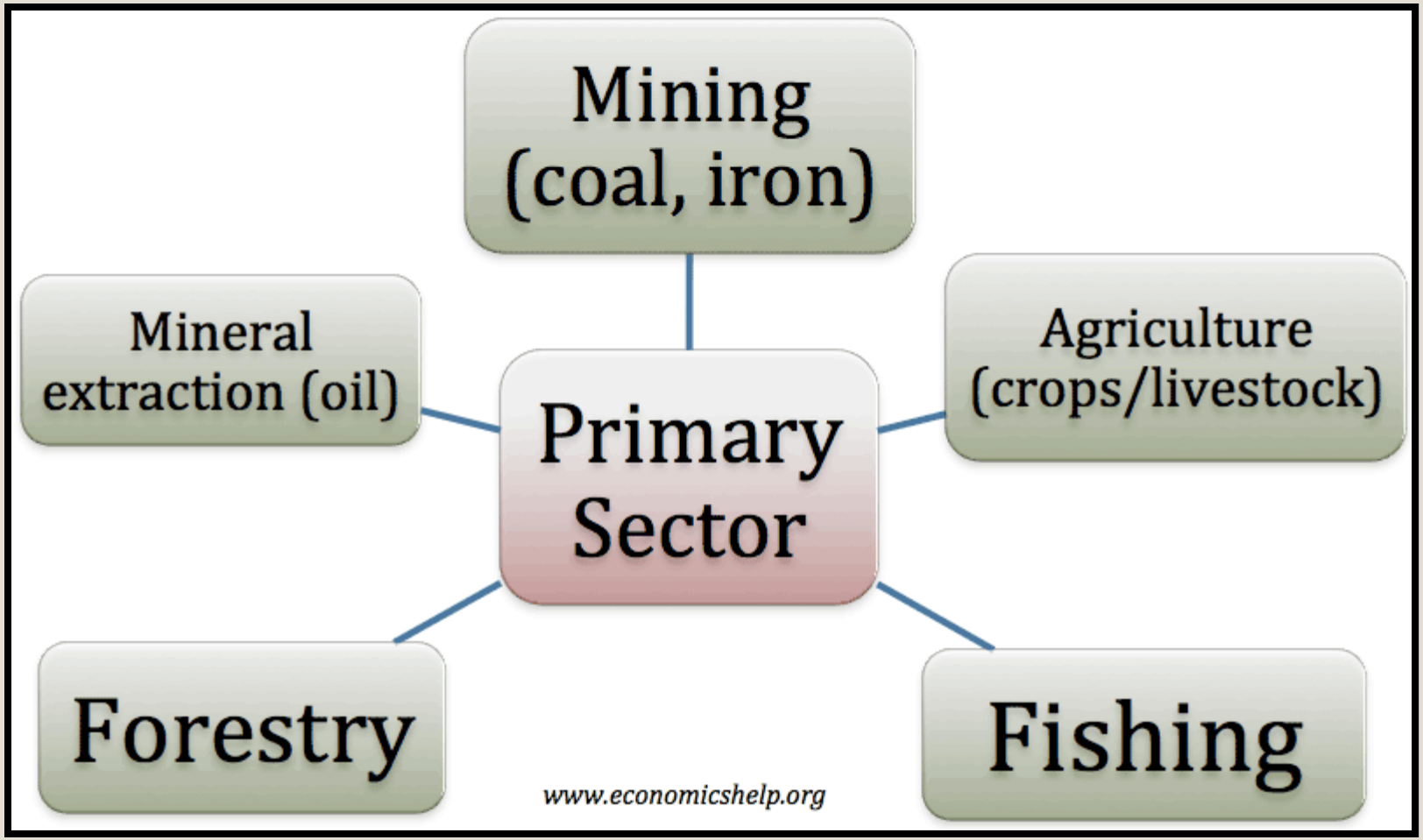
CLASSIFICATION OF PRIMARY SECTOR OF ECONOMY



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AGRICULTURE

DEFINITION)

Agriculture covers those productive efforts by which man, settled on the land seek to make use of ,and is possible ,accelerate and improve upon the natural genetic or growth processes of plant and animal life, to the end that these processes will yield the vegetable and products needed or wanted by man– Zimmerman,1951

In short, agriculture denotes man's involvement with soil or land in connection with the growth of plants and animals for food and clothing

FACTORS OF ARGICULTURE

1. **Climate**(temperature,rainfall,sunshine,wind,miosture)
2. **Topography**(altitude,slope,flatness,stability)
3. **Pedology** (soil texture,type,retention capacity,properties)
4. **Hydrology** (irrigation,river network)
5. **Economic** (capital,market)
6. **Demography** (labour force,male-female ratio,quality)
7. **Social** (inheritance law,social interaction)
8. **Religious** (religious orthodoxies for particular crop cultivation)
9. **Institutional (l**and reform,land tenure)
10. **Technologica**l (mechinaries,methods,fertilizers)
11. **International relation** (patent law, international market,market security)

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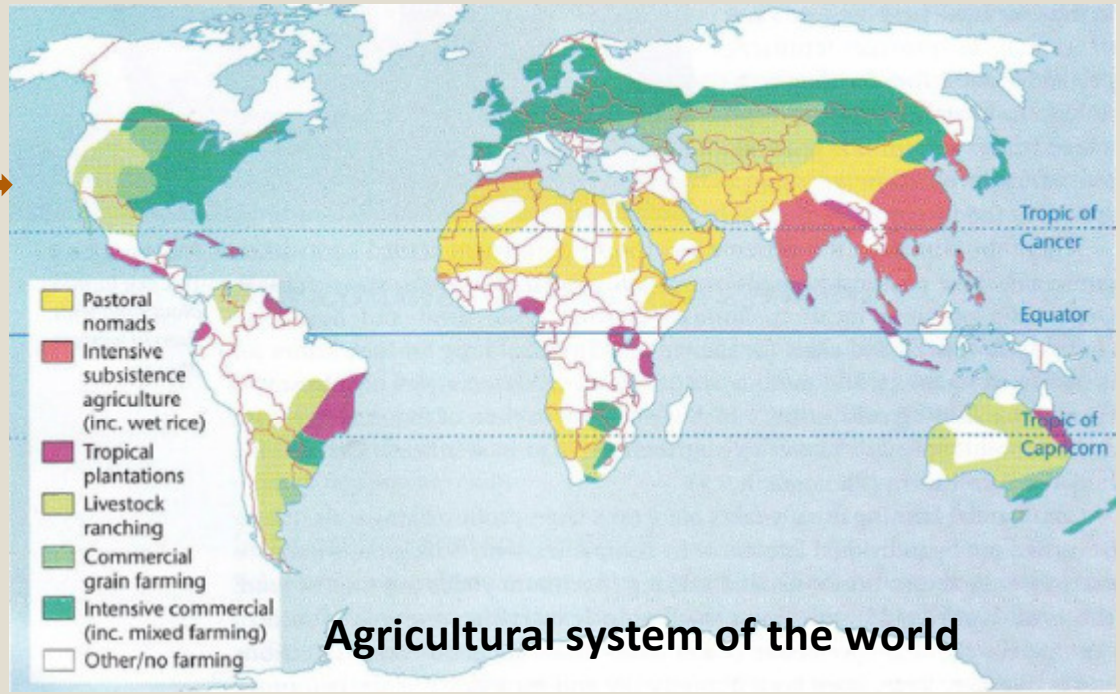
AGRICULTURAL SYSTEM

'*MAJOR AGRICULTURAL REGIONS OF THE EARTH*'-a renowned article published in 1936 in the Annals of Association of American Geographers by WHITTLESEY where he delineated major agricultural system in the world.



Types of System: 1.Nomadic herding 2.Livestock Ranching3.ShiftingCultivation4.Sedentary agriculture5.Intensive subsistence tillage with rice dominance6. Intensive subsistence tillage Without rice dominance7.Commercial plantation8.Mediterranean agriculture 9.Commercial grain Farming10.Commercial livestock and crop farming11.Commercial Dairy farming 12. Subsistence crop and stock farming13.Specialized horticulture

Basis of Classification:

- **crop and livestock association**
- **Methods of cropping and domestication**
- **The intensity of application to the land labour, capital and organization**
- **Dispersal of the products for consumption**
- **The ensemble of structure used to house and facilitate the farming operations**

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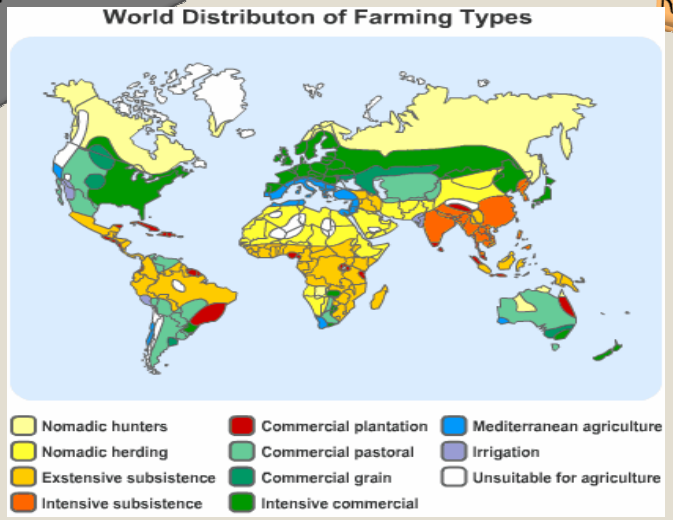
CLASSIFICATION OF AGRICULTURE:

1. On the basis of cropping season
   - Kharif
   - Rabi

2. On the basis of amount of land and density of population
   - Intensive Agriculture
   - Extensive Agriculture

3. On the basis of method of cropping
   - Single cropping
   - Doubble cropping
   - Multiple cropping

4. On the basis of Rainfall Received
   - Wet farming
   - Dry farming
   - Irrigation farming



5. On the basis of demand, Supply, market and Production
   - Shifting Cultivation
   - Sedentary Primitive cultivation
   - Intensive subsistence cultivation
   - Extensive commercial cultivation
   - Plantation Farming
   - Mixed farming
   - Horticulture

6. On the basis of Variation of Climate
   - Farming in Monsoon Region
   - Farming in Mediterranean Region.

7. On the basis of social Characteristics
   - Capitalistic agriculture
   - Feudalistic Agriculture
   - Socialistic Agriculture

8. On the basis of ownership of land
   - State-sponsored farm
   - Co-operative Farm
   - Collectve farm
   - Indiviual farm

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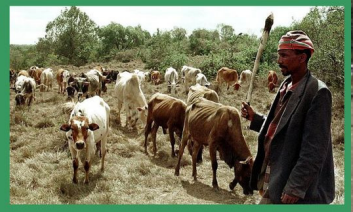
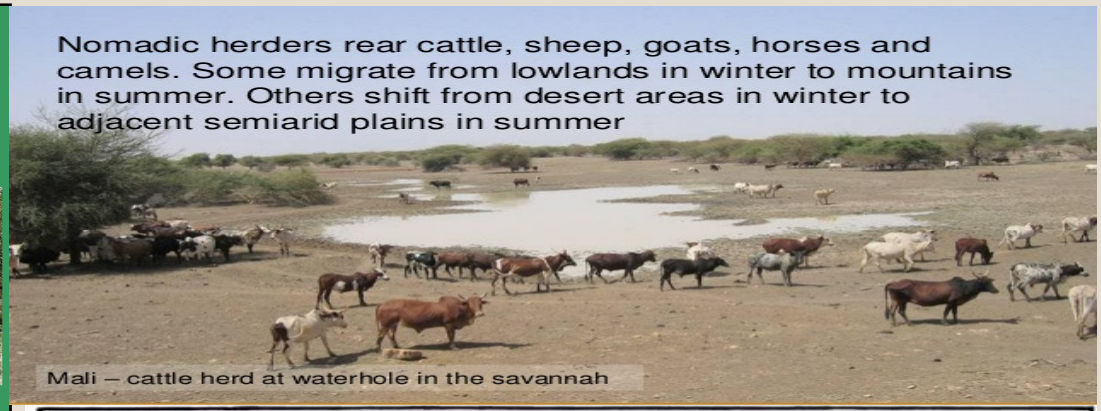
1.Nomadic Herding:

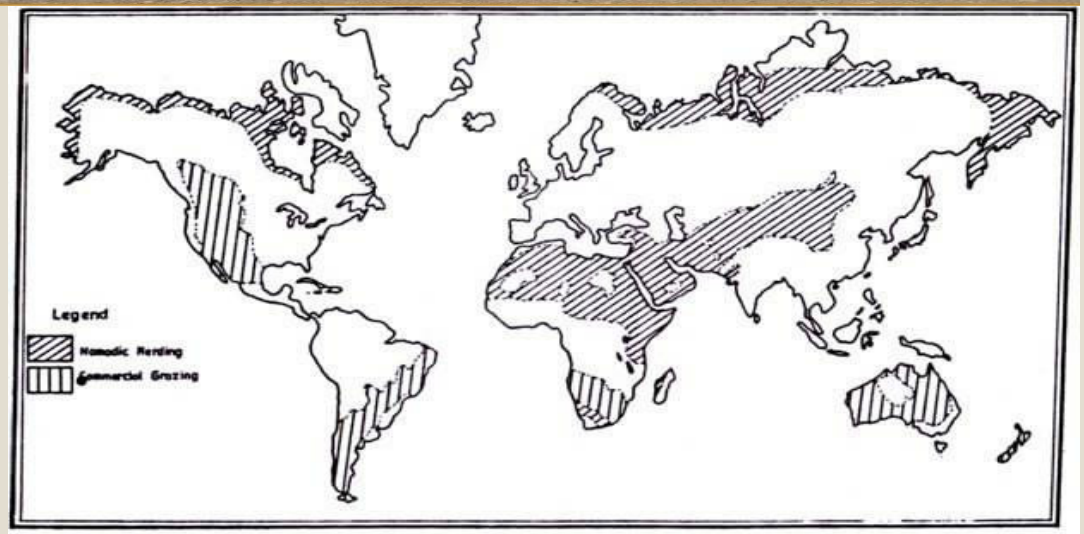
It is the simplest form of pastoralism, carried on mainly to produce food for the family and To fulfill the needs of clothing ,shelter and recreation .At present is mainly concentrated in Saharan Africa, the southwestern and central parts of Asia, northern parts of Scandinavian countries and northern Canada.

Nomadic Herding (Pastoralism)

- The **rearing of animals on natural pastures**.
- This practice is followed by the people of the **semi arid and arid regions**.
- They keep moving with their animals in search of natural pastures and lead a nomadic life.







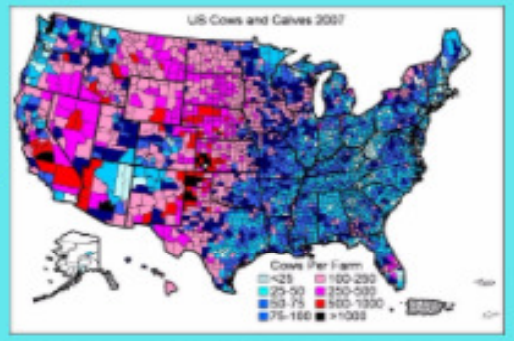
GEO-A-CC-4-08-TH-ECONOMIC GEOGRAPHY UNIT-II TOPIC:7

Livestock Ranching

Quick Facts

- Ranching is the commercial grazing of livestock over an extensive or vast area.
- Ranches are usually located where soil is too poor to support crops
- Livestock ranching is growing faster than any other agriculture sector in world
- Livestock ranching is more common in the western regions of the United States than the eastern regions.

Map shows how livestock ranching is more common in the western United States



Pros and Cons of livestock ranching

Pros

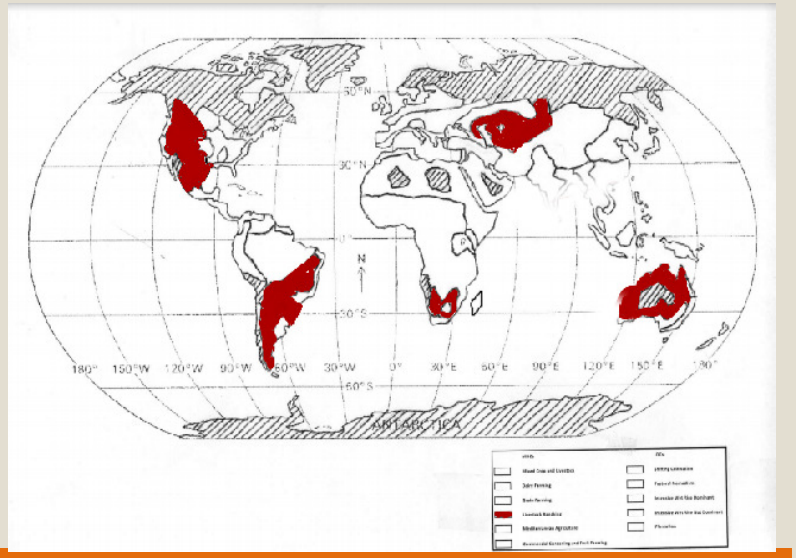
- Efficient way to raise livestock
- Efficient way to provide meat, dairy products, & raw materials
- Vital part of economies and rural development

Cons

- Reduces habitat for native species because of deforestation
- Grasses don't thrive nutrient-poor soil
- Many ranching practices have caused overgrazing
- Can be a key cause of desertification
- Major cause of global warming
- Responsible for more greenhouse gas emmissions thn transportation
- Cattle release large amounts of methane

Livestock ranch in Canada

https://infograph.venngage.com/p/100278/livestock-ranching



Livestock Ranching

- In some ways, it's commercial version of pastoral nomadism.
- Adapted to areas which are too dry for other agriculture.
- Not as profitable per acre as farming
  - if irrigation makes farming possible, ranching usually ends.
- Cattle ranching in the US:
  - In the 19th century, rapidly expanding cities became a major market for beef.
  - In the Western US, arid areas that couldn't be used for anything else could be used to produce beef cattle – the problem was getting the beef to market.

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WHAT IS JHUM/SHIFTING CULTIVATION?

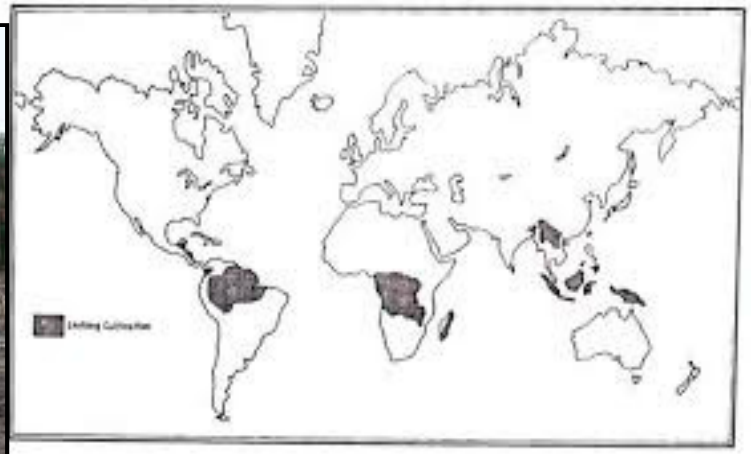
- An indigenous cultivation method in agriculture.
- Farmers slash and burn a patch of land and start growing food crops.
- When soil fertility declines they shift to another place, burn jungle again.

Effects of shifting cultivation

- Shifting cultivation causes loss of flora and fauna which includes precious species of tree plants, shrubs, medicinal plants and minor forest products.
- It is an easy method of deforestation.
- The wild animals loss their shelter.
- Causes heavy flood in the rivers below.
- Siltation to the tanks, nallas, river and reservoirs.
- Ecology is disturbed and distored which never restored.
- Soil erosion: The intensity of erosion depends on slope, soil characteristics, crop coverage, depth of soil and rainfall pattern etc.

Various names used for Jhum Cultivation

India →	JhumCultivation
Malayasia →	La dang
Phillipine →	Chenggin
CentralAmerica →	Milpa
Venezuala →	Knuka
Brazil →	Roka



Regions of jhum cultivation.

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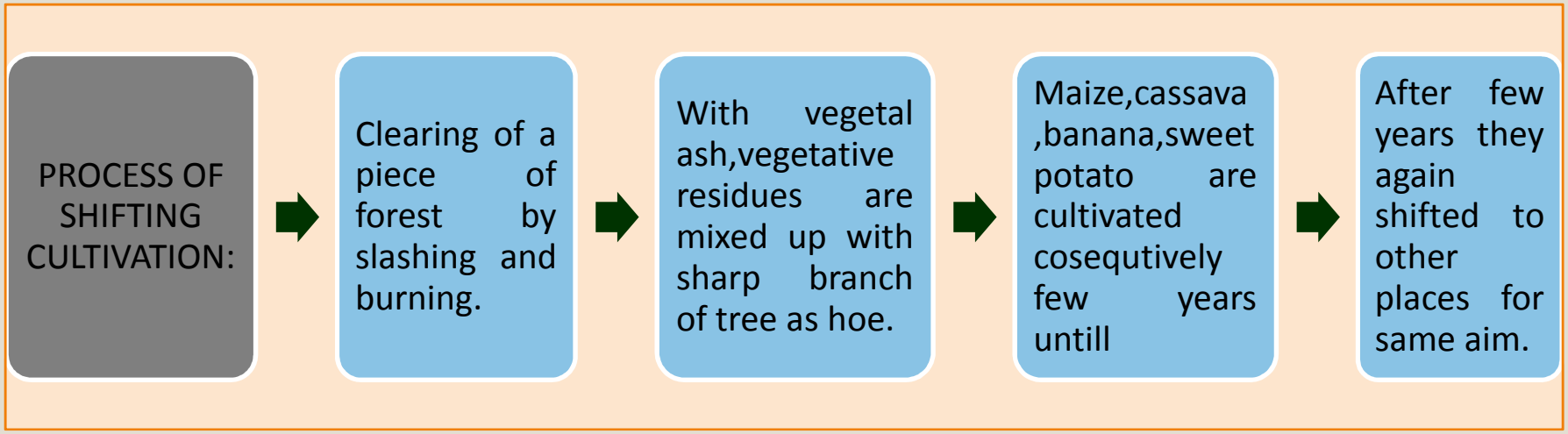

CHRACTER OF SHIFTING CULTIVATION:

- ✓It is confined to small scattered areas within tropical rainforest.
- ✓Clearing of land with aid of fire.
- ✓Use of hand implements and hand labour.
- ✓No application of manures.
- ✓Absence of drought animal
- ✓Small cultivated patch usually 0.5to 1 hectare.
- ✓Land tenure ship is for clan not for individual
- ✓Small amount of production and most of them used only for subsistence
- ✓Land rotation is practised instead of crop rotation.
- ✓Hunting , fishing ,gathering are their supplementary jobs

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SEDENTARY AGRICULTURE:

Agriculture as practiced in one place by a settled farmer in which fields are not rotated is called sedentary agriculture. The term was used for primitive agriculturists in tropical Africa who framed the same piece of land indefinitely in contrast to shifting cultivation.

Characteristics

- Small size of the holding
- Farms are subdivided due to prevalence of inheritance law.
- Use of hand implements
- The cultivators concentrate on the cultivation of food crops especially rice
- Crop rotation is practiced .
- The domesticated animals are used for draught purposes as well as for milk and meat
- Success of the venture depends on nature.
- Possibility of land degradation and environmental degradation are more.

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INTENSIVE SUBSISTENCE FARMING WITH AND WITHOUT PADDY DOMINANCE

This type of farming is distinguished by the relatively large amount of effort to produce Maximum feasible yield from a given parcel of land. It is found in the densely populated regions of the world. Relatively large number of people depend on small quantity of land resulting into small farm size and high yield rate. Intensive farming system attempts to optimize all the available inputs for farming. Even then, this farming may not be cost efficient.

Major areas:

It is most commonly found in the countries of South ,South-east and East Asia. Some of the major countries are India, China, Bangladesh, Thailand and Indonesia

GEO-A-CC-4-08-TH-ECONOMIC GEOGRAPHY UNIT-II TOPIC:7

Major Characteristics:

1.Small Farm Size

2.High labour Input

3.High yield rate

4. Low per capita output

5.Dependence on environment

6. Emphasis on food grain cultivation

7.Influence of market

8. Double or multiple cropping pattern

9.Significance of animals

10.Farming technology

Intensive with Wet Rice Not Dominant

- Climate prevents rice from being grown throughout Asia
  - Wheat most important crop after rice
  - Other grains include
    - Barley
    - Millet
    - Oats
    - Corn
    - Soybeans
    - sorghum
- Land still used intensively and worked primarily by human power
  - Some assistance with animals

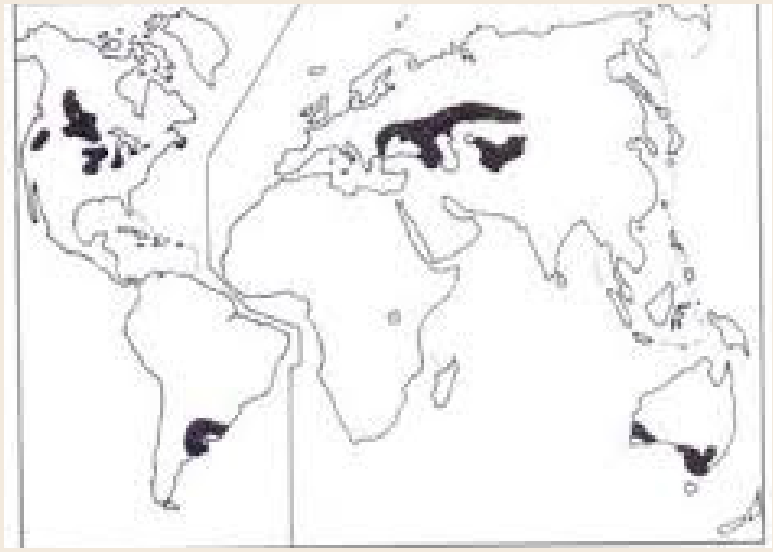
GEO-A-CC-4-08-TH-ECONOMIC GEOGRAPHY UNIT-II TOPIC:7

EXTENSIVE COMMERCIAL FARMING

This type of farming is identified by an abundance of agricultural land with a low labour input .Supply of land is significantly greater than demand primarily due to the low density of population and lesser significance of agriculture as an occupation. Extensive agriculture aims to obtain maximum production per unit of man power. Yields per hectare may be low and land may be wasted , but farming is undertaken with minimum attention and expense in relation to returns. This farming system has a tendency to become mechanized. and capital intensive

Major areas:

Countries with significant Development of extensive Farming are U.S.A ,Canada, Argentina and Australia.
This farming is also found in some parts of Asia which are sparsely populated and land is not much productive e.gNW China,W Asia.



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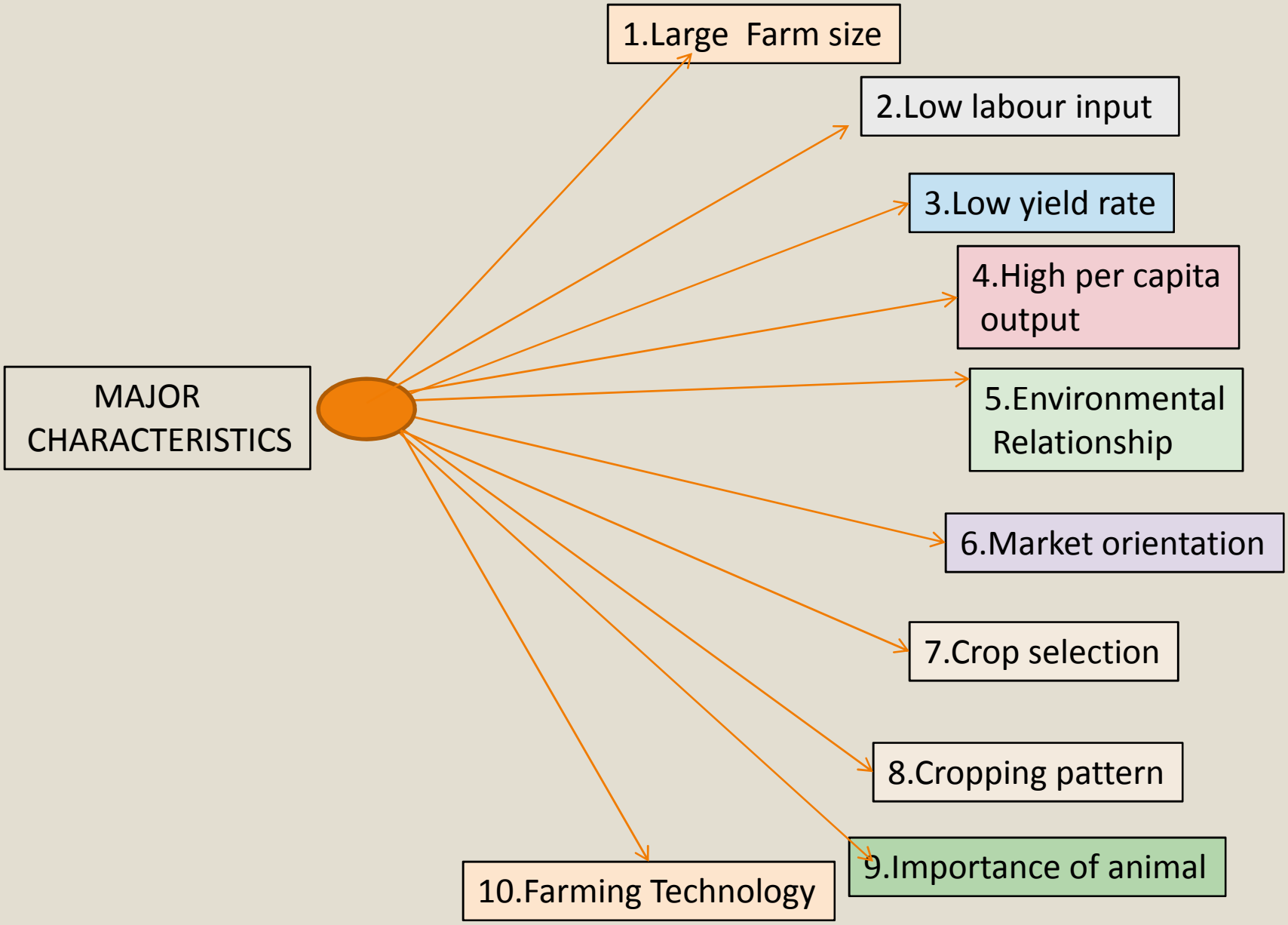

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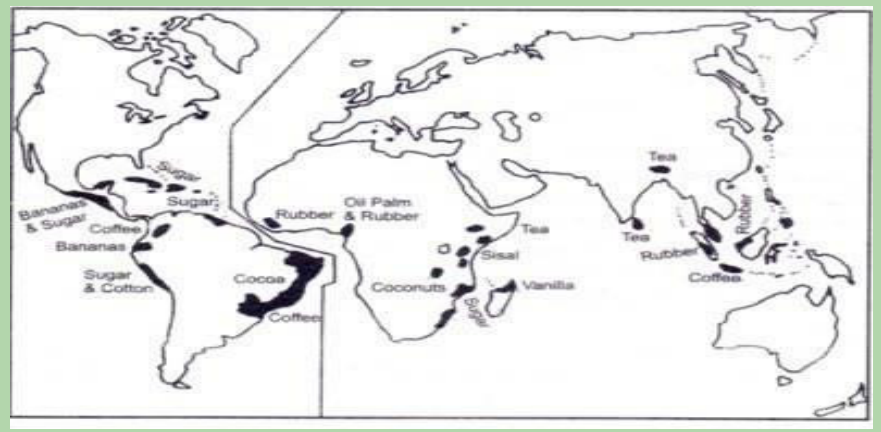
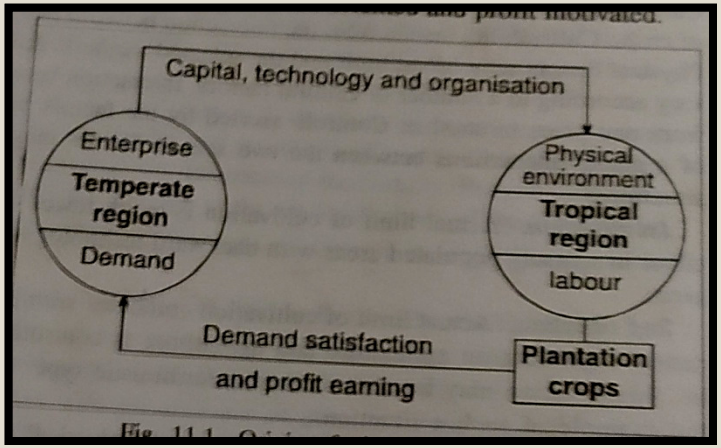
COMMERCIAL PLANTATION FARMING

This alien system introduced into regions suitable for production of tropical commodities needed by the industrial countries,ocuupies in the aggregrate a very small area compared with other types outlined.

Major areas
It is found in many parts of the colonial countries like India(tea),Brazil(Coffee),Indonesia (Rubber), Srilanka(Tea,Coffee),Mexico(Banana)





GEO-A-CC-4-08-TH-ECONOMIC GEOGRAPHY UNIT-II TOPIC:7

Major characteristics:

- ❖Estate Farming
- ❖Foreign ownership but local labour
- ❖Scientifically managed
- ❖Heavy capital outlay
- ❖Long gestation period
- ❖Mono crop culture
- ❖Associated processing unit
- ❖Export oriented cultivation
- ❖Perennial crop
- ❖Extensive agriculture
- ❖Labour intensive but highly mechanized cultivation

Problems:

- ❑Prevalence of diseases
- ❑Massive undergrowth
- ❑Deterioration of tropical soil
- ❑External market dependence
- ❑Food scarcity
- ❑Regional income in equability
- ❑Economic backwardness of the local people because of fly of profit to foreign
- ❑Ecological imbalances
- ❑Political turbulence

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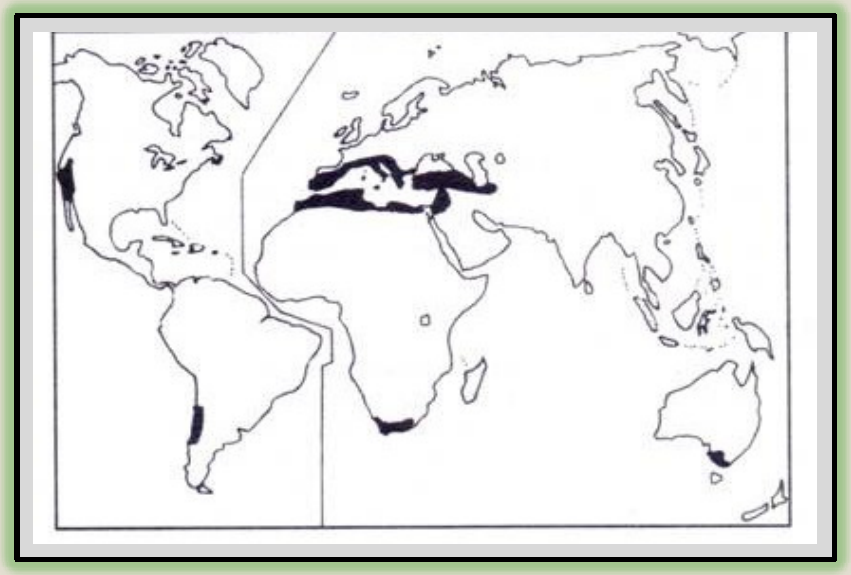
MEDITERRANEAN AGRICULTURE

The climate and its association with mountains has created a distinctive stock and crop association of related functioning forms ; all-year or winter crops grown with rain, all-year or summer crops grown with irrigation , and livestock- mainly small animals-grazed on lowlands in winter on highlands in summer.

Major areas

This type of agriculture is confined to the coastal areas of the Mediterranean Sea in Europe, Asia Minor and North African coastal strips. Areas having Mediterranean type of climate located at different parts of the world are the areas where this type agriculture is practiced.

- Figs, vine laden trees, usually elm, poplars and ash, juicy citrus fruits etc. are important plants and products found in this type of climate.
- Livestock is raised by- trance humans and animal husbandry



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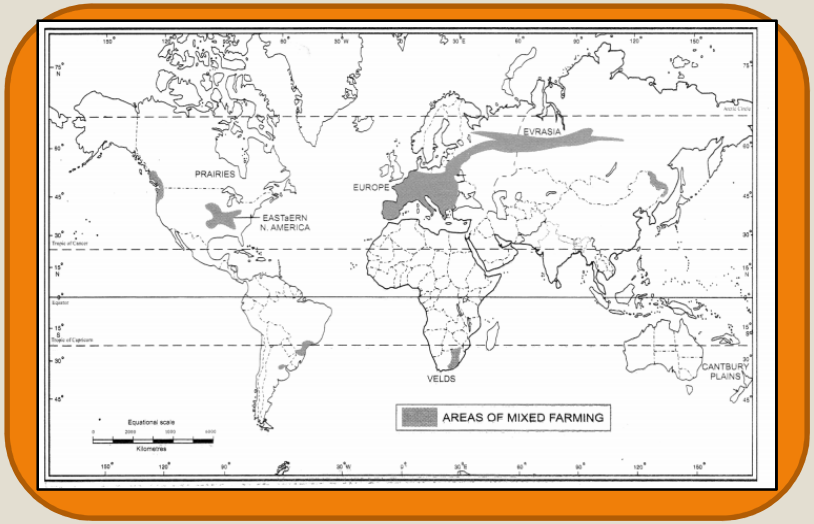
Commercial Livestock and crop farming

- It is commonly known as mixed farming as 'culture involves both crops and livestock'
- It is found in Europe, where it originated, and in the humid middle latitude so all the other continents except Asia.
- Its development, however, is governed closely by market possibilities, with tariffs, subsidies etc. influencing choice of crop or livestock.
- In the light of these and of climatic influences, varying emphasis is given to the different grains, root crops, cattle, sheep and pigs.
- Mechanization ,crop rotation and use of fertilisers are normal.



CROP ROTATION

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SUBSISTENCE CROP AND STOCK FARMING

•Originated in Northern Europe and resembles mixed farming in some of the crops and animals found on the farms, but little or nothing is sold off the farm .

•At the time when Whittlesey wrote, this type was in decline with the beginnings of reform in Russia and, to a lesser extent, in other countries.

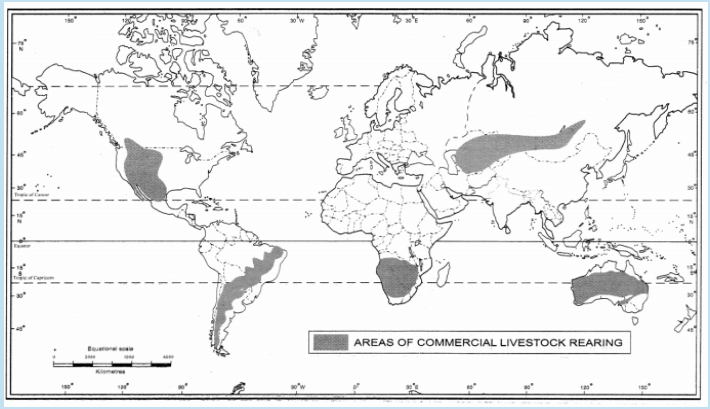
•These changes have now progressed so far that as originally described it is relatively unimportant ,though there are still many regions where sales off farms account for only a somewhat small part of the gross output.

COMMERCIAL DAIRY FARMING

Cattle rearing particularly rearing of mulch cows in order to meet demand of milk and milk products in urban areas are referred to as dairy farming.

Dairy farming in its real form developed in Europe in response to the demand of milk in industrial urban centers and in most places it is acquiring the commercial status .

This farming requires large capital, elaborate buildings, machines for feeding, milking, cleaning,Soils for fodder etc.



Refrigeration and storage of milk are very expensive. According to Whittlesey the radius for shipping fresh milk is, roughly, overnight; for cream twice as far; while refrigerated butter and many kinds of cheese can be supplied across the world.

Dairy farmers also grow fodder crops such as grasses, corn,oats and wheat.

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SPECIALIZED HORTICULTURE:

Specialized horticulture has also developed in response to the large demand in urban centers for food stuffs but the most ancient districts of specialized horticulture are the vineyards of Europe outside the Mediterranean climate

•Horticulture is well developed in countries like Britain, Denmark, Germany, Netherlands, France and Italy. Since these countries are highly developed and there is heavy demand for fresh fruits and vegetables.

•Major products of horticulture are fruits and towers.

Both these items are produced by the farmers for trade besides meeting their own requirements.

•In USA it is termed as 'truck farming' as the vegetables and fruits grown far away from urban industrial centers are supplied to the markets through the truck and transport carriers.

For more information on Agriculture follow these links:

https://www.factretriever.com/farming-facts

https://www.dosomething.org/us/facts/11-facts-about-sustainable-agriculture

http://www.factsninfo.com/2015/06/indian-agriculture-facts-information.html

https://www.ibef.org/industry/agriculture-india.aspx

https://en.wikipedia.org/wiki/Agriculture_in_India

https://www.alvinisd.net/cms/lib/TX01001897/Centricity/Domain/1121/subsistence%20vs%20commercial.pdf

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FORESTRY

Forestry is the art and science of managing the forest so as to yield, on a continuous basis, a maximum in quality and quantity of forest products and services. In broad sense, it is for the handling of forest land to satisfy the needs of man. It includes the logging ,manufacturing, marketing and use of wood products. Forest can be managed for single or multi purposes, to include protection of watershed, production of timber, wildlife conservation, regulation of stream flow, recreation, erosion control and general aesthetics.

Branches of forestry

1.Agro forestry 2.Dendrology3.Forest ecology 4.Forest economics 5.Forest hydrology 6.Forest management7.Forest Mensuration8.Forest protection 9.Silviculture 10.Tree breeding11.Urban forestry 12.social Forestry 13.Farm forestry 14.Community forestry15.eco forestry,16.Energy rotation forestry 16.Short rotation forestry 17.Analog forestry 18.Boreal Forestry.

For Detail discussion on forestry follow the link given below:

https://www.geographynotes.com/forestry/forestry-definition-branches-costs-programme-and-conclusion-geography/8370

GEO-A-CC-4-08-TH-ECONOMIC GEOGRAPHY UNIT-II TOPIC:7

Some Additional Discussion……..

(Why is lumbering ill-developed in the equatorial region of the world?)

Lumbering is not a significant economic activity in equatorial evergreen forest areas with the exception of Malaysia and some places of Indonesia and Brazil. Felling of the trees is mostly for the purpose of non-commercial use (mainly for local consumption) of fuelwood. Resource for the poor development of lumbering may be described as follows.

1. **Inaccessibility.** Equatorial forests are highly inaccessible due to dense growth and also due to the presence of innumerable varieties of creepers and small parasitic plants. It is very difficult to enter the forest even on foot and use of mechanised transport inside the forest areas is mostly an impossible task. So extraction of timber from the forest becomes difficult.
2. **Numerous varieties.** Equatorial forests have the largest varieties of trees as compared to any other type of forest in the world. Economically valuable trees which are few, are found to be highly scattered. This makes a lumbering operation very difficult.
3. **Great height and hardness of the trees.** Trees are very tall and many of these trees are of extreme hardwood varieties. These create problem for cutting the timber and bringing it out of the forest areas. Hardwood varieties of trees can not be used as raw materials for several forest based industries like paper, match box, woodboard etc. So, this forest can not promote the development of these wood-consuming industries. As a result, lack of ready demand hinders the investment on lumbering.
4. **Unhealthy physical environment.** Climate is very hot and humid throughout the year which is unhealthy and uncomfortable for human beings. Lowland areas are dotted with marshes and swamps which are full of insects and some of these are harmful and even deadly (like *tsetse fly* in Africa) for human beings. So physical environment in general is not very suitable for the development of large scale human settlements
5. **Economic backwardness.** Equatorial region is economically one of the most backward regions of the world. As a result, technology is highly backward and capital availability is poor.
6. **Distance from the market.** Purchasing power of the people in the countries of the equatorial region generally very low due to economic backwardness. As a result, market areas of the timbers are found be far from the forest areas. It causes high cost of transport and greater uncertainty in demand.

Lack of government initiative. Adequate initiative from the governments of the respective countri… generally absent and in some cases unplanned exploitation leads to environmental degradation.

REF: RESOURCE STUDIES: A.MITRA

Discussion point 2 : Reasons for the development of lumbering in the coniferous forest areas.

(Why is lumbering well developed in the northern temperate region of the world?)

Commercial lumbering is highly developed in the coniferous forest areas of the northern temperate region. Except Russia where forests are generally located in the remote areas, lumbering is highly organised in this region and creates direct and indirect opportunities for job. Some of the important countries are Canada, U.S.A., Sweden and Finland. Reasons for the development of lumbering in the softwood forest areas of the northern temperate region may be explained as follows.

1. **Industrial importance of softwood.** Coniferous forest comprises softwood varieties of trees which are used as sources of raw materials for different forest based industries. As a result, there has been a steady demand for softwood timber from these industries which promotes the development of lumbering.
2. **Easy accessibility.** Coniferous forest areas are highly accessible due to the absence of undergrowth and lower level branching of the trees. As a result, mechanised transport system can be used to enter the forest areas and bring out the timbers.

REF: RESOURCE STUDIES: A.MITRA

3. **Pure stands.** Pure stands of the trees are favourable for locating and obtaining required varieties of trees without much difficulty.
4. **Infra-structural facilities.** The countries in the northern temperate region are developed countries. So, there is no dearth of infra-structural facilities like well developed transport network, capital availability, modern forest management practices, etc.
5. **Skilled workers.** Physical environment in this region is highly unsuitable for agriculture. As a result, lumbering has been developed as a traditional primary occupation and so, skilled workers are easily available.
6. **Nearness to market.** Forest based industries are generally developed in the south of coniferous forest areas. So, the market areas are located near the forest areas which is a favourable factor for the development of lumbering.
7. **Mechanised lumbering.** Lumbering in this region is highly mechanised which increases the efficiency and reduces the cost.
8. **Government initiative.** Governments of these countries play important roles for adopting proper forestry management and developing organised forestry practices. For this reason, there is no loss of forest areas in spite of lumbering. Role of government in forest management and administration is most significant in Canada.

REF: RESOURCE STUDIES: A.MITRA

3.5 Social Forestry and Agro-Forestry

❑ Social Forestry

Social forestry can aptly be described as forestry of the people, by the people and for the people. Social forestry means the management and protection of forests and afforestation of barren lands with a purpose of helping in the environmental, social and rural development as against the traditional objective of seeking revenue. Social forestry scheme requires the following :

1. Utilisation of all the wastelands and common areas for the forestry.
2. Active participation of the rural people.
3. Awareness programme for the development and maintenance of forest areas.
4. Necessary training facilities.
5. Continuous monitoring of social forestry activities.

❑ Major Benefits of Social Forestry

1. ***Employment potential.*** Increased employment potential is clearly one of the most important benefits of social forestry because in any plantation programme labour component accounts for about 60% to 70% of the total expenditure. Social forestry plantations also generate indirect employment by providing raw material for many forest based industries.

2. ***Fuelwood supply.*** Fuelwood meets the bulk of the requirement of total energy supply in the rural domestic sector of the developing countries. Quick maturing varieties of trees planted under social forestry programme may be used as fuelwood, and these can also save the natural forest areas.

3. ***Cottage industries.*** Social forestry plantations open up a vast store of raw materials that may be used for a number of cottage industries such as furniture, baskets, wood carvings, sports goods, handmade paper, etc.

4. ***Soil conservation.*** Soil erosion is a major problem in many areas which may convert agricultural lands into barren waste. Social forestry can save these agricultural areas by protecting the soil.

REF: RESOURCE STUDIES: A.MITRA

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5. ***Flood control.*** Social forestry plantations help in flood control in the following manner : (a) forming a natural bund along the river; (b) reducing surface run off; (c) reducing the quantity of silt being brought down by the river water.

❑ **Agroforestry**

The term "agroforestry" encompasses any and all techniques that attempt to establish or maintain both forest/tree and agricultural production on the same piece of land. All forms of agroforestry are characterised by (i) the deliberate growing of woody perennials on the same unit of land as agricultural crops and/or animals, and (ii) a significant interaction between the woody and non-woody components of the system, either ecological or economical.

Agroforestry, unlike social forestry, is practiced by the individuals on their own farmland to derive certain benefits (both economic as well as environmental). Developing a supplementary source of income may become a major motivation for agroforestry.

The forms of agroforestry which have gained recognition in recent years can be grouped into three categories : (a) Agro-silvicultural systems : crops and trees, (b) Silvo-pastoral systems : pastures, legumes, animals and trees and (c) Home gardens : trees and shrubs with crops.

(a) Agro-silvicultural systems. (i) Taungya method in which trees are regularly arranged and agricultural crops are harvested on a temporary basis. (ii) Intercropping with trees in which trees and crops are grown together in various ways. (iii) Shelterbelts and wind breakers which include the forestry to protect the farmlands and to enhance the environmental values.

(b) Silvo-pastoral systems. These include the growing of (i) fast growing fodder shrubs and trees in croplands and pastures; (ii) pastures under plantation crops and (iii) pastures in forest tree plantations.

(c) Home gardens. Areas around the house and raised lands in the midst of rice fields are used for this purpose. In some countries, like Bangladesh, the home gardens supply the forest product needs of the 90% of the rural people.

Purpose. Agroforestry aims at involving the people of rural areas in the conservation programmes by providing the economic opportunities for the participants. Agroforestry includes both fuel as well as non-fuel wood. It helps in converting the wasteland into productive land, checking of soil erosion, meeting the fuel wood requirements of the local people and creating job opportunities .

Areas. The programme has had success in the Third World Countries, particularly the countries of South and South-East Asia. Major participants are India, Bangladesh, Pakistan, China, North Korea and South Korea.

Agroforestry has been increasingly playing a vital role in four situations : (i) ***Critical watershed*** areas major river system; (ii) ***Shifting cultivation*** areas in the lowland humid tropics; (iii) ***Deforested lan*** ched for the purpose of agriculture and (iv) ***Marginal lands*** and ***waste lands*** with varied la

REF: RESOURCE STUDIES: A.MITRA

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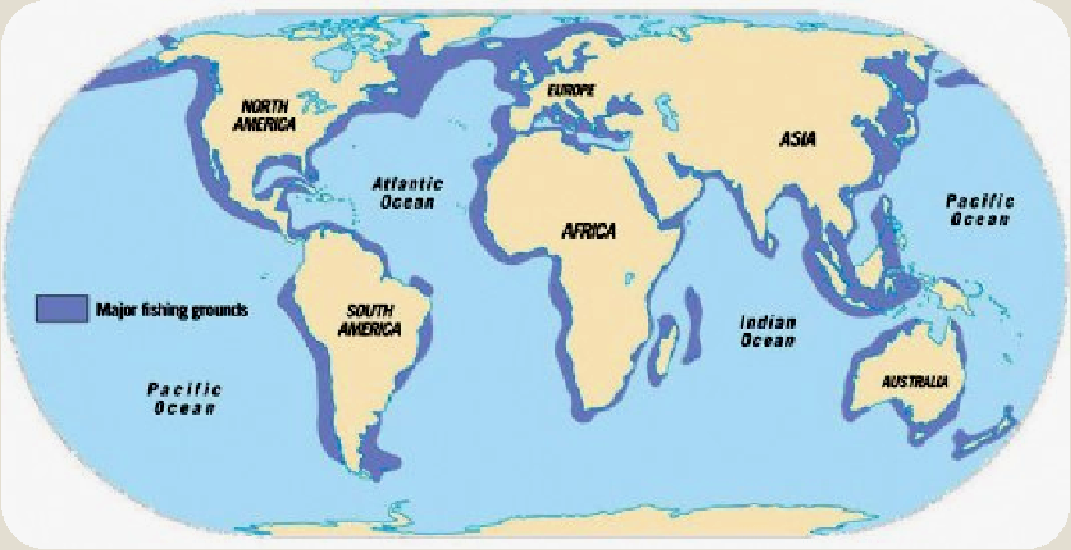
FISHING

World fish production comes from three sources: marine catch from coastal water and high seas; inland catch from lakes,rivers,ponds and canals; and acquqculture,both fresh water and marine.

Commercial fishing predominantly includes sea fishing because it accounts for nearly 80% Of the global fish harvest. Temperate ocean waters in the northern hemisphere are the most important sources of edible fish, although in recent years, significant production also comes From southern hemisphere. Continental shelves and the fishing banks near the coastal areas Are the most important sources of fish catch.



https://www.q-files.com/geography/farming/fishing

SOME IMPORTANT FACTS ON FISHING

- In 2016, 88% of the total fish production (151 million tonne out of 171million tonnes was for direct humaconsumption. This is up from 67 % in 1960s
- China is the world's top fish producer and since 2002,has also been the largest exporter of fish and fish products.
- Alaska Pollock was the top caught species in 2016. Anchoveta came in second.

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- 40.3 million people worked in this primary sector of capture fisheries in 2016.
- The value of world trade in fish and fish products has grown significantly, with export rising from USD 8 billion from 1976 to USD 143 billion in 2016

MAJOR FISHING GROUND OF WORLD:

Traditionally , the four major commercial fishing grounds in the **TEMPERATE REGION** are: i)North east Atlantic, ii) North West Atlantic, iii) North east Pacific and iv) North west Pacific

Major fishing grounds in the **TROPICAL REGION** are:

1. South east Pacific, 2.West central Pacific

For detail discussion on fishing grounds follow the links given below:

https://www.geographynotes.com/fishing-2/fishing-grounds-of-the-world-geography/5528

http://www.yourarticlelibrary.com/environment/sea/temperate-fishing-grounds-5-major-types/74567

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❑ Temperate Fishing

- ***Physical conditions for the development*** -

1. Cool climate. Plankton, which is the most essential fish-food, can survive best in the condition of cool temperature. 20°C is considered as its upper limit for best growth. Hence most of the edible fish species are concentrated in the region of cool temperate climates where temperature of the sea water is below 20°C.

Planktons are of two kinds — phyto plankton and zoo plankton. Phyto planktons (tiny plant organisms) form the food of the zoo planktons (microscopic animals) and the zoo planktons are eaten by fish.

Cool climate also favours preservation of fish because, the ready markets may not always be available near the fish-catching centres.

2. Ocean currents. Most ideal fishing grounds are developed in the regions of convergence of cold and warm ocean currents. These areas are always enriched with the supply of planktons as well as different varieties of minerals due to upwelling of waters.

Convergence of warm gulf stream current and cold Labrador current off the coast of Newfoundland of eastern North America is a very important reason for the development of fishing ground.

3. Presence of continental shelves and banks. Shallow continental shelves are good fishing grounds because, small edible fish are always found near the sea surface (upto a depth of 200m) where sunlight can penetrate.

Elevated seafloors off the coast lines are known as banks which are most ideal fishing grounds. The biggest bank in the world is the Dogger Bank of North Sea.

4. Broken coastline. Broken and indented coastlines are favourable for the development of fishing ports, because, these act as natural harbours. These types of coastline also provide protected calm waters for the spawning of fish. These coastlines were developed during the last glacial age as the product of glacial erosion in the temperate regions. The examples are Fjord coasts of Norway.

- ***Socio-economic conditions for the development of commercial Fishing***

1. Lack of Agricultural Land. Poor agricultural land has been a major consideration for development of fishing occupation in the major fish-catching countries of the world. For example, 12% of the total geographical area of Japan are suitable for cultivation.

2. Labour force. This occupation is not a labour-intensive one. In the last 20 years, mechanisation has considerably reduced the quantity of labour-force. But the demand for skilled labourers has rapidly been increased.

REF: RESOURCE STUDIES: A.MITRA

Tropical Fishing

Fish catching carried out in the tropical region is known as tropical fishing. Tropical region generally includes the area between 30°N. and 30°S. Although this region is physically much less favourable than temperate region for the development of fishing as some of the favourable conditions like low temperatures, broken coastlines etc. are generally absent ; a rough estimate shows that at present more than 1/3rd of the world's total marine fish production comes from the tropical region. Major fish catching nations included in the tropical region are China, Peru, Indonesia, Thailand and India. Chile may also be included since northern half of Chile is within the tropical region. All these countries are in the list

of top ten producers of marine fish. Other important fish catching countries in the tropics are Philippines, Mexico, Malaysia and Myanmar. In most of these tropical countries production of marine fish increased significantly during the last 10 years (1985 to 1995).

- ***Major factors for the development.*** Some of the physical advantages for the development of commercial fishing which are present in the cool temperate areas, are not found in the tropical areas. These include low temperature, high growth of planktons, broken coast lines and convergence of warm and cold ocean currents. In spite of that, fishing in the tropical areas has been gaining significance due to following reasons.

1. Stock of fish. Tropical seas are much less explored for fish catching as compared to the temperate seas. As a result, availability of fish is significantly high.

2. High demand. High growth of population in the countries of the tropics has caused the high demand for proteins. Inland fishing is no more adequate to meet the growing demand. So, these countries have increased their fish catching activities in the sea. Presence of a stable domestic market is a motivating factor for the growth of sea fishing in recent years.

3. Income level. Rise in the income level for a substantial section of people has increased their purchasing power and raised their standard of living. This factor has contributed to the increase in demand for fish.

4. Employment. High growth of population has created the demand for job opportunities. In the primary sector, job opportunities in agriculture have become more or less stagnant because it is an old traditional occupation and recent modernisation has further reduced the possibilities of employment generation. So fishing is being developed as an alternative primary occupation to provide job opportunities mainly to the people of coastal areas. As a result, fishing in these countries is much more labour intensive than the temperate countries.

5. Low cost of fishing. Tropical countries have the advantages of lower cost of fishing due to much lower labour wages as compared to the temperate countries and much less use of modern and sophisticated technological devices which are highly capital intensive. Although cost of refrigeration is high, total cost of fish catching, processing and distribution is much less than those of temperate countries.

6. Participation of the multinational corporations (MNCS) Possibilities of high profit margins have attracted the MNC to invest capital and to bring modern technological inputs for the development of fishing in the tropics. Organised fishing has caused the rapid increase in the production of marine fish in these areas.

7. Earning of foreign exchange. In addition to a stable domestic market, marine fish has a good demand in the international market. For this reason, many of the tropical countries have given emphasis to increase marine fish catch for earning foreign exchange.

8. Low level of pollution. Coastal waters of the tropical region are much less polluted due to poorer presence of industries. This condition facilitates the development of coastal fishing in the tropical areas.

REF: RESOURCE STUDIES: A.MITRA

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REVIEW ARTICLE

MINING AND ITS IMPACTS ON ENVIRONMENT WITH SPECIAL REFERENCE TO INDIA

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ABSTRACT

Mining is the extraction of valuable minerals or geological materials from the earth, usually from an ore body, vein or coal seam. Materials recovered by mining include bauxite, coal, copper, gold, silver, diamonds, iron, precious metals, lead, limestone, magnesite, nickel, phosphate, oil, shale, rock salt, tin, uranium and molbedium. Any material that cannot be grown from agricultural processes, or created artificially in a laboratory or factory, is usually mined. Mining in a widersense comprises extraction of any non renewable resource eg, petroleum, natural gas. Mineral resources are vital for the economic growth and development of the country. Minerals worth Rs. 73945 crore were produced in India in 2004-05. Opencast mining operations to result the minerals like limestone, bauxite, iron-, chromite, copper- ores and coal are getting more emphasis because of obvious reasons but are associated with various environmental concerns. One of the major environmental challenges is to handle and manage the huge volumes of overburden generated in the opencast mines. This paper presents the assessment of environmental impacts of overburden such as visual (aesthetics, landscape), soil erosion, ecological disruption, air and water pollution, safety, risk and health etc. Economic valuation aspects of environmental impacts of overburden are also briefly described in his paper.

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INTRODUCTION

Minerals are indispensable components of the national economy of any country. India is endowed with significant mineral resources. More than 0.8 million hectares of land is under mining - a substantial portion of which lies in forest areas. There are about 20000 known mineral deposits in India and as many as 89 minerals (4 fuel, 11 metallic, 52 non-metallic and 22 minor minerals) are produced worth Rs. 73944.59 Crore. (Annual Report 2004–05, Ministry of Mines). There are about 3000 working mines in the country (excluding crude petroleum, natural gas, atomic and minor minerals) including 350 opencast mechanized mines of which two thirds belong to limestone and iron ore. There is a progressive increase in average size of mine due to adoption of heavy earth moving machinery with increased production of overburden thus aggravating the existing environmental challenges. Opencast mining operations result in dumping of huge volume of overburden on unmined land in addition to pit-scarred landscape. This overburden originates from the consolidated and unconsolidated materials overlying the minerals and coal seams, and is required to be removed. One of the major environmental challenges is to manage the huge volume of overburden generated in these opencast mines which is associated with the problems of aesthetics, visual impacts and landslides, loss of topsoil, soil erosion, water and air pollution, ecological disruption, social problems, safety, risk and health etc. In addition, open cast mines makes a marked change in the land use and the challenge lies in developing suitable post-mining land use.

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Visual Impacts

Among the potential negative impacts of mining, the visual impact of opencast mining (over burden dumping, etc) deserves special attention. Visual impacts include aesthetic & scenic and landscape aspects. Visual and land use compatibility of rehabilitated mined land is the single most important consideration in designing a combination of landforms and revegetation processes. While there can be occasions where a change to a completely different land use is beneficial, for example from previous agriculture to industrial real estate. Generally speaking, the significance of the change is linked to the topography of the area and to the type of landscape and vegetation. The significance of the visual impact depends on the distance, the weather conditions and the height of the

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viewpoint. In any case visual impact is not easily discussed in absolute terms. Whether or not an over burden dump is unpleasant to the eye besides the subjective dimension of the question is very much a matter of integration into the surrounding environment (Jain, 2003). Physical screening, screen planting, landscaping and the use of existing features contribute to local surroundings. Clearly, it is difficult to measure visual impacts quantitatively through standards and regulations. It is generally agreed, that the value placed on a certain type of landscape is a subjective issue and in some cases, for example, authorities have refused permits for landscape reasons, when in fact, there is no opposition from local residents.

Erosion and sedimentation

Degradation due to erosion starts right from the source viz., rainsplash on overburden dumps induce erosion which goes on increasing in the form of sheet, reel and gully erosion. Gully erosion affects the aesthetic quality of the site as well as stability of the dumps. Nutrient value of the dumps goes down which might be helpful in revegetation of the dump top and dump slopes. Along with these the material is also lost from the dumps. Because of the large area of land disturbed by mining operations and the large quantities of earthen materials exposed at sites, erosion can be a major concern at hard-rock mining sites. Consequently, erosion control must be considered from the beginning of operations through completion of reclamation. Erosion may cause significant loading of sediments (and any entrained chemical pollutants) to nearby water-bodies, especially during severe storm events and high snowmelt periods. Sediment-laden surface runoff typically originates as sheet flow and collects in rills, natural channels or gullies, or artificial conveyances. The ultimate deposition of the sediment may occur in surface waters or it may be deposited within the flood plains of a stream valley. Historically, erosion and sedimentation processes have caused the build-up of thick layers of mineral fines and sediment within regional flood plains and the alteration of aquatic habitat and the loss of storage capacity within surface waters (Barve, 2011). The main factors influencing erosion includes the volume and velocity of runoff from precipitation events, the rate of precipitation infiltration downward through the soil, the amount of vegetative cover, the slope length or the distance from the point of origin of overland flow to the point where deposition begins, and operational erosion control structures. Major sources of erosion/sediment loading at mining sites can include open pit areas, heap and dump leaches, waste rock and overburden piles, tailings piles and dams, haul roads and access roads, ore stockpiles, vehicle and equipment maintenance areas, exploration areas, and reclamation areas.

Impacts on water quality

Surface Water

One of the problems that can be associated with mining operations is the release of pollutants to surface waters. Many activities and sources associated with a dumpsite can contribute toxic and non-toxic materials to surface waters. The mobility of the pollutants from these sources is magnified by exposure to rainfall and snowfall. The eventual discharge of surface runoff, produced from rainfall and snow melt, is one mechanism by which pollutants are released into surface waters. Impacts to surface waters include the build-up of sediments that may be contaminated with heavy metals or other toxic products, short- and long-term reductions 3 in pH levels (particularly for lakes and reservoirs), destruction or degradation of aquatic habitat, and contamination of drinking water supplies and other human health issues.

Acid drainage

It is generally acknowledged that one of the major environmental problems facing the mining industry is the formation of acid drainage and the associated mobilisation of contaminants. Commonly called acid mine drainage (AMD) or acid rock drainage (ARD) primarily depends on the mineralogy of the rocks and the availability of water and oxygen. AMD occurs at mine sites when metal sulphide minerals are oxidised. Before mining, oxidation of these minerals and the formation of sulphuric acid is a (slow) function of natural weathering processes. Natural discharge from such deposits poses little threat to aquatic ecosystems except in rare instances. Mining and beneficiation operations greatly increase the rate of these same chemical reactions by removing sulphide rock overburden material and exposing the material to air and water. The dominance of the oxidation reactions become obvious when discharged ground water comes into contact with oxygen, precipitating iron oxihydroxides and decreasing pH (Wisotzky and Obermann, 2001). Once acid drainage has occurred, controlling the releases is a difficult and costly problem. Hence prediction is becoming an important tool for regulators and operators. The addition of alkaline substances (crushed limestone to the overburden before dumping can reduce the acid drainage (Wisotzky and Obermann, 2001).

Siltation of Nallah and other Retaining Structure

Carrying Capacity: Pumped out water from the sump goes outside the leasehold boundary and siltation of nallah and other retaining structure is caused due to erosion of overburden dumps by rainfall. This also results in the loss of carrying capacity of the stream thus increasing the potential for flooding. Water Quality Effect on Human Health: Reduction in the quantity and deterioration in the quality of water is also an associated physical effect to nearby dwellers. Impact on health of human and other creatures using the polluted water is another identified physical impact. Nutrient levels, such as, N & P also increases resulting in eutrophication and other water pollution problem.

Ground Water

Mining operations can affect ground water quality in several ways. The most obvious occurs in mining below the water table, either in underground workings or open pits. This provides a direct conduit to aquifers. Ground water quality is also affected when waters (natural or process waters or wastewater) infiltrate through surface materials (including overlying overburden waste or other material) into ground water (Thakur, 2013). Contamination can also occur when there is a hydraulic connection between surface and ground water. Any of these can cause elevated pollutant levels in ground water. Further, disturbance in the ground water flow regime may affect the quantities of water available for other local uses. Finally, the ground water may recharge surface

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water down-gradient of the mine, through contributions to base flow in a stream channel or springs. Dumping of overburden should be avoided from mines in valleys or depressed tracts on the side of mined area that constitute the basic source of water supply either from surface or groundwater bodies (Nriagu, 1988). In Jamarkatra phosphorite mines, this impact is reflected as the major waste dumps made in the southern valley that contains the shallow groundwater and surface water for providing water supplies.

Impacts on air quality

Air erosion on the dump is very low compared to water erosion but it also degrades the air environment of the mine leasehold area as well as outside the boundary (Nriagu, 1988). During the course of 4 water erosion, material gets loosened and makes it susceptible to air erosion. The primary air pollutant of concern at mining sites is particulate matter. US/EPA has established National Ambient Air Quality Standards for particulate matter with a diameter of less than 10 microns. Operation of heavy earth moving machinery in the overburden dumps generate huge amount of dust and the high wind velocity moves the dust particle to the nearby residential areas which creates a lot of problems.

- The generation of dust particles can be controlled with the help of following methods: Water sprays can be used for control.
- The slope of the haul road in the dump should be optimized for the smooth movement of the dumper and that reduces the dust generation.
- Height of the waste rock dumping should be minimized to reduce the dust generation by wind erosion.
- The dumps should be, wherever feasible, made in such a manner that the impact of predominant wind direction is minimum.
- Wind also entrains dust from overburden dumps and spoil piles (either dry as disposed or the dry portions of impoundments), and other disturbed areas. Sprays from water trucks are often used when the mine is operating.
- During temporary closures, particularly after the active life, stabilization and reclamation should be aimed in part at reducing fugitive dust emissions. Rock and/or topsoil covers, possibly with vegetative covers, can be effective controls.

Noise pollution

The heavy earth moving machinery operations in the overburden handling leads to an increase in the noise levels in the nearby residential areas also. However, at the planning stage the proper selection of the dumpsite can eliminate noise impacts to the residents. During the operation stage the noise level in the overburden dump sites can be minimized by the following methods:

1. Minimize the haul road gradient in the dump as far as possible. Since the noise level of the dumper depends upon the power required by the engine. Lower the gradient of the haul road, lower the power needed and hence the noise level can be minimized to some extent.
2. Reduce the overburden material falling during the dumping operation.

Ecological disruption/ impacts

Opencast mining activities cause severe changes to the landscape. Overburden dumps are man-made habitat causing multifarious environmental problems ranging from erosion and enhancing sediment load in receiving water bodies, dust pollution, damage to visual & aesthetics, fragmentation of habitat and overall disturbance of ecosystem in the entire area. The magnitude of ecological impacts depends upon existing ecological setting of the area where mining activities are taking place. Sediments deposited in layers in flood plains or terrestrial ecosystems can produce many impacts associated with surface waters, ground water, and terrestrial ecosystems. Minerals associated with deposited sediments may depress the pH of surface runoff thereby mobilizing heavy metals that can infiltrate into the surrounding subsoil or can be carried away to nearby surface waters. The associated impacts could include substantial pH depression or metals loading to surface waters and/or persistent contamination of ground water sources. Contaminated sediments may also lower the pH of soils to the extent that vegetation and suitable habitat are lost (Barve, 2011).

Effect on aquatic life

The nallas ultimately terminate into river or reservoir. There the water pollution is caused due to increase in total solids, other minerals and leachates from the dumps. This results in reduction of dissolved oxygen of water. This in turn affects the aquatic life. Discoloration of water is another facet of pollution from aesthetic point of view. The types of impacts associated with erosion and sedimentation are numerous, typically producing both short-term and long-term impacts. In surface waters, elevated concentrations of particulate matter in the water column can produce both chronic and acute toxic effects in fish and other aquatic life.

Loss of soil fertility

The run-off water directly going to nearby fields or passing through them changes the salt content of soil and subsoil layers thereby reducing the fertility of the land. This manifests itself in the form of loss of yield of crop. Apart from this nearby settlements are always affected by the degraded environment in terms of water and air pollution, which also affect the health as well as their production from the fields (Nriagu, 1988). Beyond the potential for pollutant impacts on human and aquatic life, there are potential physical impacts associated with the increased runoff velocities and volumes from new land disturbance activities. Increased velocities and volumes can lead to downstream flooding, scouring of stream channels, and structural damage to bridge footings and culvert entries.

Safety, risk and health

Physical stability of mine is an important long-term environmental concern because of the amounts of materials involved and the consequences of slope failure (Mehta, 2002). Mining operations can result in the formation of slopes composed mainly of overburden (earth, rock, tailings, other mine wastes, or combinations of materials). Landslides in the

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hilly terrains due to steepening of slopes during opencast mining operations

are quite common. Other than sheer physical impacts, catastrophic slope failure can affect the environment or human health when toxic materials are released from the failure especially if it occurs in an area where such a release results in a direct pathway to receptors (Saxena, 2002). Ensuring physical stability requires adequate pre-mining design of overburden waste management units and may require long-term maintenance. Slope failure results from exceeding the internal mass strength of the overburden materials composing the slope. This occurs when the slope angle is increased to a point where the internal mass strength can no longer withstand the excess load resulting from over steepening or overloading of the slope. When the driving forces associated with over steepening exceed the internal resisting forces, the slope fails and the materials move to a more stable position. In 1996, Mr Dhani Ram, senior OM got buried in the OB dump of Kusmunda Project and then Sub area Manager Mr. O P Singh could only escape by a hair line difference of the sliding punch of the OB dump which was momentary. Sliding of some of the UK dumps which tolled up 100s of the school kids is an infamous episode. These are the lessons to be learnt for future for encountering such types of risks and safety from overburden dumps.

Effect on social life

Settlements near to the overburden dump sites are prone to the risk of mud sliding from the dumps in the case of slope failure. In that situation the entire muck etc. enters in the settlement and affect in many ways (Sengupta, 1993). This was the case happened in Chilkad and Basti, nearby Khadia overburden dumps. In the mean time a channel has been constructed through the Basti to drain run-off water successfully.

Economic valuation of environmental impacts of overburden

The costs of externalities like soil erosion, fertility loss, water and air pollution safety risk & health etc. should be envisaged and commensurate with the production cost so as to highlight the economic valuation of environmental costs associated with handling of overburden. These costs of externalities should be internalized in the cost of production. Overburden dumps should be both physically and biologically stabilized and the cost of such reclamation considered as cost of replacement should be included in the cost of production. Overall this will provide economic value to the rehabilated overburden dumps in the long run. It has been established that over 70% of total annual cost associated with erosion is assigned to the production loss in the mine as a result of overburden run-off blocking the haul road and faces and only about 10% of the total cost in assigned for various control measures to check siltation and in cleaning maintenance etc. (Adibee, *et al.*, 2013). Many of the impacts of overburden inside the pit are generally taken into account of the lost of production. However, most of the impacts of overburden outside the pit are still externality and signaling the failure of market for environmental goods and services and environment degradation takes place on continual basis. Economic valuation of environmental impacts of overburden facilitates to draw a picture of true lost associated with the impacts as well as the externalities, not being taken into account of the cost of production.

Overburden management

The following factors are of crucial importance in selecting a site for disposal of overburden including mines wastes:

i. Proper area for disposal should be identified at the planning stage.
ii. The sites should always be located on a secure and impervious base (solid rock if possible).
iii. Their location and building up should ensure minimum leaching effects due to natural precipitation
iv. The sites should be as far away as possible from natural water courses, shallow aquifers etc.
i. Where this is not feasible uncontaminated fresh water streams etc. should be diverted from such waste storage areas.
ii. Overburden wastes with abnormally high concentrations of iron sulphides or other undesirable reactive elements should be disposed off in sanitary landfills.
v. Such dumps and piles must not be permitted to become a major visual feature of the local landscape. The height of the dump should preferably to exceed the mature tree top level in the area. The type and characteristics of the overburden waste rock is also important in determining the height of the dump. Low height dumping of pyritical material minimizes oxidation and leaching, while low height coal dumps reduce the risk of spontaneous combustion.

Various techniques for overburden waste disposal

i. Utilization of the overburden and mine waste by back-filling to help in reclamation, restoration and rehabilitation of the terrain, without affecting the drainage and water regimes.
ii. Dumping the over-burden and wastes in available low lying areas accompanied by leveling and providing soil cover to utilize the land profitably.
iii. If considered suitable, the wastes may be used as road metal or construction aggregates, after crushing to proper size.
iv. The overburden dump must be properly graded and terraced with contour drainage as necessary.
v. Terracing of overburden dumps must be accompanied by stabilization of the slopes and terraces using proper vegetation.

Contamination of water

The effects of untreated effluent of mining industries pumping into public water ways, releasing harmful gas emission into the atmosphere, uncontrolled toxic dust, or dumping wastage which leeches dangerous chemicals into the groundwater table has fatal implications to the people living in the surrounding areas. The infamous Bhopal gas tragedy threatens the health of an entire new generation of the city's inhabitants, out of non disposed toxic waste contaminating groundwater. One article states Abdul Jabbar, a crusader for the rights of survivors of the tragedy, "We believe that around 40,000 people in localities close to the plant have been drinking the contaminated water for the last several years"9. Toxic water includes the contamination of heavy metals such as lead, mercury and

uranium and other pollutants such as arsenic and cyanide (Warhate, 2006).

- **Lead:** A build up of lead through consumption develops in the skeleton which is highly dangerous for infants and children up to the age of six years. High levels of lead in the blood lead to central nervous system disorders, decreased vitamin D metabolism, anemia and cancer. For pregnant women the high prevalence of lead in the blood may cross over the placenta increasing the risks of birth defects and difficulties during labor.
- **Mercury:** High levels of mercury can cause brain damage, paralysis, delirium, and incoherent speech. Exposure to mercury through food, water and air can cause significant harm to human health. Methyl mercury, which is the most commonly found form of mercury in the environment, can cause permanent damage to the central nervous system, lungs and kidneys. Methyl mercury intake through fish can put unborn fetuses at great risk. The mercury can cross the placental barrier and cause fetal brain damage without any symptoms in the expectant mother. Newly born infants may experience mental and physical disabilities and delayed development of motor and verbal skills. The symptoms of methyl mercury poisoning are varied and difficult to detect as they can mimic other illnesses. In relatively mild cases, the condition is barely distinguishable from common ailments. Some common symptoms are headache, fatigue, numbness of extremities, depression, memory loss, and in extreme cases, madness, coma or death.
- **Uranium:** The exposure of radioactive wastes to water has fatal health implications such as increased risks of birth defects, brain damage and cancers. In Jharkhand women are delivering physically and mentally challenged children due to the impact of radiation from uranium mines.
- **Arsenic:** occurs naturally or is possibly aggravated by over powering aquifers and by phosphorus from fertilizers. High concentrations of arsenic in water can have an adverse effect on health. A few years back, high concentrations of this element was found in drinking water in six districts in West Bengal. A majority of people in the area was found suffering from arsenic skin lesions. It was felt that arsenic contamination in the groundwater was due to natural causes. The government is trying to provide an alternative drinking water source and a method through which the arsenic content from water can be removed (Thakur *et al.*, 2013).
- **Cyanide:** is used during gold and silver mining to assist in the dissolving of heavy metals during processing. It is highly toxic to humans, as it causes a decrease in Vitamin B12, thyroid damage, decrease in iodine uptake, essential for hormone production and stability an imbalance of hormones disrupts the reproductive system. Exposure during pregnancy increases the risk of birth defects and complications pre and post natal care.

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