

ENVIRONMENTAL GEOGRAPHY -18MAG14E

Syllabus, Unit– III: Man’s modification on Biosphere – Agriculture – Green Revolution – HYV, Bio-Fertilizers, Pesticides, Insecticides– Man’s impact on land, mining, soils and coastal areas.

Green Revolution

The green revolution started in 1965 with the first introduction of high yield seeds in Indian agriculture. This was coupled with better and efficient irrigation and the correct use of fertilizers to boost the crop. The result of the green revolution was to make India self-sufficient when it came to food grains.

After 1947 India had to rebuild its economy. Over three quarters of the population depend on agriculture in some way. But agriculture in India was faced with several problems. First the productivity of grains was very low. And India was still monsoon depend because of lack of irrigation and other infrastructure.

There was also an absence of modern technology. And India had previously faced severe famines during British raj, who had only promoted cash crops instead of food crops. The idea was to never depend on any other country for food sufficiency.

So in 1965 government with the help of Indian geneticists M.S. Swaminathan, known as the father of green revolution launched the green revolution, known as the father of green revolution. The movement lasted from 1967 to 1978 and was a great success.

Features of the Green Revolution

- The introduction of the high yield varieties seeds for the first time in Indian agriculture. These seeds had more success with the wheat crop and were highly effective in regions that had proper irrigation. So the first stage of the green revolution was focused on states with better infra like Punjab and Tamilnadu.
- During the second phase, the high yield variety seeds were given to several other states. And other crops than wheat were also included into the plan.
- One basic requirement for the high yield variety seeds is proper irrigation. Crops from high yield variety seeds need alternating amount of water supply during its growth. So the farms cannot depend on monsoon. The green revolution vastly improved the inland irrigation systems around farms in India.
- The emphasis of the plan was mostly on food grains such as wheat and rice. Cash crops and commercial crops like cotton, jute, oilseeds, etc. were not a part of the plan.
- Increased availability and use of fertilizers to enhance the productivity of the farms.
- Use of pesticides and weedicides to reduce any loss or damage to the crops.
- And finally the introduction of technology and machinery like tractors, harvesters etc. This is helped immensely to promote commercial farming in the country.

Impacts of The Green Revolution

- Increase in agriculture production:
Food grains in India saw a great rise in output. It was a remarkable increase. The biggest beneficiary of the plan was the wheat grain. The production of wheat increase to 55 million tons in 1990 from just 11 million tone's in 1960.
- Increase in per acre yield:
Not only did the green revolution increase the total agricultural output, it also increased the per hectare yield. In case of wheat, the per hectare yield increased from 850 kg /hectare to an incredible 2281 kHz/hectare by 1990.
- Less dependence on imports:
After the green revolution, India was finally on its way to self-sufficiency. There was now enough production for the population and to build a stock in case of emergencies. We did not need to import grains or depend on other countries for our food supply. India was able to start exporting its agricultural produce.
- Employment:
It was feared that commercial farming would leave a lot of the labor force jobless. But on the other hand, we saw a rise in rural employment. This is because the supporting industries created employment opportunities. Irrigation, transportation, food processing, marketing all created new jobs for the workforce.
- A benefit to the farmers:
The green revolution majorly benefits the farmers. Their income saw a significant raise. Not only were they surveying. They were prospering. It enable them to shift to commercial farming from only sustenance farming.

HYV (High Yielding Variety Seed):

- ✚ High Yielding Variety Seeds (HYV seeds) are seeds are of better quality than normal quality seeds. These seeds are a better option of seeds in order to obtain a healthy and surplus crop.
- ✚ These seeds have good immune system to fight with High-Yielding Varieties (HYVs) of agricultural crops are usually characterized by a combination of the following traits in contrast to the conventional varieties:
 - ❖ Higher crop_yield per area (hectare)
 - ❖ Dwarfness
 - ❖ Improved response to fertilizers
 - ❖ High reliance on irrigation and fertilizers - see intensive_farming
 - ❖ Early maturation
 - ❖ Resistive to many diseases
 - ❖ Higher quality and quantity of crops can be produced.

- ✚ Most important HYVs can be found among wheat, corn, soybean, rice, potato, and cotton. They are heavily used in commercial and plantation farms.
- ✚ HYVs become popular in the 1960s and play an important role in the Green Revolution, although their ancestral roots can be older.
- ✚ Hybrid seeds that have been selected and developed to give high productivity with using more chemical fertilizers and pesticides.

Bio fertilizers Definition

- ✚ “Bio fertilizers are substances that contain microorganisms, which when added to the soil increase its fertility and promotes plant growth.”

What is Bio fertilizer?

- ✚ Bio fertilizers are the substance that contains microbes, which helps in promoting the growth of plants and trees by increasing the supply of essential nutrients to the plants. It comprises living organisms which include mycorrhizal fungi, blue-green algae, and bacteria. Mycorrhizal fungi preferentially withdraw minerals from organic matter for the plant whereas cyanobacteria are characterized by the property of nitrogen fixation.
- ✚ Nitrogen fixation is defined as a process of converting the di-nitrogen molecules into nitrogen compounds. For instance, some bacteria convert insoluble forms of soil phosphorus into soluble forms. As a result, phosphorus will be available for plants.

Types of Bio fertilizers

Following are the important types of bio fertilizers:

✚ Symbiotic Nitrogen-Fixing Bacteria

Rhizobium is one of the vital symbiotic nitrogen-fixing bacteria. Here bacteria seek shelter and obtain food from plants. In return, they help by providing fixed nitrogen to the plants.

✚ Loose Association of Nitrogen-Fixing Bacteria

Azospirillum is a nitrogen-fixing bacteria that live around the roots of higher plants but do not develop an intimate relationship with plants. It is often termed as rhizosphere association as this bacteria collect plant exudate and the same is used as a food by them. This process is termed as associative mutualism.

✚ Symbiotic Nitrogen-Fixing Cyanobacteria

Blue-Green algae or Cyanobacteria form the symbiotic association with several plants. Liverworts, cycad roots, fern, and lichens are some of the Nitrogen-fixing cyanobacteria. Anabaena is found at the leaf cavities of the fern. It is responsible for nitrogen fixation. The fern plants decay and release the same for utilization of the rice plants. Azolla pinnate is a fern that resides in rice fields but they do not regulate the growth of the plant.

✚ Free-Living Nitrogen-Fixing Bacteria

They are free-living soil bacteria which perform nitrogen fixation. They are saprotrophic anaerobes such as *Clostridium beijerinckii*, Azotobacter, etc.

Among all the types of bio fertilizers, Rhizobium and Azospirillum are most widely used.

Components of Bio fertilizers

The components of bio fertilizers include:

✚ Bio Compost

It is one of the eco-friendly product composed of waste material released from sugar industries which are decomposed. It is magnified with human-friendly bacteria, fungi, and various plants.

✚ Tricho-Card

It is an eco-friendly and non-pathogenic product used in a variety of crops as well as in horticultural and ornamental plants, such as paddy apple, sugar cane, brinjal, corn, cotton, vegetables, citrus, etc. It acts as a productive destroyer and antagonistic hyper parasitic against eggs of several bores, shoot, fruit, leaves, flower eaters and other pathogens in the field.

✚ Azotobacter

It protects the roots from pathogens present in the soil and plays a crucial role in fixing the atmospheric nitrogen. Nitrogen is a very important nutrient for the plant and about 78% of the total atmosphere comprises of nitrogen.

✚ Phosphorus

Phosphorus is one of the essential nutrients for plants growth and development. Phosphate solubilizing microorganisms, hydrolyse insoluble phosphorus compounds to the soluble form for uptake by plants. Many fungi and bacteria are used for the purpose such as *Penicillium*, *Aspergillus*, *Bacillus*, *Pseudomonas*, etc.

✚ Vermicompost

It is an Eco-friendly organic fertilizer comprises of vitamins, hormones, organic carbon, sulfur, antibiotics that help to increase the quantity and quality of yield. Vermicompost is one of the quick fixes to improve the fertility of the soil.

Importance of Bio fertilizers

Bio fertilizers are important for the following reasons:

- Bio fertilizers improve soil texture and yield of plants.
- They do not allow pathogens to flourish.
- They are eco-friendly and cost-effective.

- Bio fertilizers protect the environment from pollutants since they are natural fertilizers.
- They destroy many harmful substances present in the soil that can cause plant diseases.
- Bio fertilizers are proved to be effective even under semi-arid conditions.

Applications of bio fertilizers

Following are the important applications of bio fertilizers:

Seedling root dip

This method is applicable to rice crops. The seedlings are planted in the bed of water for 8-10 hours.






Seed Treatment

The seeds are dipped in the mixture of nitrogen and phosphorus fertilizers. These seeds are then dried and sown as soon as possible.

Soil Treatment

The bio fertilizers along with the compost fertilizers are mixed and kept for one night. This mixture is then spread on the soil where the seeds have to be sown.

HYV (HIGH YIELDING VARIETY SEED) IMPACT ON ENVIRONMENT:

-  The major disadvantage associated with HYV seeds is bigger requirement of irrigation facility, chemical fertilizers and pesticides to produce best quality yield.
-  Higher yields are possible only from the combination of HYV seeds, better irrigation facility, good amount of chemical fertilizers and pesticides.
-  If heavy amount of chemical fertilizers, pesticides and water is used then the cost of farming will also increase.
-  Allowed a more varied diet as higher yields meant that some fields could be used for other crops, such as vegetables. HYVs needed a reliable and controlled water supply and greater amounts of machinery which increased farmers' costs. Yields were more reliable as new varieties were disease resistant. Only farmers who could have afforded to invest benefitted. Faster growing HYVs allowed an extra crop to be grown each year.
-  Increased used of pesticides poisoned other forms of wildlife. Greater production meant an enhanced quality of life with more money for better roads and housing. Mechanisation lead to rural unemployment and migration to overcrowded cities. Increased yields would have meant a drop in food prices for local people in rural areas. Those who could not have afforded the extra cost of mecanisation ran into debt and were forced off their land.

BIO FERTILIZER IMPACT ON ENVIRONMENT:

- ✚ The application of bio-fertilizers that contain living microorganisms is one of the management practices that can help to maintain or increase the content of organic matter and improve soil fertility in arable soils.
- ✚ Biofertilizers provide lower nutrient density than chemical fertilizers, so more product is often required for the same effect.
- ✚ Biofertilizer production requires specific machinery.
- ✚ Biofertilizers can be difficult to store and may have a much shorter shelf-life than chemical fertilizers.
- ✚ Some of the harm chemical fertilizers may cause include waterway pollution, chemical burn to crops, increased air pollution, acidification of the soil and mineral depletion of the soil.
- ✚ Some of these impacts include algae blooms causing the depletion of oxygen in surface waters, pathogens and nitrates in drinking water, and the emission of odors and gases into the air. Nutrients from manure and fertilizers enter lakes and streams through runoff and soil erosion.

INSECTICIDES

- Insecticides are the kind of substances used to kill insects, they include **ovicides** and **larvicides** used against insect eggs and larvae respectively.
- Insecticides are used in agriculture, medicine, industry and by consumers.
- Insecticides are claimed to be a major factor behind the increment of agricultural productivity in the 20th century. Nearly all insecticides have the potential that they can alter **Ecosystem**.

ADVANTAGES

- They kill harmful insects.
- They help to increase the productivity of food.
- They help to control **cerebral diseases** by killing germs.

DISADVANTAGES

- Insecticides kills not only harmful insects but also useful insects for pollination like butterflies and Bees.
- They are mostly synthetic and non-bio degradable.
- **DDT** is a stable and non-bio degradable insecticide with long term effect. Hence, it harms human beings, animals, birds and plants. DDT can cause air pollution, water pollution and soil pollution.
- If it enters into the human body through contaminated food, it badly effects liver, kidneys and other organs. It also effects birds in laying eggs.
- They leave a harmful deposit in fruits and crops when they are used.

PRECAUTIONS WHILE USING INSECTICIDES

- Person should be very careful while using insecticides because they can take the life as well.
- They should not be stored along or near with other food materials.
- They must be kept away from the children.
- They are stored away from the houses like Store rooms.
- Excessive usage of insecticides should be avoided.
- We have to clean our hands well, with soap and water after using insecticides.

PESTICIDES

- **Pesticides** are chemical substances that are meant to kill pests. In general, a pesticide is a chemical or a biological agent such as virus, bacterium, anti-microbial or disinfectant that alters in capacities kills, pests
- The pesticides used by farmers can kill pests, but they can also damage people's health.

Types of Pesticides

- Pesticides can be grouped according to the types of pests which they kill they are :

Insecticides – Insects

Herbicides – Plants

Rodenticides – Rodents (Rats and Mice)

Bactericides – Bacteria

Fungicides – Fungi

Larvicides – Larvae

Examples of Pesticides

- Examples of pesticides are :

Insecticides

Herbicides

Insecticides

- Examples of specific synthetic chemical pesticides are :

Glyphosate

Acephate

Deet Propoxy
Metaldehyde
Boric acid
Diazinon
Dursban
DDT malathion etc...

Benefits of Pesticides

- The major advantage of pesticides are they can save farmer by protecting crops from insects and other pests.
- Controlling of pests and plant disease vectors.
- Controlling human/livestock disease vectors and nuisance organisms.
- Controlling organisms that harm other human activities and structures.

Effects of Pesticides

- The toxic chemicals in these are designed to release deliberately into the environment.
- Though each pesticide having its own advantage, instead they enter into the air, water, sediments and even end up in our food.
- Pesticides have been linked with human health hazards from short term impacts like headaches and nausea to chronic impacts like cancers and reproductive harm.
- Use of these also impacts the general biodiversity in the soil.
- If there are no chemicals in the soil there is high soil quality and this allows for high water retention, which is essential for plant growth.

Man's Impact on Land

Human impact the physical environment in many ways. Overpopulation, Pollution, Burning oil fuels and deforestation changes like these have triggered climate change, soil erosion, poor air quality and undrinkable water.

These negative impacts can affect human behavior and can prompt mass migration or battles over clean water.

Human impact on the environment or anthropogenic impact on the environment includes changes to biophysical environment and ecosystems, biodiversity, and natural resources caused directly or indirectly by humans, including global warming, environmental degradation, mass extinction and biodiversity loss, ecological crisis, and ecological collapse.

Modifying the environment to fit the needs of society is causing severe effects, which become worse as the problem of human overpopulation continues.

Importance of Land:

Our agriculture, horticulture, and forestry industries, which all make a major contribution to our economy and support our way of life, depend largely on land.

Land provides food and materials, such as timber, and supports ecosystem services, such as the filtering of water.

There are five types of land use: Residential, agriculture, recreation, transportation and commercial.

People should make sure they use land responsibly to respect other people and our environment.

MINING

Mining is the extraction of valuable minerals or other geological materials from the earth, usually from an ore body, lode, vein, seam, reef or placer deposit. These deposits form a mineralized package that is of economic interest to the miner.

Mining include:

Metals, coal, oil shale, gemstones, lime stone, chalk, dimension stone, rock salt, potash, gravel and clay.

Mining in a wider sense includes extraction of any non-renewable resource such as petroleum, natural gas, or even water.

Impact of Mining

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Impacts on water resources

- Acid mine drainage and contaminant leaching.
- Erosion of soils and mine wastes into surface waters
- Impacts of tailing impoundments, waste rock, heap leach, and dump leach facilities.
- Impacts of mine dewatering

Impacts of mining projects on air quality

- Mobile sources-
- Stationary sources
- Fugitive emissions-pressurized equipment due to leaks and other unintended or irregular releases of gases
- Incidental releases of mercury
- Noise and vibration

Impacts of mining projects on wildlife

- Habitat loss
- Habitat Fragmentation

Impacts of mining projects on soil quality

- contaminated soil resulting from windblown dust, and

- Soils contaminated from chemical spills and residues.
- Fugitive dust can pose significant environmental problems at some mines

Impacts of mining projects on social values

- Human displacement and resettlement
- Impacts of migration
- Lost access to clean water
- Impacts on livelihoods
- Impacts on public health
- Impacts to cultural and aesthetic resources

Environment impacts of mining can occur at local, regional, and global scales through direct and indirect mining practices. Impacts can result in erosion, sinkholes, loss of biodiversity, or the contamination of soil, groundwater, and surface water by the chemical emitted from mining processes.

These processes also have an impact on the atmosphere from the emission of carbon which have effect on the quality of human health and biodiversity. Some mining methods may have such significant environmental and public health effects that mining companies in some countries are required to follow strict environmental and rehabilitation codes to ensure that the mined area returns to its original state.

Soil

Soil is a mixture of organic matter, minerals, gases, liquids, and organisms that together support life. Earth's body of soil, called the pedosphere, has four important functions:

- As a medium for plant growth.
- As a means of water storage, supply and purification
- As a modifier of earth's atmosphere
- As a habitat for organisms

All of these functions, I their turn, modify the soil and its properties.

Impact on Soil

- ❖ Erosion
- ❖ Desertification
- ❖ Acidification
- ❖ Deforestation
- ❖ Salinization
- ❖ Mining
- ❖ Urbanization

Soil impacts is the displacement of the upper layer of soil; it is a form of soil degradation. This natural process is caused by the dynamic activity of erosive agents, that is, water, ice (glaciers), snow, air(wind), plants, animals, and humans.

Soil impacts may be a slow process that continues relatively unnoticed, or it may occur at an alarming rate causing a serious loss of topsoil.

Intensive agriculture, deforestation, roads, anthropogenic climate change and urban sprawl are amongst the most significant human activities in regard to their effect on stimulating erosion.

Impact on Coastal Area

- Living resources
- Water quality/pollution
- Land use and human populations
- Coastal industries and constructions
- Dredging and dumping at sea
- River runoff and load
- Groundwater discharge into the coastal waters
- Seawater intrusion into the coastal aquifer
- Recreation and tourism- Beaches, swimming, recreational boating, Ecotourism

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