UNIT 8 DISASTER AND DEVELOPMENT

Structure

8.1 INTRODUCTION

We have been facing natural disasters since ages but the present decade has seen significant variations in seasonal patterns of climate variations that impact differently in terms of time and place. Unpredictable heavy rains causing floods and deluges, earthquakes of greater intensity and magnitude with huge death rates, massive landslides, delayed monsoons have overwhelmed the developed and developing countries of the world. Areas having good rainfall have been facing drought. There is worldwide food insecurity and there is water crisis and conflict between communities and states over water in many parts of the world. Research and science have indicated the threat of global warming as the reason for such crises. Therefore, this Unit attempts to discuss the issue of global warming and the steps taken by the countries around the world, especially India in reducing it. The handling of disasters is part of ensuring human security as the entire system is involved in extending a helping hand to the victims in times of crisis and having sustainable development.. This is a different facet of human security that has now come under the ambit of non-traditional security dimension.

Aims and Objectives

After studying this Unit, you should be able to:

- recognize disaster management as part of non-traditional security.
- analyse the relationship between development and global warming;
- describe the initiatives undertaken by countries in handling different forms of crisis.

8.2 DEVELOPMENT AND GLOBAL WARMING

At the turn of the last century, the Earth's atmosphere contained about 280 parts per million of carbon dioxide. This means that the global average temperature is of about 57 degrees Fahrenheit. This was not considered to be adverse . But as fast industrialization and growth started taking place, beginning with the industrial revolution in the Western Countries and followed by the rest of the World, industrial pollution, chemical changes were the outcome. Many experts and researchers showed the negative impact of the process of such development based on high growth rates. As Bill McKibben puts it, with growing developmental needs, we started using more coal, gas and oil to power our lives that increased this 280 number. As industrialisation gained pace, there was a simultaneous growth in the economy as also an increase in the carbon emissions and the green house gases (GHGs) in the Earth's atmosphere owing to the use of fossil fuels, gas and oil. The automobiles that we are driving today are producing and emitting so much of GHGs. Likewise, incessant use of pesticides and fertilisers to boost agriculture productivity are generating and emitting green house gases like methane and nitrous oxide. And it is these emissions that are causing the atmosphere of the Earth to get heated up and become unduly warm. One of the features of the molecular structure of CO_2 is that it traps heat near the planet's surface that would otherwise radiate back out to space. So obviously, with the increase in the CO_2 parts and other GHGs, the Earth's temperature started rising. Now, it is at 380 and increasing by roughly two parts per million annually. The extra heat that CO_2 traps, a couple of watts per square metre of the Earth's surface, is enough to warm the planet considerably. And this is already showing results in terms of receding glaciers, unpredictable seasonal patterns, and sea level rise throughout the world. This is causing an adverse affect on the economy, especially agriculture and industry, more so of the developing world, not to mention the undesirable costs on health.

Based on a number of reports in recent years, scientists argue that the CO_2 parts should not increase beyond 450, as this will lead to the melting of Greenland and Antarctic ice sheets. Therefore, it is necessary and also an obligation on the part of the countries of the world to contain CO_2 emissions. Scientists warn that the current CO_2 emissions should be cut by at least half over the next 50 years to avert a future global warming disaster. The projected emission is of 16 billion metric tons of carbons a year by 2057, if we do not reduce (McKibben 2007).

The industrialised countries have the highest of carbon emissions, and U.S. carbon emissions are a quarter of the world's total, and this is continually and steadily rising. China and India (India's carbon emissions, which currently account for almost 6 per cent of the world total, will more than triple within the next 20 years. According to a report compiled by a number of Indian institutions, the country's emissions will soar from 1.2 billion tonnes today to between 4 and 7 billion tonnes in 2030) have started producing huge quantities of CO_2 and today, China has overtaken U.S. in terms of the carbon emissions that was 6.2 billion metric tons of carbon dioxide in 2006 in comparison to the United States, which produced 5.8 billion metric tons of CO_2, underscoring the pace and speed of industrialisation taking place in the country. With huge populations and rapid economic growth of these countries, the prospect of worldwide decline in emissions seems much more daunting.

It appears very difficult to bring about the differentiated responsibilities with rapid and sustained cuts in emissions by the technologically advanced countries and large scale technology transfer to the developing world. The question is whether the former can think and act in a manner that is conducive to reduction in emissions on a major scale and transfer of technology that can enable the developing countries to contain emissions without compromising on development and growth agenda. The stabilisation of the current carbon emissions at the present level along with reducing them in future is the need of the hour.

8.3 STABILISATION WEDGES

In the past fifty three years, the global carbon emissions has been rising (3.7 metric tons of CO_2 emissions contains a metric ton of carbon) and today global carbon emissions are estimated at 8 billion metric tons a year. By 2057, the projected emissions will be of 16 billion metric tons of carbon a year. The possible temperature rise will be +9 degree Fahrenheit to the existing temperature of 78 degree Fahrenheit and the atmospheric CO_2 concentration in parts per million will be over 800 ppm as against the current 525 ppm.

There are three possible paths for future carbon emissions:

- First, 'maintain' the current rate of increase;
- Second, 'hold' emissions at today's rate by following 08 carbon cutting wedges by 2057 and then reduce further; and
- Third, 'reduce' emissions by half over the next 50 years by cutting 04 more wedges and then reduce further.

How is this going to be done?

Princeton researcher Robert Socolow and Stephen Pacala have described 15 'stabilisation wedges' (carbon-cutting wedges) using existing technologies to realise the goal. Adopting any combination of the below mentioned strategies that equals 12 wedges could lower emissions by 50 per cent. Each carbon-cutting wedge would reduce emissions by a billion metric tons a year by 2057. These wedges are:

1) Efficiency and conservation
   - improve fuel economy of the two billion cars expected on the road by 2057 to 60mpg from 30mpg
   - reduce miles travelled annually per car from 10,000 to 5,000
   - increase efficiency in heating, cooling, lighting and appliances by 25 per cent.
   - improve the coal fired power plant efficiency to 60 per cent from 40 per cent
2) Carbon capture and storage
   - use capture systems at coal driven hydrogen plants producing fuel for a billion cars
   - use capture systems in coal derived synthetic fuel plants producing 30 million barrels a day
   - introduce systems to capture CO_2 and store it underground

3) Low carbon fuels
   - replace large coal fired power plants with natural gas fired plants
   - displace coal by increasing production of nuclear power to three times of today's capacity
4) Renewable sources of energy
   - Increase wind-generated power to 25 times of current capacity
   - Increase wind power to 50 times current capacity to make hydrogen for fuel cell cars
   - Increase solar power to 700 times of current capacity
   - Increase ethanol bio-fuel production to 50 times of current capacity
   - Stop all deforestation
   - Expand conservation tillage to all cropland

Source: Bill McKibben in the National Geographic

So we can hold emissions at today's rate by cutting 8 wedges and reduce emissions by half over the next 50 years by cutting 4 more wedges and then reduce further.

8.4 'GREEN' WAYS TO A CLEANER WORLD

When we discuss the issue of stabilisation wedges, whether it is the strategy of efficiency and conservation or carbon capture and storage or low carbon fuels or renewable sources of energy, what strikes the goal is making fuel from crops interpreted in this paper as 'green'- specific crops and plants that can contribute towards conservation and preservation of our planet not only by making it cleaner and healthier but also productive by wedging the carbons and other GHGs.

Food crops-green ways to a cleaner world: An analysis

Food crops are being increasingly used as energy suppliers and replacing coal, oil and gas, which are the largest emitters of CO_2. The food crops like corn, sugarcane, soybean, ethanol and such others like jatropha and algae produce large amounts of energy. These crops can help the countries to replace their coal fired energy that is the cause of expansion of the CO_2 parts in the Earth's atmosphere.

Herein, we will discuss some of the food crops and such other plants and how their energy content can replace our carbon generating fuels and thus lessen carbon emissions.

Ethanol

Ethanol can cut our carbon emissions in a very significant way as compared to the fossil fuel and hence can be used as a substitute for gas, oil and diesel. It is made from crops like corn, soybean and sugarcane. It is not only a renewable source of energy but also what it emits as carbon is what the crops get from the sun during the growing season.

In the U.S. there is a boom in corn growing. The U.S. government has provided subsidies for ethanol production and millions of dollars are provided for research with the goal of replacing 15 per cent of the gasoline use with ethanol and other biofuels by 2017. However, there is need to pay attention to certain aspects. Corn plantation requires good doses of fertiliser and consumes just about as much fossil fuel as the ethanol itself replaces. It is still a gasoline additive (like in U.S. it is 85 per cent ethanol and 15 percent gas). Also, it can replace other crops in terms of cultivation, as it is more lucrative to the farmers. All corn grown will be routed by the farmers to produce ethanol and so we can be bereft of our food crop. Researchers like Nathaniel Greene emphasise on replacing our food crops with plant material like corn stalks, algae, and fast growing trees in producing biofuels. Some of the farmers are now experimenting by using biogas from the cattle manure to burn the corn. The process of burning the corn can be done by biogas that can be generated with the use of bio-digesters. The bio-digesters are fed with the cattle manure.

In Brazil, ethanol from sugarcane is being produced. It has been using ethanol from sugarcane, known as 'alcool' since the 1920s. From last thirty years ethanol plants have come up in large numbers owing to the subsidies and finances provided by the government. Also, Brazilian car manufacturers were given incentives to design cars that could burn straight ethanol. By the mid 1980s nearly all the cars sold in Brazil ran exclusively on alcool. Volkswagen introduced Brazil's first 'Total Flex' vehicle in 2003 that could automatically adjust the air-fuel ratio and spark advance for any mixture of gasoline and alcohol. Today, 85 per cent of cars sold in Brazil are Flex. Today, its Sao Martinho plant turns over seven million tons of cane into 300 million litres of ethanol for Brazilian cars. It is also building a three million ton unit exclusively for ethanol in the Goias state.

The benefit of sugarcane is that unlike corn, in which the starch in the kernel has to be broken down into sugars with expensive enzymes before it can be fermented, the entire sugarcane stalk is already 20 per cent sugar and it starts to ferment as soon as it is cut. Cane yields 600 to 800 gallons of ethanol an acre, more than twice as much as corn. The plant where sugarcane is treated to produce fuel does not consume fossil fuel or electricity but uses cane waste known as 'bagasse' for burning the sugarcanes. The experts find that producing and burning cane ethanol generates anywhere from 55 to 90 per cent less carbon dioxide than gasoline. But the process of making the alcohol is very unclean. To kill snakes and to make the cane easier to cut by hand the fields are usually burned before harvest. This fills the air with soot and also releases nitrous oxide, a greenhouse gas. Besides, it makes it very backbreaking for the workers and they sometimes die of exhaustion (Joel K. Bourne, JR.)

8.5 FUEL-FOOD DEBATE

There is a continuous debate on the issue of food security, where the food crops are sent for generating biofuels at the cost of being provided as food to people. We are facing a food crisis and we cannot help watching millions going hungry at the cost of generating biofuels. As crops being supplied as food for the people becomes less and get diverted for production of biofuels, the food prices will shoot up and this will further lead to serious health problems, especially of the poor and it will be a grave violation of human rights.

Greene has proposed several alternate pathways that can address the problem. He says that, we can make use of biomass, that is, shredded corn, sugarcane stalks, leaves, wood, sawdust or even prairie grasses like switch grass instead of food crops. Agricultural residues like husks of crops, stalks, leaves etc.; forestry wastes like wood chips and sawdust, and tree bark; municipal solid waste like household garbage; and paper products and paper pulp will provide biodiesel that will produce 68 per cent less GHGs as compared to diesel.

For example in the U.S., a small operation at the National Renewable Energy Lab in Golden, Colorado can convert a ton of biomass into 70 gallons of ethanol in a week. Likewise, switch grass can produce as much ethanol per acre, as sugarcane. Cellulose in corn plants can double the ethanol output. Cellulose ethanol derived from prairie grasses grown on land unfit for other crops, could replace up to 13 per cent of the world's oil consumption, if an efficient way to turn cellulosic plant matter into ethanol can be developed. A 2005 study by the U.S. Department of Agriculture and U.S. Department of Energy estimated that by planting 50 million acres of fallow land with perennial grasses and fast –growing trees, the country can produce 1.3 billion tons of feedstock for ethanol. Also, the National Renewable Energy Lab pointed that all plant matter could replace more than half the transportation fuel currently burned each year. As Mike Pacheco, former director of NREL's Bioenergy Centre says, "the green line is what we think we can make on farms and from trees and switch grass- the equivalent of 3.5 billion barrels of oil" (Joel K. Bourne, JR).

Besides biomass, Jatropha curcas has a good potential to reduce carbon emissions. Jatropha curcas is a drought-resistant perennial plant that grows well in marginal and poor soil with low nutrient content. It is an oil bearing plant. It is also very easy to plant and grows very quickly with minimum inputs of fertiliser, water and pesticides. It has a lifespan of 50 years and spreads very easily.

The non-edible vegetable oil of jatropha curcas has the potential of providing a commercially viable alternative to diesel oil, since it has desirable physicochemical and performance characteristics comparable to diesel. Cars can be run with jatropha curcas without requiring much change in design. The jatropha seeds are rich in oil content of 33% - 37%, which can be combusted as fuel without being refined. It burns with clear smoke-free flame and is being used as a fuel for diesel.

Jatropha has also many comparative advantages over diesel in terms of the environment. The most obvious is that using jatropha oil as a fuel creates a closed CO_2 cycle, that is, when the oil is burned CO_2 is given out into the atmosphere. But when the next crop of jatropha grows, it takes the CO_2 back out of the atmosphere. Therefore, there is no net release of carbon dioxide. With diesel combustion however, the CO_2 that was locked up inside the fuel millions of years ago is released, but there is no absorption. So, jatropha helps to reduce the climate change owing to global warming.

It can be used for multiple sourcing of renewable energies. The kernels consist of oil to about 60 percent and can be transformed into bio-diesel through esterification. Bio-diesel derived from seed is clean and renewable and does not contain sulphur and led, thus producing no hydrocarbon. The shell of the fruits and kernels of the seed or the oil cake obtained after extraction of oil from the seed can be used to generate biogas, bio-electricity, which is one of the best renewable energies. It can help in meeting domestic needs of energy services including cooking and lighting.

The oil cake contains 3.2% nitrogen, 1.4% phosphorus and 1.2% potash and is a good organic fertilizer. The land, where jatropha plantation occurs, becomes fertile after 10-12 years of plantation and becomes cultivable for the normal crops. It is also grown around crop fields and gardens to keep out animals, to act as a windbreak and to reduce soil erosion by wind and water. Jatropha hedges reduce the degrading effect of the wind and water, as soil collects at the bases of the hedges and these accumulations reduce erosion by surface runoff. It is very easy to grow, as a cutting taken from a plant, left to dry for 2 days, and simply pushed into the soil will take root. Jatropha needs only 400mm of annual rainfall to grow, which means it can flourish even in semi-desert regions. Jatropha curcas is a very fast growing plant. Plants grown from seeds take 2 years to produce seed; those from cuttings take just 1 year. This means that jatropha plant can be an important weapon in the fight towards desertification.

The planting of Jatropha as a hedge has positive environmental effects, as it protects the soil from wind erosion. The roots of the plant bind the topsoil, so it is less vulnerable to the wind that is responsible for 30% of soil degradation. When planted in hedges, the wind blows soil to accumulate at the base of the plants, forming boundaries along the ground. This holds in water, allowing more absorption of water into the soil and consequently less loss of soil carried away by surface runoff. The roots of the plants also break up the earth and allow more infiltration of water into the soil. The production of good quality fertiliser, as a by-product of oil production, can also improve soils and agricultural production, such as small scale gardening. It can be used to reclaim waste lands in the forests and outside.

Other than the above given examples and cases, there is yet another significant ethanol producing agent, the single celled scum, which we call as algae. It is the one that can do wonders as compared to other biofuels crops. For example, an acre of corn can produce around 300 gallons of ethanol a year and an acre of soybean around 60 gallons of biodiesel, but an acre of algae can produce 5,000 gallons of bio-fuels a year (Joel K. Bourne, JR). The starch they produce can be processed into ethanol. Some of the algae produce tiny droplets of oil that can be churned into biodiesel. Algae not only reduce carbon emissions of industrial plants but can also gobble other pollutants. Green Fuel Technologies (Cambridge, Massachusetts) uses algae in plastic bags to siphon CO_2 emissions of power plants. And the best part is that it multiplies within hours, can grow in wastewater, can be harvested every day and does not require more than sunlight and carbon dioxide to grow. The only aspect that requires thinking is to reduce the cost of algae fuel and keep it cheaper than petroleum and diesel to flourish.

8.6 PRECISION FARMING

In precision farming advanced agro-technology and water-efficient irrigation, fertigation systems are used. Seedlings are raised under shaded houses with insect-proof netting. Water and soluble fertiliser are applied precisely to the root zone of the plants using modern drip irrigation, to keep the ideal level of soil moisture and aeration. Weeds are less as the surface of the soil is dry during the cropping season. Rather, this water economic precision farming system brings down the labour cost, usage of pesticides and fertilisers. As root-zone fertigation ensures precise dosage at critical stages, plants grow faster. In the green house system, atmospheric moisture is maintained at the desirable level using mist irrigation. With this technology, about 100 to 150 per cent higher yield is expected for all crops. Besides, quality of the produce is much higher as the crops are grown in a controlled system. Harvesting period, too, can be extended with fertigation.

In India, states like Tamil Nadu, Andhra Pradesh, Kerala and Punjab have farmers who are practising precision farming. They are reaping a bumper harvest of chilli, tomato, banana, capsicum and a variety of fruits and vegetables. “Tomato output with traditional farming was one tonne but now with precision farming it has been pushed to 3.5 tonnes. Capsicum grown in the 1,000 sq. feet green house has fetched Rs. 2.5 lakh in the last six months" say the farmers. The water requirement has also been brought down by 70 percent. They further reiterate that although the cost of having green house farming (there is open house precision system also) is a expensive at the initial stages, cultivation can be done round the year irrespective of the climatic conditions. Thus, with exactness and accuracy in the fertiliser and water requirement for each vegetation that is derived on the basis of laboratory test of the sample of soil and water of the farmlands, a package of irrigation and fertigation is designed accordingly and provided to the farmers. Thus, precision farming protects the health of the farmers, does not affect the yield and does not pollute the environment.

8.7 ORGANIC FARMING

Organic farming can replace the use of chemical pesticides with a combination of physical and biological measures, including eco-friendly bio-pesticides. Bio-pesticides are locally available. Organic materials that do not harm the health of the farmers, do not affect the yield and do not pollute the environment. They include extracts of chillies and garlic, neem seeds, cow dung and cow urine, milk, ghee, fish, jaggery, yoghurt, lime, eggs, custard apples and so on. Initially, the farmers are taught to cultivate without pesticides, and once this is done, they do without fertilisers too and become completely organic. Some of the crops grown under the organic farming are paddy, red gram, groundnut, cotton, jowar, bajra, sunflower, castor, turmeric, chillies and vegetables. Organic farming is now being practised in many states across the country such as Maharashtra, Punjab and Andhra Pradesh. There is an added advantage that once farmers learn these practices, they disseminate the knowledge to others. The farmers in Andhra Pradesh have also been doing their own research and coming up with original solutions. This is crucial in making the farmers self-reliant in terms of knowledge and inputs.

8.8 SUMMARY

This Unit dealt with the relationship between development and global warming and how with growing developmental needs, the emissions have increased owing to the incessant use of fossil fuels. We have discussed the stabilisation wedges that pertain to efficiency, conservation, carbon capture, storage etc. We showed that biofuels like ethanol and alcool from corn, soybean and sugarcane have helped in reducing the emissions of carbon from the burning of fossil fuel. Precision farming and organic farming have been good steps in this direction. This is one way of protecting both the man and nature and sustaining in order to survive in the much polluted environment today. Human security does not confine to protecting people from direct and indirect violence; it extends to both latent and active impending disasters. Environmental security is the need of the hour as the world is witnessing excessive pollutants in its atmospheric levels. Eco-friendly measures need to be adopted if we have to achieve human security at all possible levels.

8.9 TERMINAL QUESTIONS

1. How is human security related to environmental security? Are they similar or different in their perspectives?
2. What are the effects of global warming? What are its effects on development?

3. What is stabilisation wedges? How can this be done?
4. Discuss the fuel-food debate for a cleaner environment.
5. Write notes on the following:
   (a) Precision Farming
   (b) Organic Farming?

SUGGESTED READINGS

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