BLOCK 4
INTERNATIONAL ENVIRONMENTAL PROBLEMS

INTRODUCTION TO BLOCK 4

Block 4 is on International Environmental Problems. It has two units (Units 8 and 9). **Unit 8** is on 'Transboundary Environmental Problems'. It first outlines the 'issues in transboundary pollution'. Under this, it explains the concept of 'global commons'. The unit then discusses the issues of (i) marine pollution, (ii) ozone depletion and (iii) global warming and climate change. These are discussed under the broad theme of 'transboundary regional and global pollution'. The next area explained in the unit relates to an 'economic analysis of global warming and climate change'. Under this, the unit covers the approaches of (i) emission trading, (ii) emission markets, (iii) Kyoto protocol and (iv) Paris convention. An outline on the 'international environmental agreements' concludes this unit.

Unit 9 is on Trade and Environment. It begins with an account on the relationship between 'economic growth and environmental quality'. This is explained in terms of three effects viz. the scale effect, the technological effect and the composition effect. The relationship between 'trade and environment' is explained in terms of: (i) comparative advantage, (ii) FDI, (iii) migration of polluting industries and (iv) distinction between PHH (pollution haven hypothesis) and PHE (pollution haven effect). Different explanations to the PHH is then provided in terms of: (i) competitiveness, (ii) institutions, (iii) race to bottom and (iv) ecological dumping.

UNIT 8 TRANSBOUNDARY ENVIRONMENTAL PROBLEMS*

Structure

8.0 OBJECTIVES

After reading this unit, you will be able to:

- indicate the different dimensions of 'transboundary environmental problem';
- delineate the issues behind 'transboundary pollution';
- define the concept of 'global commons';
- describe the complexities involved in addressing the pollution effects in global commons;
- explain the four major dimensions of transboundary pollution;
- state the concept and consequence of 'green paradox';
- discuss the various aspects behind the issue of economic analysis of 'global warming and climate change; and
- specify the major international environmental agreements.

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8.1 INTRODUCTION

Transboundary pollution is that pollution which is not confined to the boundaries of nations but travels across national borders (through pathways like water or air) at varying rates causing varying damages to many countries. Transboundary pollution, may take the form of: (i) spillover from one to another nation (unilateral spillover), (ii) spillover from one to other nation and vice versa (bilateral spillover) and (iii) spillover among several nations and different directions (multilateral spillover) across hundreds or even thousands of kilometers. It can take the form of contaminated water or the deposition of airborne pollutants across national borders. It can be caused by catastrophic events such as the Chernobyl nuclear explosion. With the increase in population and the scale of production across the globe, the potential for pollution spillover from one country to another increases.

Transboundary pollution thus takes many forms from *regional* (affecting the neighbouring nations) to *global* (affecting the entire globe with various nations contributing to the cause in varied intensity). Global pollution is a special case of transboundary pollution and is multilateral spillover. It can be perpetrated by both private industry and government activities. Against this background, the present unit discusses issues behind transboundary pollutions.

8.2 ISSUES IN TRANSBOUNDARY POLLUTION

One of the most famous case of transboundary river pollution is that of the Rhine River with its point of incidence in Basel, Switzerland. This was a catastrophe of great proportions. The source of pollution was an explosion at a chemical plant. In the process of putting out the fire, great volumes of water were used. The water mixed with the chemicals at the plant creating a highly toxic discharge. This lethal mixture washed into the Rhine River and coursed its way to the Baltic Sea affecting every country along the way. Citizens of six sovereign nations were affected with extensive damage. There was further consternation when compensation for damage was difficult to obtain. Although the chemical company volunteered to pay some compensation, it was not enough. It was possible that each affected nation-state tried the case in their own jurisdiction but the issue was *how to collect compensation* for damages?

In transboundary cases, if there is no treaty or convention in force, the critical issue is: by what combination of international law principles, can the rules of liability and remedy be determined? In the absence of precedence, it becomes problematic to institute legal action against another country. Since there is no history of litigation between nation-states in cases of environmental damage, there is no precedent to determine outcome. Historically, legal disputes have been resolved (albeit, extremely slowly) through negotiations and treaties. There is no *polluter pays* statute in international law doctrine.

Thus, when pollutants traverse the global commons, there is a problem of *weak property right*. Global solutions to transboundary pollution can only be

successful if all nations arrive at consensus to implement controls in order to mitigate such pollution. They should jointly lay down rules to extend cooperation and share responsibility for accidents that damage the environmental quality of other nations. However, international cooperation through agreements and conventions for issues of transboundary pollution are mostly ineffective due to varying consensus among the nations. The only mechanism that is currently available to compensate injury is private litigation between parties. This is difficult due to a lack of agreements to enforce civil judgements. Where the polluter is the national government, like in the case of the *Chernobyl disaster*, it may nearly be impossible to gain compensation for damages.

Compounded with the problem of inefficacy of regulatory mechanism to control its impact of trans-boundary magnitude, there is scientific *uncertainty* regarding the functioning of various pollutants, their relationship with the ecosystem and the effectiveness of various combating mechanisms. This makes the situation more complicated for understanding the *magnitude of the transboundary problem*.

International environmental protocols came to feature in environmental governance after transboundary environmental problems became widely perceived in the 1960s. Following the *Stockholm Intergovernmental Conference in 1972*, international environmental agreements proliferated. Due to the difficulties mentioned above, environmental protocols are not a panacea for global commons issues. Often, they are slow to produce the desired effects and lack monitoring and enforcement. They also take an incremental approach to solutions particularly where sustainable development principles suggest that environmental concerns should be mainstream political issues. The 1979 *Convention on Long-Range Transboundary Air Pollution (CLRTAP)* is an early international effort to protect and gradually reduce and prevent air pollution. The concept of the *global commons* is important for an understanding of transboundary pollution.

8.2.1 Global Commons

A *commons* is defined as ‘a tract of land or water owned or used jointly by the members of a community’. *Global commons* includes those parts of the Earth’s surface beyond national jurisdictions i.e. the open ocean and the living resources found there and notably the atmosphere. The only landmass that is regarded as part of the global commons is Antarctica (UNEP/WWF).

Global common-pool resources bears the similar connotation of common pool resources in terms of *non excludability* and also faces the problem of *tragedy of the commons* in terms of congestion, overuse, or degradation (which makes them *rivalrous*). It is subject to massive *negative externality* problem. Pollutants crossing national boundaries impose external costs with neither emitters nor the nations within which they emit having the proper incentives to control them. The political difficulties of implementing any comprehensive cost effective regulation covering all the stakeholder nations make the management of global commons highly complicated.

The 'atmosphere' is a global commons into which various harmful effluents (e.g. greenhouse gases) are released from multiple sources from across the globe. The phenomena of *global warming* refers to the increased concentration of carbon dioxide (CO_2) in the atmosphere exceeding the absorptive capacity (and the prescribed limits) of the atmosphere. Global pollution creates a '*public bad*' borne by all (i.e. a negative externality with a severe long term impact). In order to combat global warming, the negative externalities need to be internalised. However, few controls exist for carbon dioxide (CO_2) [the major effluent of fossil fuels and the major greenhouse gas]. The problem emanates from the fact that the world energy consumption is increasing phenomenally and is highly dependent on the fossil fuels like coal and petrol. Moreover, it has less immediate damaging effects at the ground level. When no agreement or rules on emissions exist, no individual firm, city or nation has the incentive to bear the international binding agreement although consensus on it is not lacking.

There are several key differences in the management of resources in the global commons from those of the commons in general. The most obvious difference is in the scale of the resources. The number of users at the local versus the global level is another. There are also differences in the shared culture and expectations of resource users. More localised commons property users tend to be more homogeneous while global users are heterogeneous. This contributes to differences in the possibility and the time it takes for new learning about resource usage to occur at the different levels. Moreover, global resource pools are less likely to be relatively stable. Their dynamics too are less easily understood. Many of the global commons are *non-renewable* on human time scales. Thus, resource degradation is more likely to be the result of unforeseen and unintended consequences, not immediately observable or easily understood. For instance, the carbon dioxide emissions that drive climate change continue to do so for at least a millennium after they enter the atmosphere and last forever. Because there are significant differences in the benefits, costs and interests at the global level, there are significant differences in externalities between local resource uses and the use of global-level resources.

Check Your Progress 1 [answer within the space given in about 50-100 words]

1) What are the various forms of Transboundary pollution?

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2) State the major issues behind the Transboundary pollution.

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3) What are the differences between a global commons and commons in general?

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8.3 TRANSBOUNDARY REGIONAL AND GLOBAL POLLUTION

Acid rain, or acid deposition, is a broad term that includes any form of precipitation with acidic components (such as sulphuric or nitric acid that fall to the ground from the atmosphere in wet or dry forms). This can include rain, snow, fog, hail or even dust that is acidic. The primary sources of acid rain are emissions of sulphur dioxide (SO_2) and nitrogen oxides (NO_X) into the atmosphere. The SO_2 and NO_X react with water, oxygen and other chemicals to form sulphuric and nitric acids before falling to the ground. Winds can blow SO_2 and NO_X over long distances (ranging from 50 to 2000 kilometers) and across borders. Thus, acid rain is a clear example of how air currents can carry destructive pollution from one nation-state to another, and indeed, around the globe. While a small portion of the SO_2 and NO_X that cause acid rain is from natural sources such as volcanoes, most of it comes from the burning of fossil fuels (e.g. two thirds of SO_2 and one fourth of NO_X in the atmosphere come from electric power generators). The other major sources of SO_2 and NO_X in the atmosphere are: vehicles and heavy equipment, manufacturing, oil refineries and other industries.

Acidity and alkalinity are measured using a pH scale for which 7.0 is neutral. The lower a substance's pH (less than 7), the more acidic it is; the higher a substance's pH (greater than 7), the more alkaline it is. Normal rain has a pH of about 5.6; it is slightly acidic because carbon dioxide (CO_2) dissolves into it forming weak carbonic acid. Acid rain usually has a pH between 4.2 and 4.4.

Acid deposition is an international issue having adverse impacts on forests, freshwaters, soils and insects and aquatic life-forms. It causes paint to peel, steel structures (such as bridges) to corrode and stone buildings and statues to be affected from weathering. It also impacts adversely on human health.

Places significantly impacted by acid rain around the globe include most of eastern Europe (from Poland northward into Scandinavia), the eastern third of the United States, and south-eastern Canada. Other affected areas include the south-eastern coast of China and Taiwan. This precipitation is damaging lakes, streams, forests and buildings in countries that may have little sulphur and nitrogen generation of their own. It is the most industrialised nations that are producing these pollutants due to increased production. Very often the pollution rains down on developing countries that have neither the resources nor the technical expertise to clean up the mess. Moreover, air as a vector of pollution is particularly insidious because air patterns can change abruptly, confounding a country's attempt to monitor where pollutants come from. Thus, while 'acid rain' is an important negative fallout of transboundary environmental pollution, there are other three equally major factors (or sources) of concern viz. marine pollution, ozone depletion and 'global warming and climate change' (GW & CC).

8.3.1 Marine Pollution

Marine pollution is an easy illustration of a transboundary pollution problem involving many nation-states and unlimited *point sources* of pollution. Marine pollution can be the result of on-shore industrial processes that use the ocean as a waste disposal site. Ships at sea find the ocean just too convenient as a sewer system and surface ocean activities such as oil drilling are a constant source of pollution due to oil discharges. Accidents at sea are well-documented, the most famous in recent years being the **Exxon Valdez oil spill off** of Alaska in Prince William Sound in 1989. It spilled 10.8 million US gallons of crude oil into the sea over the next few days. It is considered to be one of the most devastating human-caused marine disasters. Immediate effects included the deaths of 100,000 to as many as 250,000 seabirds, at least 2,800 sea otters, approximately 12 river otters, 300 harbour seals and 247 bald eagles. The cleaning up of this messy situation was helped by two conventions that had been arrived at earlier in an international conference held in 1969. As a result of this conference two treaties were developed and signed that would respond to oil pollution on the high seas. These treaties or conventions are: (i) The *Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter* and (ii) *The Convention for the Prevention of Marine Pollution by Dumping from Ships and Aircraft*. These conventions cited specific pollutants considered extremely detrimental to marine environment. The pollutants identified are organohalogenic compounds and mercury (as well as slightly less harmful compounds such as lead, arsenic, copper and pesticides). The two conventions indicate a rising commitment to the control of transboundary pollution carried by the ocean's currents. It provided some guided principles which helped resolve the question of remedies in the Valdez catastrophe.

8.3.2 Ozone Depletion

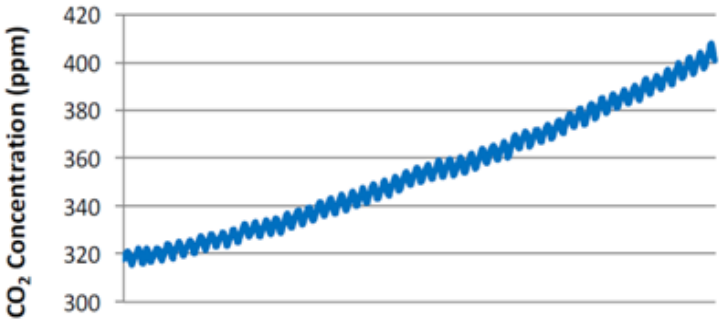
Ozone depletion describes two related events observed since the late 1970s: (i) a steady lowering of the total amount of ozone in Earth's atmosphere (the ozone layer) and (ii) a much larger springtime decrease in stratospheric ozone

(i.e. the portion of the atmosphere just lying above troposphere) around Earth's polar regions. The latter phenomenon is referred to as the *ozone hole*. The presence of small amount of ozone in the stratosphere plays a critical role in absorbing the harmful ultraviolet light (UV light) from passing through the earth's atmosphere. This stratospheric ozone shields people, plants and animals from the harmful radiation effects having cancer risks and other adverse health effects.

The main cause of ozone depletion and the ozone hole is manufactured chemicals (especially manufactured halocarbon refrigerants, solvents, propellants and foam-blowing agents). Chlorofluorocarbons (CFCs) and hydro-CFCs, halons [the three together referred to as ozone-depleting substances (ODSs)] are mainly responsible for man-made chemical ozone depletion. These compounds are transported into the stratosphere by the winds after being emitted at the surface. Once in the stratosphere, they release halogen atoms through photo dissociation [which catalyses the breakdown of ozone (O_3) into oxygen (O_2)]. Both ozone depletion and the ozone hole were observed to increase with increase in emissions of halocarbons. These depletions have generated worldwide concern and threat which ultimately pushed 24 nations to sign the Montreal Protocol in 1987. As per this agreement, the signatory nations were to curtail the production and consumption of ozone gases to 50 percent of 1986 levels. However, soon after the protocol was signed, new evidence suggested that the damage was increasing more rapidly than previously thought. A new ozone agreement was signed by 59 nations at a conference in London held in July 1990. This agreement called for complete phasing out of halons and CFCs. Two other destructive chemicals (carbon tetrachloride and methyl chloroform) were added to the protocol and were scheduled to be eliminated by 2000 and 2005 respectively. The new agreement also generated consensus to raise a fund over a period of next three years to help the poor countries to switch from ozone depleting chemicals to more expensive but less harmful substitutes. This was an important breakthrough because without this assistance ozone depleting chemicals was expected to rise dramatically in the developing countries.

8.3.3 Global Warming and Climate Change (GW and CC)

Multiple lines of scientific evidence show that the climate system is warming. Global warming, also referred to as climate change, is the observed century-scale rise in the average temperature of the Earth's climate system and its related effects (Fig. 8.1). The 2013 and 2014 reports of the 'intergovernmental panel on climate change' (IPCC) attribute the majority of the observed warming (since the mid-20th century), to human-made greenhouse gas emissions such as carbon dioxide, methane and nitrous oxide. Climate model projections summarised in the report indicated that during the 21st century, the global surface temperature is likely to rise a further 0.3 to 1.7 degrees in the lowest emissions scenario and 2.6 to 4.8 degrees in the highest emissions scenario. These findings have been recognised by the national science academies of the major industrialised nations and are not disputed by any scientific body of national or international standing.



Source: National oceanic and Atmospheric Administration, Earth System Research laboratory, Global Monitoring Division http://www.esrl.noaa.gov/gmd/ccgg/trends/data.html

Note: Seasonal variations mean that CO_2 concentrations rise and fall each year with growth and decay of vegetation and other biological systems, but the long-term rend, measured in parts per million or ppm, is a steady increase ude to human emissions of CO_2.

Fig. 8.1: Atmospheric Corbondioxide levels

Check Your Progress 2 [answer within the space given in about 50-100 words]

1) What are the four major dimensions of Transboundary pollution?

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2) What does the term 'acid rain' mean? What are its two primary sources?

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3) Besides acid rain, which are the other three equally major factors or sources of concern in Transboundary pollution?

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4) Which are the two major conventions or treaties which helped in cleaning up the mess created in the historic '*Exxon Valdez Oil Spill Off*'?

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5) What would you identify as an important breakthrough signed in the 1990's London conference on solution to Transboundary environmental pollution?

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8.4 ECONOMIC ANALYSIS OF GW AND CC

The economic analysis of climate change is extended in the framework of *negative environmental externalities* and over-exploitation of *common property resources*. Global pollution creates a *public bad* affecting everyone — a negative externality with a wide impact. Many countries have environmental protection laws limiting the release of local and regional air pollutants. Such laws aim at internalising the externalities associated with local and regional pollutants (to some extent). But until relatively recently, few controls existed for carbon dioxide (CO_2), the major greenhouse gas. As a result, concentrations of CO_2 in the atmosphere have risen steadily. It recently crossed the benchmark of 400 parts per million (ppm) atmospheric concentration.

Carbon dioxide and other greenhouse gases, which are emitted due to human activities, continuously accumulate in the atmosphere for thousands of years. Hence stabilising or 'freezing' emissions will not solve the problem as already accumulated green house gases continue to affect the climate of the entire planet long after they are emitted. This is thus the case of a *stock pollutant*. Only major reductions in emission levels of a stock pollutant will prevent ever-increasing atmospheric accumulation. Development of national and international policies to combat global climate change is a huge challenge, involving many scientific, economic, and social issues.

Impacts of climate change have already begun to affect climate patterns. These effects range: (i) from melting polar ice to raising sea levels, (ii) from collapse of marine ecosystems to loss of bio diversity and to increasingly

severe water stress in large parts of the world and (iii) from changing weather patterns accompanied by more frequent and more violent climactic episodes (hurricanes, floods, droughts) to wider spreading of pathogens and diseases. WHO has estimated that more than 140,000 people per year are dying as a direct result of climate change, primarily in Africa and Southeast Asia.

Economists have attempted to quantify these impacts in monetary terms but these assessments can be controversial. Two main policy responses to global warming are: (i) to *reduce* greenhouse gas emissions (climate change mitigation) and (ii) to *adapt* to the impacts of global warming (e.g. by building embankments in response to sea level rise). Another policy response which has recently received much attention is geo-engineering of the climate system (e.g. injecting aerosols into the atmosphere to deflect sunlight away from the Earth's surface). The long time scales and uncertainty associated with global warming have led analysts to develop 'scenarios' of future environmental, social and economic changes. These scenarios can help nation states to understand the potential consequences of their decisions.

One of the responses to the uncertainties of global warming is to adopt a strategy of sequential decision making. Governments might choose to use risk management as part of their policy response to global warming. For instance, a risk-based approach can be applied to climate impacts which are difficult to quantify in economic terms (e.g. impacts of global warming on indigenous people). Analysts have also assessed global warming in relation to sustainable development (which considers how future generations might be affected by the actions of the current generation). Policies designed in some areas to address global warming may contribute positively towards other development objectives. In other areas, the cost of global warming policies may divert resources away from other socially and environmentally beneficial investments (i.e. the opportunity costs of climate change policy).

The distribution of CO_2 emissions among the main emitters are: China (29%), US (15%), European Union (11%), India (6%), Russia (5%), Japan (4%) and the rest of the world (30%) [Oliver et. al., 2014]. However, in terms of per capita consumption (Figure 8.2), the industrialised developed countries (e.g. US, Japan, Russia, Germany) are much ahead as compared to China and India. The emission of carbon dioxide is still largely dominated by the developed countries. However, most of the future growth in carbon emissions is expected to come from rapidly expanding developing countries such as China and India (China surpassed the US in 2006 as the largest carbon emitter in the world).

In developed countries, there has been a rapid switch from coal to natural gas and renewable energy lowering the overall CO_2 emissions. In developing countries, coal production is still expanding but an increasing share of new energy production is also coming from renewables. It is currently unclear if the levelling-off of emissions is a temporary phenomenon or signals a turnaround in total emission trends.

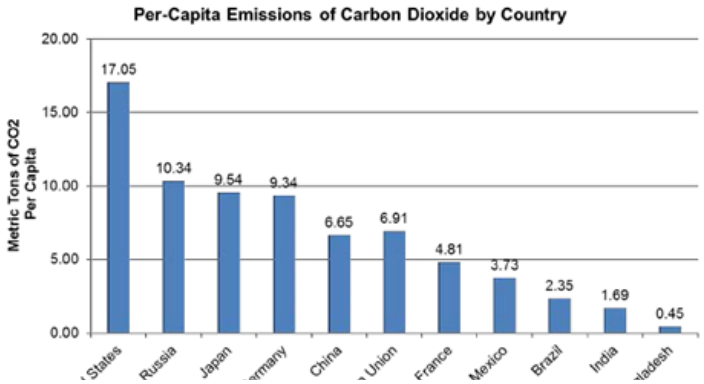

Fig. 8.2: Per-Capital Caron Bioxide Emissions, by Country

Source: British Petroleum, Energy Charting Tool 2015.

There are issues of *green paradox* arising from the interactions between emissions and global energy markets. This is a type of spatial energy leakage operating through changes in energy demand. In the context of global climate change, efforts to reduce energy consumption (and hence carbon emissions) by a subset of countries will lower the global energy price and hence lead to increase energy use (and higher carbon emissions) for the other part of the world. This may strategically induce acceleration of resource extraction from the owners of fossil fuel resources in anticipation of reduced demand for fossil fuel in the future due to drastic transformation in the energy sector towards cleaner and greener energy. This may therefore act like an 'announced expropriation for the owners of fossil fuel resources', inducing them to accelerate resource extraction. The reduced price and increased supply may further trigger global warming.

When we talk of the regulatory aspect of the Global Warming and Climate Change (GW&CC), it is important to know about certain concepts and events. These are: (i) emission trading, (ii) emission market, (iii) Kyoto Protocol and (iv) Paris agreement.

8.4.1 Emission Trading

In an emissions trading system, the government sets an overall limit on emissions and defines permits (also called allowances) to emit up to the level of the overall limit. Polluters are required to hold permits in amount equal to their emissions. The government may sell the permits but it mostly gives permits to participants equal to each participant's baseline emissions. The baseline is determined with reference to the participant's historical emissions. To demonstrate compliance, a polluter must hold permits (at least) equal to the quantity of pollution it actually emitted during the time period. If every participant complies, the total pollution emitted will be at most equal to the sum of individual limits. Polluters who want to increase their emissions must buy permits from others willing to sell them. In theory, polluters who can reduce emissions most cheaply will do so thereby achieving the emission reduction at the lowest cost to society. They can sell the residual permit at the market rate to the agents emitting in excess of their entitled limit. For greenhouse gases, permit units are called 'carbon credits'.

8.4.2 Emission Markets

Emissions trading needs an 'emissions market'. In the emissions market, one emissions permit is considered equivalent to one metric ton of CO_2 emissions. Other names used for emissions permits are carbon credits, Kyoto units, assigned amount units and 'certified emission reduction' (CER) units. These permits can be sold privately or in the international market at the prevailing market price. Since they trade internationally, they allow permits to be transferred between countries.

8.4.3 Kyoto Protocol

In 1990, the first 'intergovernmental panel on climate change' (IPCC) report took initiatives to find an international framework within which harmful emissions could be regulated. This led to the Kyoto Protocol being adopted in 1997. It was signed by 192 countries (with the exception of Afghanistan, Sudan and the USA) with most developed nations agreeing to legally bound targets to bring down their emissions of six major greenhouse gases. Emission quotas prescribed were agreed by each participating country for reducing the overall emissions by 5.2 percent (from their 1990 levels) by the end of 2012. Till 2012, the overall reduction achieved in their CO_2 emissions was 12.5 percent. The IPCC has projected that the financial effect of compliance through trading within the Kyoto commitment period would be between 0.1 to 1.1 percent of GDP among the trading countries.

8.4.4 Paris Convention

In December 2015, parties to the UNFCCC (United Nations Framework Convention on Climate Change) arrived at another landmark agreement to accelerate and intensify the 'actions and investments needed for a sustainable low carbon future'. The Paris Agreement brings all nations to a common cause on combating climate change with enhanced support to assist developing countries in the task. As such, it charts a new course in the global climate effort. The Agreement's central aim is to strengthen the global response to the threat of climate change by keeping a global temperature rise this century below 2 degrees Celsius and to pursue efforts to limit the temperature increase even further by 1.5 degrees Celsius. The Agreement reaffirms the obligations of developed countries to support the efforts of developing countries to build clean, climate-resilient futures and encourage voluntary contributions to the effort.

Check Your Progress 3 [answer within the space given in about 50-100 words]

1) What is meant by the term 'stock pollutant' in the context of environmental pollution?

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2) In what dimensions has the effect of environmental pollution being experienced by mankind?

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3) What has been the two main policy response to 'global warming'?

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4) What is meant by the term 'green paradox' in the context of global climatic change?

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5) Specify the major international environmental agreements.

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8.5 INTERNATIONAL ENVIRONMENTAL AGREEMENTS

Some 'multilateral environmental agreements' (MEAs) focus on particular themes [e.g. (i) Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal, (ii) Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade and (iii) Stockholm

Convention on Persistent Organic Pollutants]. Others are outcomes of international conferences like the Rio Convention, United Nations Convention to Combat Desertification, UN's 'framework convention on climate change' (FCCC), etc. Still others, such as the Regional Seas Conventions and Action Plans, deal with specific regions.

The term *multilateral environmental agreement* (also called *protocol*) and *convention* are used interchangeably. A convention typically precedes a protocol. A protocol suggests concrete steps to tackle an environmental problem with most protocols requiring that a country first become a party to the framework of a convention before it can become a party to a protocol. Generally, countries find it relatively easy to agree on framework conventions (which are mainly declarations of intentions) but far more difficult to agreeing on protocols which specify explicit and concrete commitment for emission reductions.

Even if countries agree on the design of a treaty that is beneficial for all participants, *free-riding* jeopardises the success of MEAs. A country is usually better off either by remaining a non-participant (first type of free-riding) or by acceding to an MEA but violating its terms (second type of free-riding). The first type of free-riding is obvious as in most MEAs the number of signatories fall short of the total number of countries involved in the externality problem. This is at least true for those MEAs with explicit and ambitious abatement targets. For instance, the pollutants CFCs and greenhouse gases affect all countries i.e. roughly 200 countries, but only 38 industrialised countries have accepted emission ceilings under the Kyoto Protocol. In contrast, participation in the framework conventions without specific abatement obligations preceding these protocols is very high (e.g. FCCC, 186; Vienna Convention, 180).

8.6 LET US SUM UP

Transboundary pollution is not confined to a single nation-state, but rather travels across national borders (through pathways like water or air) at varying rates and causing varying damages to countries. It can be regional and global. Since the zone of influence of the pollutants extends beyond local boundaries, they do not fall under the jurisdiction of any particular nation. Thus, there is a usually a problem of weak *property right*. Global solutions to transboundary pollution can only be successful if all nations form consensus to jointly lay down the rules to extend cooperation to mitigate such pollution and share responsibility for accidents that damage the environmental quality of other nations. However, international cooperation dealing with various issues of transboundary pollution are not effective. They are undermined by disputes due to varying consensus among the multiple stakeholder nations.

8.7 KEY WORDS

Global Common : The term describes international or global resource domains in which common-property resources are found. They include the

earth's shared natural resources, such as the high oceans, the atmosphere and outer space and the Antarctic in particular.

Point and Non Point Sources of Pollution : Pollutants enter the water environment from two main types of sources: point source and non point sources. A point source is a single, identifiable source of pollution, such as a pipe or a drain. Industrial wastes are commonly discharged to rivers and the sea in this way. Non-point sources of pollution (also termed 'diffuse' pollution refer to such impacts which occur over a wide area and are not easily attributed to a single source. For instance, in farming areas non-point sources of pollution include pesticides, fertilizers, animal manure and soil washed into streams in rainfall run-off.

Stock Pollutant : Pollutants towards which the environment has low absorptive capacity are called stock pollutants (e.g. persistent organic pollutants such as PCBs, non-biodegradable plastics, and heavy metals). Stock pollutants accumulate in the environment over time. The damage they cause increases as more pollutant is emitted and persists as the pollutant accumulates. Stock pollutants can create a burden for future generations, by passing on the damage that persists well after the 'benefits' received from incurring that damage are forgotten.

Tragedy of Commons : This is a term used in social science to describe a situation in a shared-resource system where individual users acting independently as per their own self-interest behave contrary to the common good of all users by depleting or spoiling that resource through their collective action. The concept became widely known owing to an article written by the American ecologist and philosopher Garrett Hardin in 1968. In the modern economic context, commons is taken to mean any shared and unregulated resource such as atmosphere, oceans, rivers, fish stocks, or even an office refrigerator.

It is argued that the very term 'tragedy of Commons' is a misnomer since 'the commons' refers to land resources with rights jointly owned by members of a community with no individual outside the community having any access to the resource. However, the term is now used in social sciences and economics for describing a

problem where all individuals have equal and open access to a resource. Thus, 'tragedy of open access regimes' or simply 'the open access problem' are more apt terms.

8.8 SOME USEFUL BOOKS AND REFERENCES

1) Nick Hanley Jason F. Shogren, Ben White, Chapter 6, Transboundary Pollution Problems in Environmental Economics in Theory and Practice.

2) Harris, Jonathan M., Brian Roach, Environmental and Natural Resource Economics : A Contemporary Approach, 4th edition, 2018, Routledge.

3) Harris, Jonathan M., Brian Roach and Anne-Marie Codur, The Economics of Global Climate Change, 2017, Global Development And Environment Institute (GDAE), Tufts University, Medford, MA 02155, http://ase.tufts.edu/gdae

4) Tietenberg, Tom, Environmental and Natural Resource Economics, 2003, 6th edition, Pearson Education.

8.9 ANSWERS/HINTS TO CHECK YOUR PROGRESS EXERCISES

Check Your Progress 1

1) It can be unilateral, bilateral or multilateral (each referring to whether only one country, or two countries are many countries are involved). It can also be classified as regional and global (regional referring to neighbouring countries and global referring to the entire globe).

2) Weak property rights and enforceable laws pose issues of 'how to collect compensation and enforce agreements'. Lack of scientific certainty on the functioning of pollutants and their relationship with the ecosystem makes the estimation of the 'magnitude of Transboundary problem' difficult.

3) First is in terms of the scale of resources which is larger for global commons. The second is the number of users. There are also differences in the culture and expectations of users. Users of global commons will be more heterogeneous with the resources themselves being non-renewable.

Check Your Progress 2

1) Acid rain, marine pollution, ozone depletion and 'global warming and climate change'.

2) It is a broad term that includes any form of precipitation with acidic components that fall to the ground from the atmosphere in wet or dry form (like rain, snow, fog, hail). Sulphur dioxide (SO_2) and nitrogen oxides (NO_X) are its two primary sources.

3) Marine pollution, ozone depletion and 'global warming and climate change' (GW & CC).

4) (i) The Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter and (ii) The Convention for the Prevention of Marine Pollution by Dumping from Ships and Aircraft.

5) A fund was decided to be generated to aid the developing countries for adopting the more expensive but less harmful ozone depleting chemicals.

Check Your Progress 3

1) The term refers to the effect of CO_2 accumulation in the atmosphere over years whose effect will be felt long after their release for centuries to come.

2) The impact is far-reaching: (i) to raising sea levels, (ii) to loss of bio diversity and severe water stress, (iii) to frequent violent climactic episodes (hurricanes, floods, droughts) and (iv) to wider spread of pathogens and diseases.

3) To *reduce* greenhouse gas emissions (climate change mitigation) and *adapt* to the impacts of global warming (e.g. by building embankments to cope with sea level rise).

4) Efforts to reduce energy consumption by resorting to cleaner technologies by some countries would lead to lowered prices of energy. This would spur the use of energy in other parts of the globe. This acts as an inducement to accelerate resource extraction for owners of fossil fuel resource (in anticipation of reduced demand in the future). The reduced price and increased supply further triggers global warming.

5) Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (London, 1972), Convention for the Prevention of Marine Pollution by Dumping from Ships and Aircraft (Oslo, 1972), Montreal Protocol on the Reduction of CFCs (1987), Kyoto Protocol (1992), Paris Convention (2015), etc.

UNIT 9 TRADE AND ENVIRONMENT*

Structure

9.0 OBJECTIVES

After reading this unit, you will be able to:

- explain the relationship between trade and environment;
- describe the concept of comparative advantage in trade;
- state the conditions under which migration of polluting industries take place from the developed to the developing countries;
- distinguish between displacement hypothesis and pollution haven hypothesis; and
- discuss the various explanations offered for the pollution haven hypothesis.

9.1 INTRODUCTION

Worldwide, deterioration of environmental quality has caused much concern sparking efforts to understand more clearly the reasons for environmental

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degradation. Desire to achieve higher levels of economic growth through industrialisation, and as a result reap the multiplier benefits by increased trade between countries, combined with the growing consciousness on the resulting environmental degradation owing to unregulated industrial expansion and trade, have generated a heated debate on how such a growth process adversely impacts environment. Environmental degradation became an important issue in early 1990s, particularly with the work of Grossman and Krueger (1991) who highlighted the link between trade and environment.

International Trade is associated with dismantling of barriers to flow of goods, services, capital, etc. Trade provides opportunities for the developing countries to grow with the aid of capital inflows and technological transfer that it entails. A country gets benefits from opening up the economy to trade but quite often it is at the cost of environmental degradation particularly in the early stage of growth and development. Trade is thus one of the major factors responsible for shaping the relationship between environmental degradation and economic development. We use the terms 'growth' and 'development' interchangeably at times although in the strict sense we are aware that 'growth' yields income and when it is spent on raising the 'education, health and living conditions' (i.e. overall capabilities) of marginalised sections of people, the term 'development' really becomes applicable. Thus, growth is necessary for development but it does not automatically follow growth i.e. growth is a necessary but not sufficient condition for development.

9.2 ECONOMIC GROWTH AND ENVIRONMENTAL QUALITY

Environmental quality deteriorates in early stage of economic development but improves in later stage as an economy grows. This is because environmental pressure increases faster than income in the early stage of development but slows down (relative to GDP growth) in later stages. This relationship between economic development and environmental quality is termed as the Environmental Kuznets Curve (EKC) following the work of Kuznets (1955) who observed such a systematic relationship between income inequality and economic development. In the first stage of economic development, through industrialisation, pollution grows rapidly because high priority is given to increasing material output, and the economy is in greater need of jobs (and income) than clean air and water. Such growth inevitably results in greater use of natural resources and emissions (or pollutants), which in turn put more pressure on issues of sustainability of environmental resources on the one hand and the capacity of environment to absorb the pollutants on the other. In the later stages of industrialisation, as income rises, society values the environment more, regulatory institutions are set up and with time they become more effective in their implementation. As a result, pollution level declines and environmental quality improves. Thus, the Environmental Kuznets Curve hypothesis posits a well-defined relationship between level of economic activity and environmental pressure (defined as the level of concentration of pollution or flow of emissions, depletion of

resources, etc.). An Environmental Kuznets Curve reveals how a technically specified measurement of environmental quality changes as the income level of a country (or a large human community) undergo change.

9.2.1 Impact of Economic Growth on Environmental Quality: Three Different Channels

As economic development accelerates, with the intensification of agriculture and other primary resource extraction (e.g. water, minerals), the rate of resource depletion exceeds the rate of resource regeneration. Waste generation also increases in quantity and toxicity. This is at the take-off stage. But at higher levels of development, structural change in the economy (like growth of information-intensive industries and services, increased environmental awareness with better enforcement of environmental regulations, adoption of better technology and higher levels of pollution abatement expenditures, etc.) results in levelling off and gradual decline of environmental degradation. Grossman and Krueger (1991) bring out the effect of economic growth on the quality of environment in three different channels viz. scale effect, technological effect and composition effect.

Scale Effect: Increasing output requires more input and thus more natural resources are used up in production process. More output also implies more wastes and emissions as by-product, which contributes to degrading environmental quality. Economic growth, thus, exhibits a scale effect that has a negative impact on environment. International trade accelerates this scale effect further more. In the globalised era, every country tries to increase its export escalating *scale effect* with more production.

Technological Effect: A wealthy nation can afford to spend more on research and development (R&D) as technological progress is aided by economic growth. The dirty and obsolete technologies are replaced by upgraded new and cleaner technology, which improves environmental quality. This is the technological effect which has a positive impact on environment. Trade plays an important role for upgrading to new technology thereby improving the environmental quality.

Composition Effect: Economic growth has a positive impact on environment through a composition effect. As income grows, structure of the economy tends to change and gradually increases its share of cleaner activities that produce less pollution. Environmental degradation tends to increase as structure of the economy changes from rural to urban or agricultural to industrial, but starts falling with another structural change i.e. when energy intensive industry yield to 'services and knowledge based technology intensive industry' in terms of their respective dominance in the overall composition (i.e. relative share) of the economy.

Therefore, negative impact on environment of the scale effect which prevails in the initial stages of development, will eventually be outweighed by the positive impact of the composition and the technological effect that tend to lower the emission levels.

9.3 TRADE AND ENVIRONMENT

Trade leads to increase in size of the economy which, in turn, increases pollution. Thus, *ceteris paribus*, trade is the cause of environmental degradation. Many economists have for long argued that trade is not the root cause of environmental damage (Birdsall and Wheeler, 1993; Lee and Roland-Holst, 1997; Jones and Rodolfo, 1995) as free trade has contradictory impacts on environment– both increasing pollution and aiding to achieve reductions in it. Environmental quality could decline through the *scale effect* as increasing trade volume (especially export) raises the size of economy which, in turn, increases pollution. On the other hand, trade can improve the environment through composition and technological effects (i.e. as income rises through trade, environmental regulation is tightened reducing pollution). In other words, the pollution from the production of pollution-intensive goods declines due to self-motivated or coerced adoption of clean technology. In light of this, there are certain compelling arguments made in favour of international trade. These are the following.

9.3.1 Comparative Advantage

International trade functions on the basis of a country's relative comparative advantage. This could be in terms of labour productivity, availability of capital or technology, natural resource endowment or experience in production, etc. A country with fewer environmental attributes (i.e. capability to take measures to control pollution), exports less pollution-intensive goods and vice versa. The issue of international pollution problem weakens the argument for free trade to an extent although other factors mentioned above provides an edge to the argument of 'relative comparative advantage'.

Given the above, economic globalisation acts as a driving force for achieving higher growth. The issue of potential conflict, however, arise due to: (a) the wide acceptance of market oriented economic reform process on the one hand and (b) rising environmental protection standards on the other. Market oriented economic reforms are adopted in most developing economies with an eye on reaping the dividends of higher income through employment generation rendered feasible through the free flow of capital and technology. Globalisation is thus also a vehicle through which polluting activities are redistributed globally. Viewed from this angle, globalisation is the cause of rising pollution as it tends to shift polluting activities to poor countries with weak environmental policy. This phenomenon is called as 'pollution haven hypothesis' on which we will study in this unit later.

Countries with weak environmental policy thus have a comparative advantage in accommodating polluting industries. In other words, through lower levels of trade barriers, weak environmental policy becomes a source of comparative advantage for less developed countries. The differences in trade barriers between high income and low income countries result in pollution-intensive industries moving from high income countries to low income countries having relatively lax environmental regulation. This means that for given levels of environmental policy, liberalisation in trade and FDI

inflow causes polluting industry to relocate to countries with weaker environmental laws. Conversely, rigorous or higher standards of pollution control policy (by increased environmental standards) of one country causes the relocation of polluting industries to other countries with weaker environmental policy. Environmental policy, therefore, becomes a determining factor of comparative advantage.

Environmental externalities are also the result of laws or rights on 'common property resources' (CPR). Countries with a higher degree of private property ownership and established CPR laws and property rights succeed in instituting more efficient resource allocation mechanisms reaping the benefits of increased income generation and decreased environmental issues.

Situations of 'internal uncertainty' in countries also creates a source for comparative advantage. In the 1980s, *capital flight* i.e. movement of capital from a country with 'more uncertain' domestic environment to a country with more stable policy environment became a major factor for investment decisions. Viewed from this angle, globalisation redistributes the capital from strong to less protectionist countries not only in terms of environmental laws but also more generally to a country with an atmosphere of greater 'internal certainty'.

9.3.2 Foreign Direct Investment (FDI)

Developing countries provide a 'pollution hub' if they set environmental standards below 'efficiency level standards' in order to attract foreign investment. Most of the developing countries rely on technology transfer through foreign direct investment from developed countries as a primary means of technology acquisition. However, recent increased global ecological consciousness, linking trade and investment with environmental issues, has the potential to disrupt the investments flow.

Most of the developing countries often offer a wide array of incentives like lower taxes, duty exemptions and market access to attract FDI. Such an approach is because of an expectation that FDI contributes positively to the local economy through employment generation, technology transfer, management know-how and competitiveness. There is thus an expectation of 'global market access' termed as '*local to global access*'. However, the potential impacts of FDI on host countries' natural environment remain controversial.

With international trade, technological innovation is more important than in a closed market economy. Developed countries must continually innovate, not only to just grow but also to maintain their real incomes. Diffusion of technology prevents economic latecomers by requiring the same levels of material and energy inputs per unit of production than what was needed before i.e. by old technology. International trade however enhances *'diffusion of clean technology'*.

International community also plays an important role in lowering pollution by financing for: (i) appropriate training, (ii) policy reforms, (iii) information collection and dissemination, and (iv) public environmental education. Their

aid to research programmes provide access to information on local environmental quality, cost of pollution abatement, cost-effective measures, etc. helping reduce environmental pollution levels.

There are conflicting views with competing hypotheses about the impact of FDI on environment. One stream of literature (e.g. Mani and Wheeler, 1998; Bommer, 1999) suggest a possible asymmetry between foreign and local environmental standards, which attracts dirty industries from MNCs motivated to reduce their pollution abatement cost. Therefore, FDI aggravates pollution supporting the 'Pollution Haven Hypothesis' (PHH) [elaborated later in Section 9.4 below]. A second stream of literature (e.g. Christmann and Taylor, 2001; Eskeland and Harrison, 2003) claim that, FDI by diffusing advanced technologies, managerial skills and practices, they also create *pollution halos* in less developed economies i.e. there is the benefit of adaptation of clean technology in developing countries. This is referred to 'Pollution Hallo'. Thus, whatever may be the contesting claims of different streams of opinion in the literature, it also follows that openness improves developing countries' environment by increasing local income, introducing more energy efficient production technology, increasing competition, etc. Thus, FDI has beneficial effect on a developing country's environment with the multinationals helping to '*crowd out of inefficient local firms*' by changing the 'industrial structure' in the recipient developing country.

9.3.3 Migration of Polluting Industries

Under certain circumstances, the pollution intensive industries migrate from countries with stronger environmental regulations to those with weaker regulations. The composition of international trade shows that the countries exporting more manufactured goods tend to have higher energy consumption. Poor countries are therefore likely to be net exporters (and rich countries net importers) of pollution-intensive goods. This is mainly due to graduated international specialisation where poor countries are initially concentrated with *dirty* and material intensive production while richer countries specialise in *clean* and service intensive production. This is how the environmental effects are displaced from one country to another giving credence to the *Displacement Hypothesis*. This hypothesis introduces the concept of *migration of polluting industries* at the international level.

The emergence of a structural change in production at international level is linked to changing consumption patterns owing to international trade. The changes in the structure of production in developed economies are not accompanied by major changes in their consumption pattern relative to those in the developing countries. Rothman (1998), therefore, speculates that what appears to be an improvement in environmental quality may in fact be an indicator of increased ability of consumers in developed countries to distance themselves from the environmental degradation in the relatively poorer developing countries. The *Displacement Hypothesis* therefore postulates that trade liberalisation leads to rapid growth of pollution-intensive industries in less developed economies driven by the developed economies' enforcement of stricter environmental regulations.

9.3.4 PHH and PHE: Distinction

People of developed nations are more vigilant about environmental degradation and enact stringent environmental regulations which increases the cost of production. In contrast, less developed nations generally have weak environmental regulations. Developing countries with their low wages and lax environmental regulation thus provide a 'haven' to such displaced (dirty) industries. In this process, the dirty industries migrate from industrially developed countries to less developed countries, thereby becoming exporters of pollution intensive goods with the developed countries acting as corresponding net importers of these goods. The PHH postulates that jurisdictions with weak environmental regulations will attract polluting industries relocating to less developed area from stringent regions. In other words, low environmental standards become a source of comparative advantage for developing countries to attract FDI and with it act as 'pollution haven' in the developing economies.

A weaker version of PHH is *the pollution haven effect (PHE)*. This predicts the movement of FDI in response to environmental regulation. Copeland and Taylor (2004) provide a precise distinction between PHH and PHE as: the *pollution haven effect* occurs if net exports of dirty goods are deterred by tougher environmental regulations in the North, while the *pollution haven hypothesis* predicts pollution-intensive industries will relocate to the South as environmental regulation is made more stringent in the North. Hence, the PHE is a necessary but not a sufficient condition for the PHH to hold (Taylor 2004).

Check Your Progress 1 [answer within the space given in about 50-100 words]

1) Why does environmental pollution takes place at a faster pace than increase in income in the early stage of development?

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2) State any three factors which results in the gradual decline of environmental degradation in the later stages of development.

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3) How does 'weak environmental policy' become a source of comparative advantage for developing countries?

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4) In what way better CPRs laws/rights contribute to decreased environmental issues?

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5) Why does developing countries offer wide ranging benefits to attract FDI?

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6) In what ways does the international community contribute to lowering of pollution levels?

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7) What does the 'displacement hypothesis' basically convey? Is it the same as the Pollution Haven Hypothesis?

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8) Distinguish between PHH and PHE.

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9.4 THE POLLUTION HAVEN HYPOTHESIS: EXPLANATIONS

There are several explanations for pollution haven effects or pollution haven hypothesis. Differences in environmental regulatory policy coupled with trade liberalisation may lead to the emergence of pollution havens, with polluting activity relocating to areas with less stringent regulation. So, one of the driving forces for spatial redistribution of industrial activities is inter-regional differences in environmental regulation policies. Tightening regulation causes regulated sectors to bear higher production cost for compliance and/or search for re-location in regions with laxer regulations. Intuitively, environmental regulations raise the cost of pollution-intensive-goods production reducing the region's comparative advantage in producing those goods. With trade liberalisation, the foreign direct investment (FDI) is free to flow to any country, but in reality, FDI flows out of the country imposing stricter environmental regulation. Thus, according to the PHH, the developed countries use FDI as their transmission channel to shift the pollution intensive activities to their developing counterparts. Some specific explanations are further given as follows in this regard.

9.4.1 Competitiveness

Environmental actions generate competitive advantages as its regulation becomes a source of cost entailing *competitive disadvantages* for the affected firms. The key argument against this view is the *Porter hypothesis*. The hypothesis asserts that stricter environmental standards spur innovations which enhance competitiveness. Therefore, right kinds of environmental policies greatly reduce the 'complying cost' making the companies more profitable. Thus, according to this hypothesis, in the long run, the objectives of environmental protection and commercial competitiveness are congruent with each other. Porter theorises that properly designed environmental regulations trigger innovations within the firm that partially or fully offset the costs of complying with those regulations. Such innovation can not only improve product quality and value but also may lower the total cost by allowing companies to use a range of inputs more efficiently. This enhanced resource productivity makes companies and countries not only more competitive but also stimulate further innovations for upgraded technology.

There are two key principles of design for the *Porter hypothesis*: (i) the first requires regulations that focus on outcomes (e.g. by specifying performance

standards) as opposed to regulations that impose technology standards limiting flexibility; (ii) the second requires that regulations are complied with. Under these conditions, Porter and Linde (1995) have shown that firms re-examine their processes and technologies, often finding greater efficiencies and cleaner processes. Specifically, Porter argues that a pioneering environmental policy role can create technological first-mover advantage making such front-running companies more competitive. This is based on the assumption that other countries follow the pioneering country and adopt environmental regulations at some later point of time. If this actually happens, the regulation imposed on domestic industry at an earlier point in time will give the pioneering country a head-start. It enables providers of environmental technologies to export their solutions to other countries and the greater (ecological) efficiency of consumers of such technology on the domestic market will place them at an advantage vis-à-vis their foreign competitors.

The empirical evidence for the Porter hypothesis is mixed but most studies tend to at least demonstrate that stricter environmental regulations do not result in a significant deterioration in competitiveness. Recent findings on the Clean Air Act Amendments (CAAA) in the US have found that the effect of non-attainment status for a county is significantly negative on the polluting firms' location and growth. In other words, the regulation caused the US-based multinational firms to increase their foreign production with the estimated cost of relocating far below the estimated benefits. Thus, Porter's dynamic view of comparative advantage and endogenous technological change suggest that properly designed environmental regulations spur innovation improving competitiveness of regulated sectors in the long run. In fact, increased resource productivity can save more money than the initial compliance cost imposed thereby improving the comparative advantage. Referred to as '*innovation offsets*', such benefits accrued to innovating industries or companies are identified to two separate off-sets viz. product off-set and process off-set. While *product offsets* lead to new and improved products the *process offsets* lead to more efficient use of inputs. Thus, the Porter hypothesis argues for internalisation of negative environmental externalities maximising total social utility or welfare.

Tightening up pollution policy reduces net exports or net incoming FDI in affected sectors. This is the *pollution haven effect* or *competitiveness hypothesis* to which we referred above in Sub-section 9.3.4. The pollution haven effect predicts that FDI responds to environmental regulation by moving from countries with high regulation to those with low regulation. A necessary condition for the PHH is thus a strong pollution haven effect. The PHE may be triggered by changes in either home country or host country regulation.

9.4.2 Institutions

Economic development and trade liberalisation influence the environmental quality. The unsettled question results in part from the lack of a well-defined framework to explicate the institutional contexts for FDI's positive

environmental externalities. We have already noted in Section 9.2 above that FDI exerts an impact on environment through changes in economic scale, industrial composition, and techniques. This is the *process-oriented approach* that documents several environmental externalities due to the FDI inflow. However, it ignores the role of local institutions in the FDI-environment relationship or FDI-related strategic choices.

FDI influences institutional factors, such as environmental standards, corruption and democracy. While FDI is influenced by the location and environmental behaviour of multinational companies, the *institution-linked perspective* is very important in determining the consequences of FDI on the host country's environment. This is because the environmental externalities of FDI are subject to the host country's own institutional development given that the potential damage of inflowing FDI can be mitigated only with more developed institutions. However, in countries or regions with underdeveloped institutions, the potential damage gets magnified. This therefore partly resolves the inconsistent findings in earlier literature suggesting FDI's environmental impact to be varied (i.e. positive, negative or insignificant). In other words, this is the composite effect attributed to the two related hypotheses of Displacement and Pollution Haven. Fundamentally, the two hypotheses are basically the same (with respect to comparative advantage in international trade) as trade relates one country with international communities where an underdeveloped economy could rely on technology transfer through FDI which may also reduce pollution through innovation.

9.4.3 Race to Bottom

Globalisation could trigger the environmental '*race to bottom*' in which competition increases for investment and jobs. In fact, 'the bottom' rises with economic growth. Poor economies improve their environmental quality as investment increases income and employment. Thus, globalisation is compatible with pollution reduction.

In a race to bottom scenario, relatively high environmental standards in developed economies impose high costs on polluters. So, polluting activities in high-income economies face higher regulatory costs than their counterparts in developing countries. This creates an incentive for at least some highly polluting industries to relocate resulting thereby in international capital relocations. Rising capital outflows in high-income countries force the governments to begin relaxing environmental standards. As the race to bottom accelerates, emission levels begin rising towards higher levels of pollution.

Thus, while economic globalisation is truly a driving force for global economic growth and development, there are issues relating to its overall environmental impact. It raises the issue of potential conflicts between two powerful current trends viz. the market oriented economic reform process and environmental protection. Market oriented economic reform raises the scale of economic activities creating pressure on the existing environment. This results in environmental quality degrade with expansion of waste generating

economic activities. Opposite pressure is generated in the economy to protect the environment from such waste or pollutants that deplete ecological system.

9.4.4 Ecological Dumping

The argument that governments may have an incentive to weaken environmental policy in the presence of imperfect competition is an extension of the strategic trade literature. In this, governments first select the type and level of environmental policy, then firms compete in either output or price. Weak environmental policies purposely seek to promote the competitiveness of the export industry– characterised as '*ecological dumping*'. The prospect of ecological dumping has been a major issue in the trade-environment debate. It presupposes that a strong environmental policy hampers competitiveness. Empirical studies may not fully support the idea that strong environmental policy will improve the general performance of firms as postulated in *Porter hypothesis* (also referred to as 'green strategy'). Ecological dumping is thus an environmental policy where the marginal abatement cost falls short of marginal environmental damage.

9.5 INVESTMENT DECISIONS AT INTERNATIONAL LEVEL

Relocation of firms (especially relocation of manufacturing industries) depends on energy price which is a key factor influencing investment decision. Generally, energy price is higher in developed nations than in developed economies. Empirical findings suggest that investment decisions are negatively related to fuel prices and particularly manufacturing sectors are sensitive to energy price.

Location decision depends on the interaction between production costs and *ease of access* to markets. However, ease of access determines *trade costs* which depend on both transport and transaction costs. Production cost determines location at low trade costs. While market location determines production location at high trade costs, no unique solution is possible at intermediate trade cost levels. Therefore, multiple equilibria may occur depending on the level of trade costs and the structure of the industry. Thus, the effects of tougher climate policy raises a firm's manufacturing costs on location decisions which also depend on trade costs.

Recently, carbon regulations are adopted to reduce global emissions. But there is growing concern that such regulation may simply shift production to unregulated regions increasing global emissions in the process. *Carbon tariffs* have emerged as a possible mechanism to address these concerns by imposing carbon costs on imports at the regulated border. *Carbon leakage* can result despite the implementation of carbon tariffs when firms choose from discrete manufacturing technologies with offshore producers holding a comparative cost advantage. In this context, foreign firms adopt clean technology at a lower emissions price than firms operating in the regulated region. Thus, entry of foreign companies increases only for certain range of 'emissions prices' within which foreign firms hold this technology

advantage. As a consequence, global emissions decrease when carbon leakage happens under carbon tariffs. The source of potential welfare improvement is realised through carbon tariffs that require both foreign comparative advantage and endogenous choice of technology.

Check Your Progress 2 [answer within the space given in about 50-100 words]

1) What is the basic argument behind Porter's hypothesis? What are its two key principles?

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2) What is meant by 'innovative off-set'? What are its two components?

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3) What does the PHH basically predicts?

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4) What does 'race to bottom' basically connote?

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5) What is 'ecological dumping'? What basically triggers it?

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9.6 LET US SUM UP

Growth in economic terms, to yield the vital resources needed for development, is important for developing economies much more than the developed ones. This is the basic reason why developing countries seek out FDI expecting generation of employment and income for its vast labour force. However, there is a trade off in terms of what technology comes into the developing countries from the developed countries in this process. This is linked to stringent versus weak environmental laws and old versus new technology which is either more pollution generating or environmental friendly. The present unit is centred around this theme. It discusses some important hypotheses like the Displacement Hypothesis and the Pollution Haven Hypothesis. It offers explanations as to why developing economies have to go through this route for its development, what are its compulsions, and even so what are its gains in terms of long term developmental goals.

9.7 KEY WORDS

Capital Flight : Describes a phenomenon of outflows of resident capital due to distortion in domestic policies and political risk or instability.

Pollution Haven Hypothesis (PHH) : Predicts that removal of trade barriers between developed (high income) and less developed (low income) countries results in pollution intensive production moving to low income countries with relatively low environmental regulation.

Pollution Haven Effect : This is a weaker version of PHH which predicts the movement of FDI in response to environmental regulation and net pollution of developed country declines.

Porter Hypothesis : Asserts that stricter environmental standards spur innovations that enhance the character of competitiveness, and hence, right kinds of environmental policies will help the economies in the long run.

Pollution Halo : FDI brings new and cleaner technology that reduces pollution level in developing countries. Such FDI diffuses advanced technologies, upgrades managerial skills and practices creating *pollution halos* in developing economies.

Discrete Manufacturing Production Technology : A firm can produce one good/product for distinct purposes with differentiated technologies for a given time. For instance, M&M company produces Jeeps with discrete technology for civilian and defence.

9.8 SOME USEFUL BOOKS AND REFERENCES

1) Acharya, Rajat (2013). Trade and Environment, OUP.

2) Copeland, B. R. and Taylor, M.S., (2004). *Trade and the Environment: Theory and Evidence*, Princeton University Press.

9.9 ANSWERS/HINTS TO CHECK YOUR PROGRESS EXERCISES

Check Your progress 1

1) In the initial stages of growth, there is both greater use of natural resources and emissions. This declines in the later stages due to concerns of society and its capacity to take measured needed (Section 9.2).
2) Broadly, structural changes in the economy (for specifics see Sub-section 9.2.1).
3) By accommodation of polluting industries or through lower levels of trade barriers (Sub-section 9.3.1).
4) Such laws and rights helps in instituting efficient resource allocation mechanisms (Sub-section 9.3.1).
5) Because of an expectation that FDI contributes positively to the local economy (Sub-section 9.3.2).
6) By financing for: (i) appropriate training, (ii) policy reforms, etc. (Sub-section 9.3.2).
7) Displacement hypothesis suggests that people create/keep distance from pollution or polluted products. It, however, does not suggest any mechanism to create distance (Sub-sections 9.3.3 and 9.34).
8) PHE refers to the 'pollution haven effect'. This means that pollution level declines in developed countries due to migration of polluting industries from DC to LDC. However, it does not say anything about the increase of pollution in LDCs.

Check Your Progress 2

1) According to this hypothesis, in the long run, the objectives of environmental protection and commercial competitiveness are congruent with each other (Sub-section 9.4.1)
2) Increased resource productivity can save more money than the initial compliance cost imposed, thereby, improving the comparative advantage (Sub-section 9.4.1).
3) It predicts that FDI responds to environmental regulation by moving from countries with high regulation to those with low regulation (Sub-section 9.4.1).
4) That globalisation is compatible with pollution reduction (Sub-section 9.4.3).
5) It refers to the concept that 'weak environmental policies purposely seek to promote the competitiveness of the export industry' (Sub-section 9.4.4).