Environmental Impact Assessment
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Lecture - 01
State of Global Environment (Air)

Welcome to the course, Environmental Impact Assessment. Before we get into the details to understand Environmental Impact Assessment what is it? How do we define it? What purpose does it serve? How did it start? And where do we as a nation, position ourselves in the process? Let us first walk through the world's environmental status, we need to know what is the situation that we are trying to curtail.

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For this reason, we will skim through the report of Global Environmental Outlook 6, which focuses on a healthy planet, and healthy people published by the United Nations Environmental Program in 2019, and while we go through this, we are going to reflect upon the need for Environmental Impact Assessment. In particular, we will look at Chapter 2 and Chapter 5 of the report to understand the environmental scenario at the global level concerning the drivers of environmental change and environmental status. Today, we will cover only environmental concerns related to air.

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So accordingly, our coverage would include drivers of environmental change, we will look into human activities that generate emissions, and we will review the global environmental status concerning air. We will discuss the impact of human activities on human health and well-being, food security, and ecosystems.

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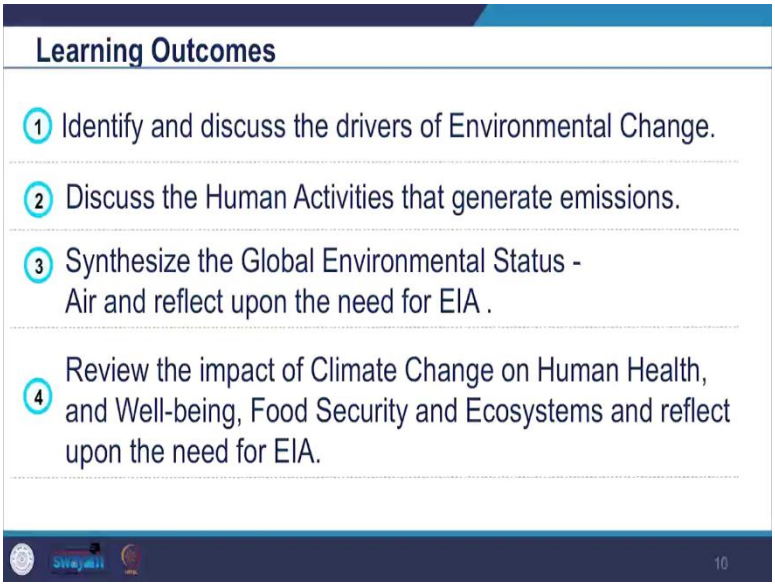

So, accordingly, the expected learning outcomes after completion of this session include that you should be able to identify and discuss the drivers of environmental change, and you should be able to discuss and review the human activities that generate emissions. Further, you should be able to synthesize the global environmental status of air and reflect upon the need for EIA. You should be also able to review the impact of climate change on human health and well-being, food security, and ecosystems, and reflect upon why and how we are dealing with EIA.

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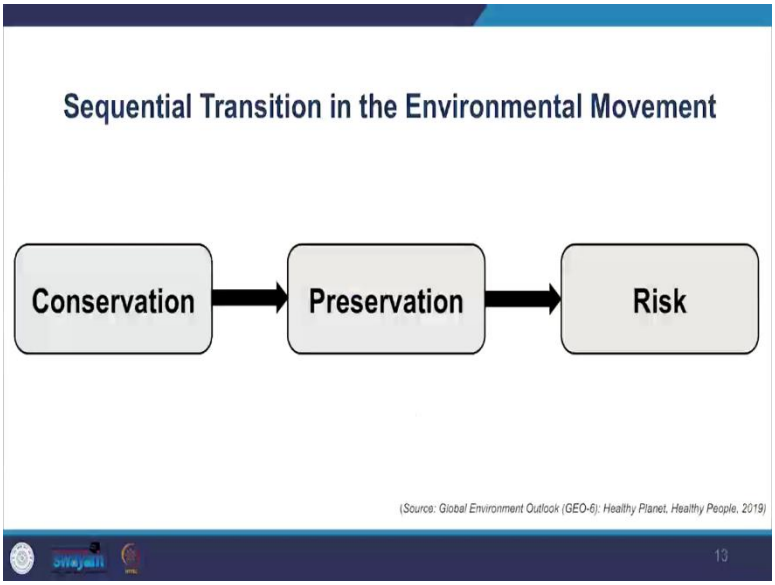

Referring to the report, there has been a sequential transition in the environmental movement, so we have been observing environmental movement for some time. Initially, the movement focused on the conservation of the future, then the focus was on preservation with value seen in nature like why we should preserve nature.

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The modern environmental movement, which is now we see is more about the risk, the risk that environmental degradation possesses to human health and well-being. Industrialization in the 19th century and World War I led to deflection, rapid outdoor recreation brought many people direct contact with environmental degradation and heightened commitment to preservation.

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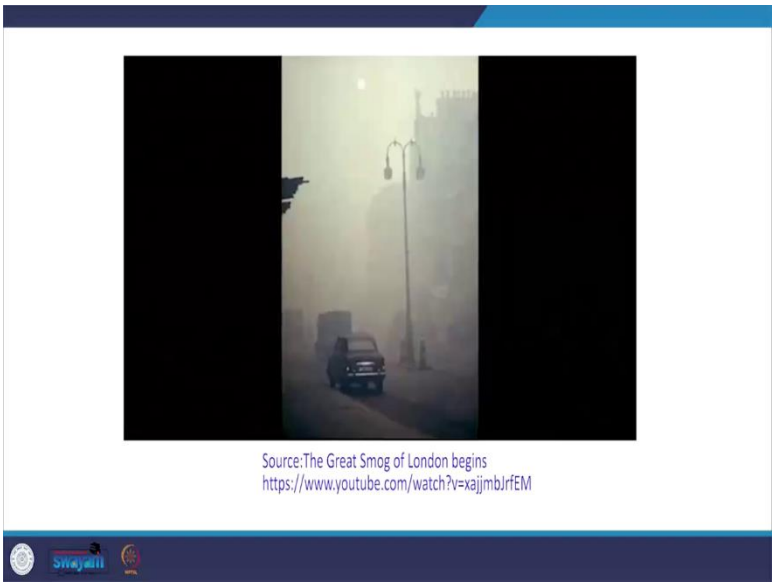

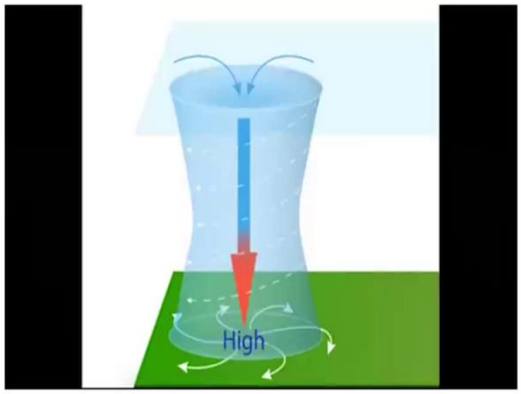

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No. 30,309 LONDON, MONDAY,

LONDON'S 40-MILE FOG BLACK-OUT

ALL BUSES STOPPED: PLANES DIVERTED

EFFORT TO MAINTAIN SERVICES TO-DAY

LITTLE HOPE OF CLEARANCE: DRIVERS WARNED

DAILY TELEGRAPH REPORTER

Source:The Great Smog of London begins
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Post, World War II, rapid economic growth created concerns for the quality of life. You may recollect the great smog of London, the deadly smog that covered the city of London for 5 days from December 5th to 9th in 1952 caused by a combination of industrial pollution and high-pressure weather conditions. This combination of smoke and fog brought the city to a near standstill and resulted in thousands of deaths. Because of this, its consequence prompted the passing of the Clean Air Act four years later, which marked a turning point in the history of environmentalism.

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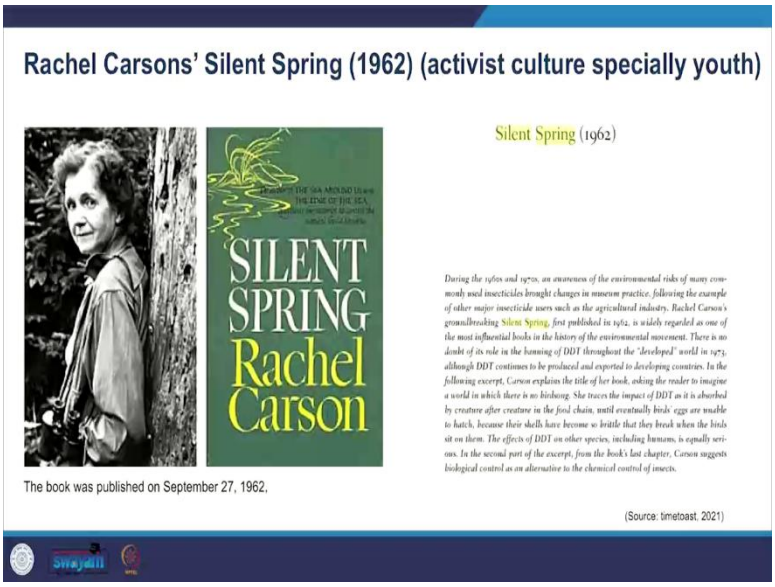

The key voice that brought up environmental risk was Rachel Carson through her writing on Silent Spring in 1962, she highlighted the environmental risk of commonly used insecticides. Her book is considered the most influential in the history of the environmental movement. You may also reflect upon the Bhopal gas tragedy, where a gas leak incident took place on the night of 2nd and 3rd

December in 1984 at Union Carbide India Limited, a pesticide plant in Bhopal, Madhya Pradesh in our country.

You can think about all the incidences that took place to realize the risk involved and, the environmental risk involved. Increasingly, there are concerns that the enormous gain in life expectancy and quality of life since the Industrial Revolution is in danger of being reversed, so we are already here where we are starting to see these changes. The report which we are looking into, looks into what is the state of the global environment. How is it changing? And what are the major factors and drivers both positive and negative, influencing these changes?

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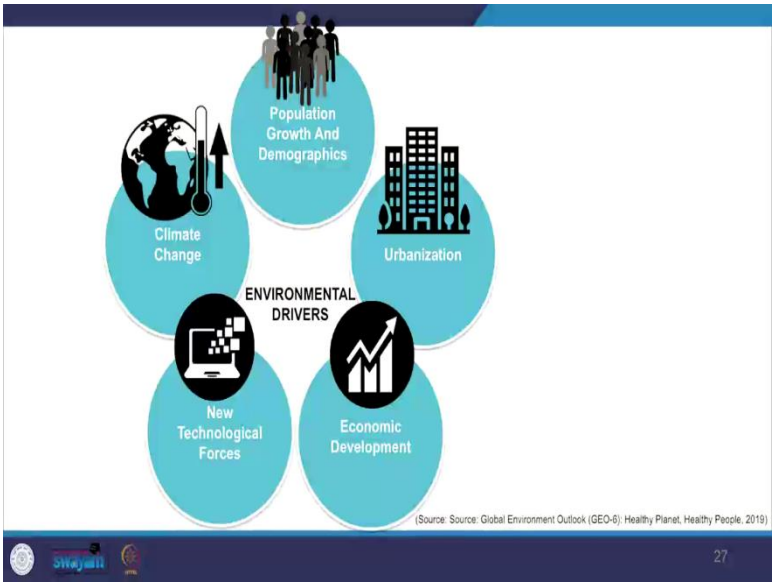

In the report, 5 drivers are reviewed, first, we see the population growth and demographics, then we see urbanization as another drive then we see economic development, and we also see new technological forces and one also identifies climate change as an independent driver to the change in the environment, which we are experiencing. The report states that these have led to wealth, all urbanization has led to wealth but might also cause trouble for us.

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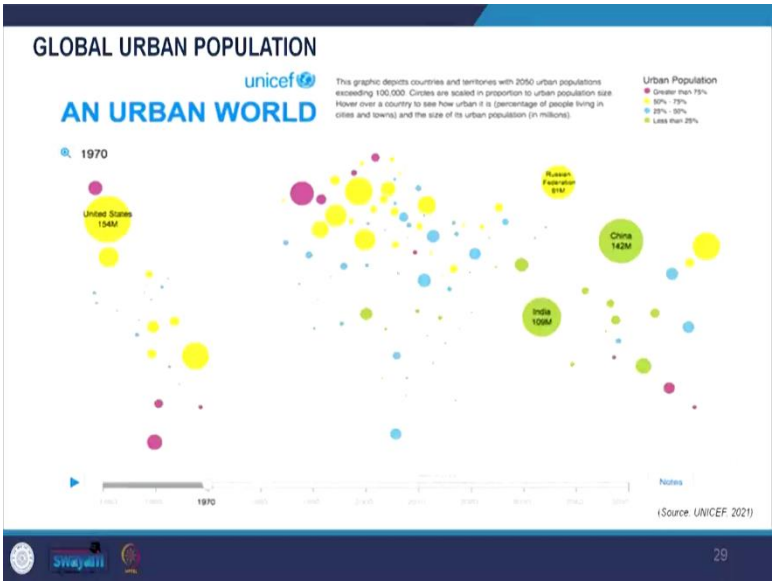

Looking a bit closer between today and 2050, the global urban population will continue to increase. Urbanization has been going on throughout history, but now the major concern is the pace of urbanization, it is happening very fast. The scale in which it is happening, the urbanization is happening, and the impact, of the urban areas have accelerated sharply over the environment in recent decades.

As we see large populations keep flowing into the cities, this inflow can place great strain on the environmental institutional resources and infrastructure, and this is going on increasing. The people we have to manage in cities, the money we have to put into cities, the urban transportation which has to be taken care of, water supply and sewerage system, which one needs to provide for the city, so all, the pressure is increasing all these infrastructures.

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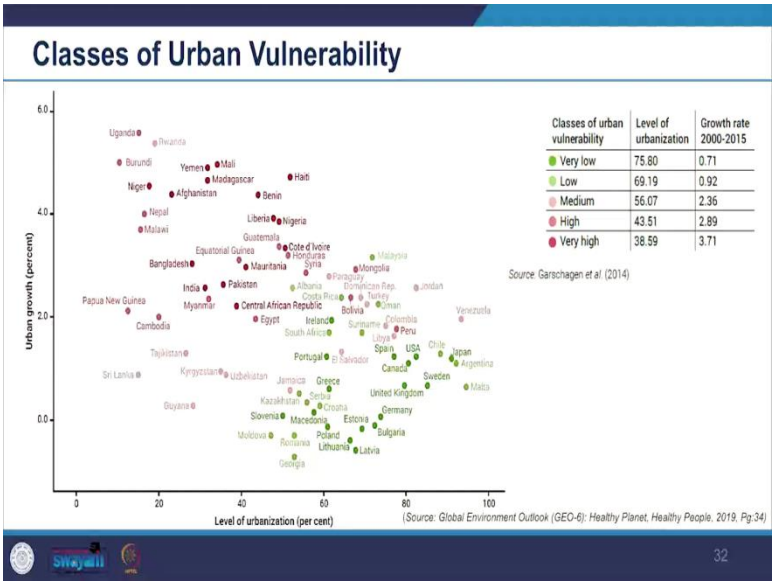

Classes of urban vulnerability	Level of urbanization	Growth rate 2000-2015
Very low	75.80	0.71
Low	69.19	0.92
Medium	56.07	2.36
High	43.51	2.89
Very high	38.59	3.71

In the figure, from the report, we see the countries with levels of urbanization and the rate of growth. In countries with low levels of urbanization, urbanization is happening at a lower level, but there is a high growth rate in population. Urban citizens are considered highly vulnerable, which you can see here in red color as per the report, Indian cities are highly vulnerable. The vulnerability, how in this report they are calculating, the vulnerability is calculated by adding the urban susceptibility, the weakness, the lack of coping capacities, and the lack of urban adaptive capacities.

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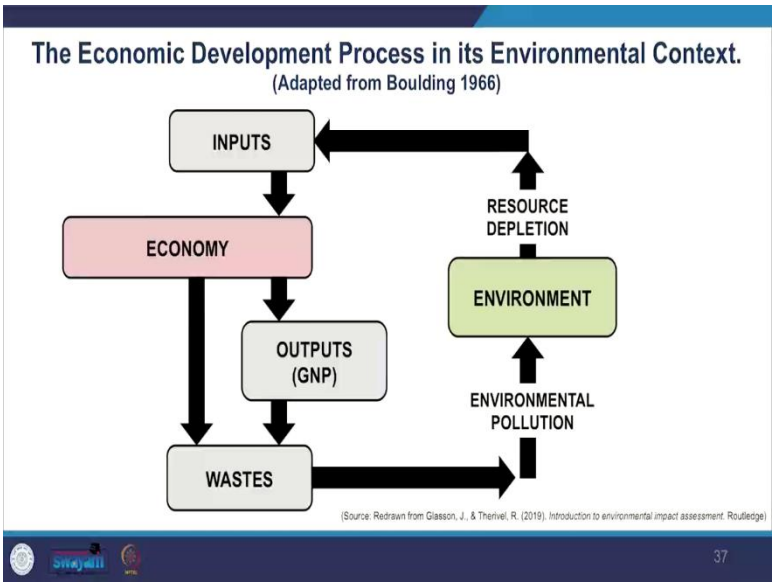

Moving on, looking into the economic driver, economic developments in the past have brought wealth, so we could reflect upon how industrialization and all the economic development, our income increased, but has been a driver of increased resource, use and environmental damage at the time. We can see this as explained by Glasson and Therivel from Boulding's work. Boulding in 1966, portrayed the dichotomy, the contrast between the throughput economy and the spaceship economy in which we are.

The economic goal of increased gross national product is the way generally we calculated using more input to produce more goods, so more and more input is required to produce more and more goods and services. This particular process contains the seed of its destruction, increased output brings with it not only goods and services but also more waste products, increased inputs, and demand more resources.

As explained, through the Bouldings concept, the natural environment is the sink for the waste and the source of the resources, so the environment is also providing us with things as well as it is absorbing the waste which we are generating. So, environmental pollution and the depletion of resources are invariably always the ancillaries to economic development. So, as long as this happens, even the environmental pollution and the pollution is going to go on happening.

This interaction and the impacts between human actions and the biophysical world have been recognized by governments from local to international levels. Attempts are continuously made to manage the interaction better, so you can think about how EIA fits in here. Further, reports indicate that the technological advances have been tremendous in past decades and continue to be much more rapid now. However, these advancements have resulted in both positive as well as negative impacts.

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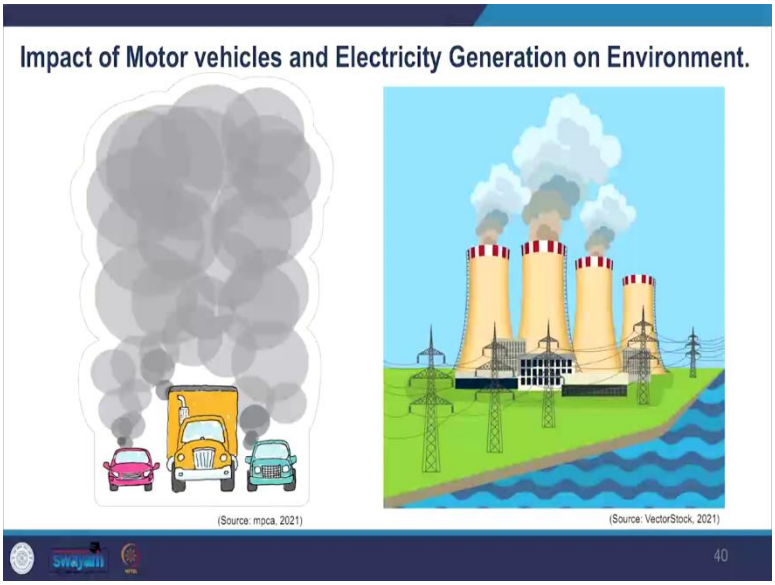

For example, as included as we have all, we have been experiencing using motor vehicles and electricity, which represent two of the most important technological breakthroughs of the 20th century, but their negative environmental and resource impacts are likely to persist well through the 21st century.

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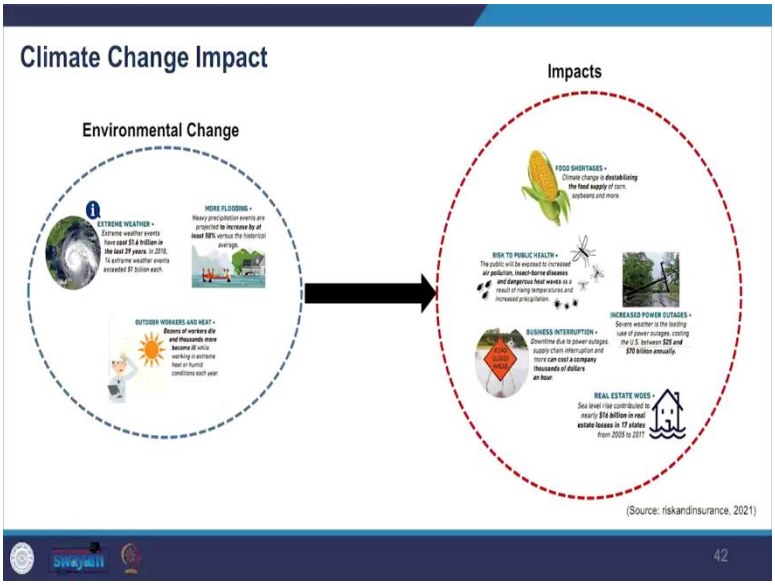

Now, we may also note that, as per the report, climate change has become an independent driver of environmental change and poses a serious challenge to future economic development, so in itself, it has become a driver for change. Climate change poses a risk to human societies, through impacts on food and water security. This fact is established what we are talking about is scientifically established, but more work is required to undertake this, as we see in the report. Climate change will also increase the existing risks and will create new risks for the natural and human systems, this is also a well-established fact.

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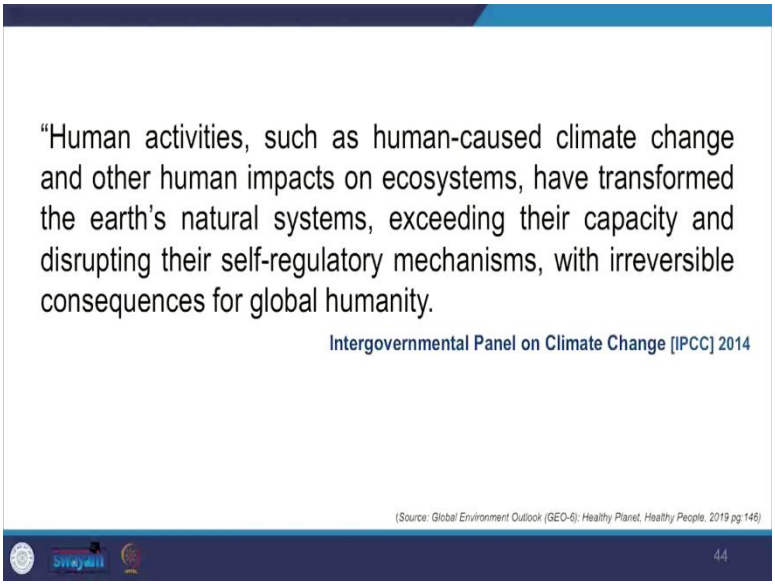

In the report, it is highlighted that human activities have caused climate change and impacted ecosystems. They have transformed the earth's natural system exceeding the capacity and disrupting their self-regulatory mechanism, self-regulating mechanism, the resources they can provide, or the

waste they can sink in. With irreversible consequences, so this cannot, we cannot reverse it for global humanity as per the intergovernmental panel on climate change study.

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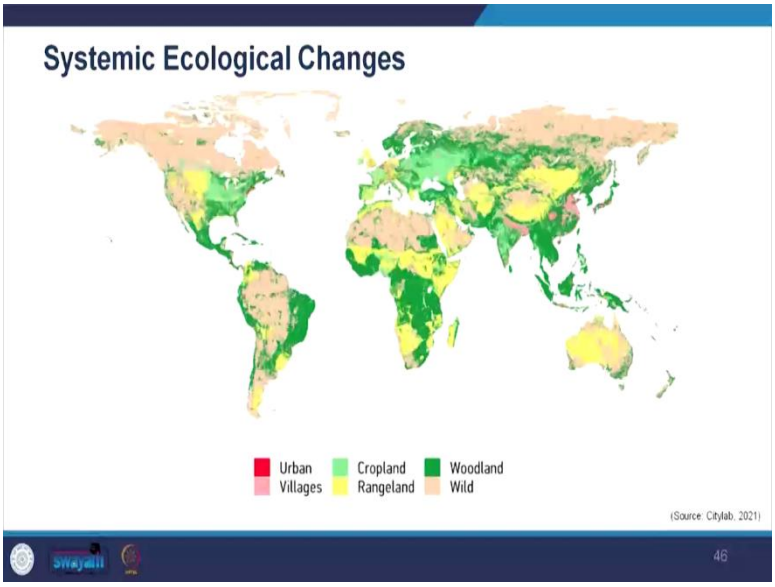

Further, we see that humanity has already been seriously affected by ongoing systematic ecological changes, such as climate change and land use change, so we see, that we are experiencing what kind of climate change is happening, we can also see a lot of land use change. These have reached the point that the ecological foundations of human society and natural systems that support other species or what we see around the other species around us and provide invaluable ecosystem services are in great danger, so we are there, we are in the danger zone now.

So, our human, activities are causing increasing amounts of pollution to the extent that this is now recognized as the biggest single risk to human health worldwide, so our activities are the single biggest risk to our health. Before us it was a big challenge to survive with this range of human-induced damage, so there is a big challenge in front of us, including climate change, deforestation, desertification, loss of biodiversity, scarcity of natural resources, pollution, and the consequent natural and the associated environmental impacts.

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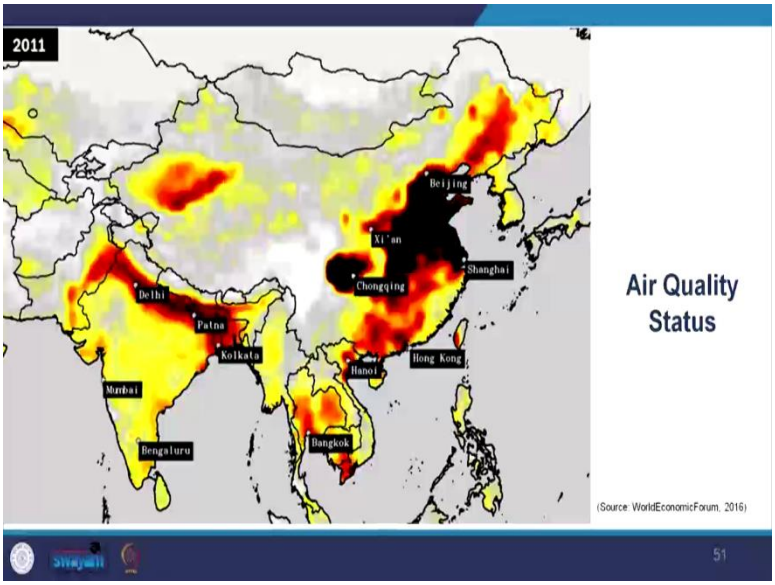

Now, let us look at the current global environmental status as per the report, looking first at the air status, that is what I focused on today. It says that the emissions generated by human activity have changed the composition of the earth's atmosphere, with consequences for the health of people and the planet, so it is costing us the health and the planet as a whole, it estimates that the global burden of disease contributed by air pollutions have doubled. People change the atmosphere, mainly by generating emissions, so you must be experiencing emissions around you.

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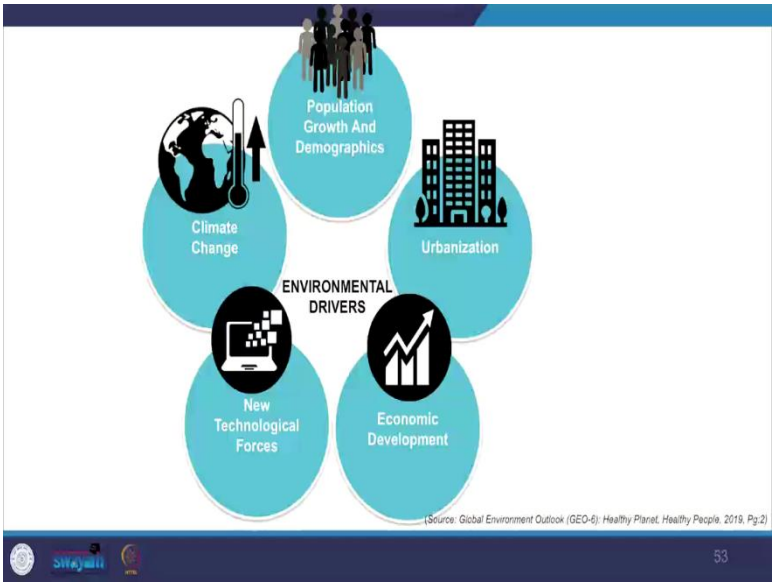

As we have already seen trends in human-caused emissions are driven by changes in population, urbanization, economic activity, technology, and climate, as well as by behavioral choices, what choices do we make about our lifestyle? and then also it talks about conflict. All these drivers are

influenced by policies, so we also try to regulate it through policies as to what action we take, or how we respond to these situations as a nation through policy interventions.

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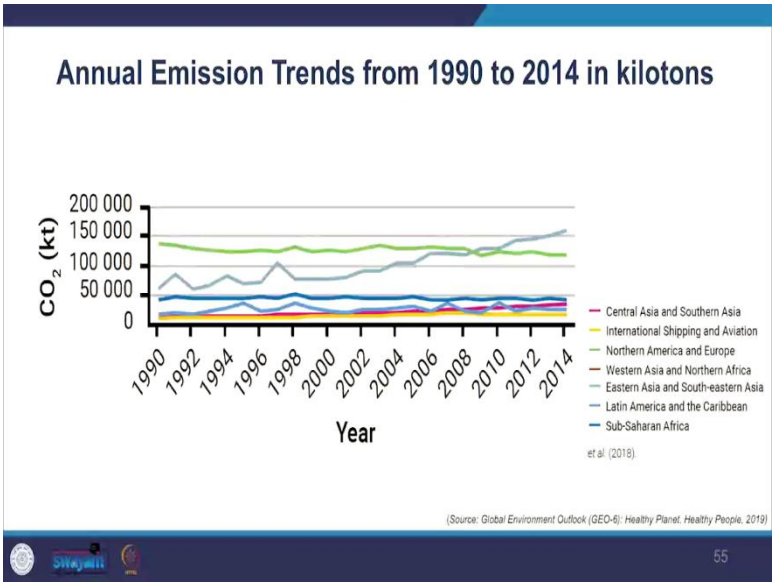

As per the report globally anthropogenic means environmental pollution and pollutants originating in human activity, what we do, and what kind of changes pollution and pollutants we create anthropogenic carbon dioxide emission increased by more than 40 percent from 1990 to 2014. This increase is largely driven by a massive increase in Asia, so all these increases are happening because of the increase in Asia. The report also indicates more decline in anthropogenic carbon dioxide emissions in North American Europe because of the technology that they are curtailing it.

Let us see some of the human activities that generate emissions as per the report, the electricity and fuel production sector is the largest anthropogenic emitting sector. Within the sector, electricity generation contributes around 70 percent of key pollutants, despite increases in renewable energy capacity, fossil fuels still domin0ate the global power system, three-quarters of these sectors' emissions are from coal-fired plants, and coal combustion is also the second most important anthropogenic source of global mercury emissions.

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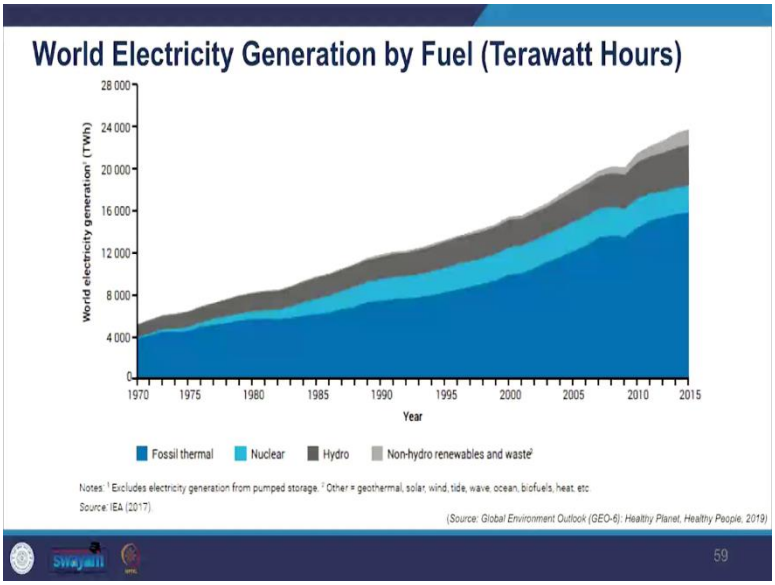

Electricity generation production doubled between 1990 to 2015, as seen in the figure from the report, but emissions of air pollutants did not increase at the same time, so this is mostly because of technological interventions. The main reason for this diversity included in the results, first is the improvement of energy efficiency, so we have efficiently learned how to use energy, tighter emission standards, their change in these standards, and also the progressive end of pipe control technologies, then we also see there has been development of natural gas, renewable and nuclear power.

However, despite existing policies and the announced aims targets, and intentions, electricity demand is expected to increase by two-thirds by 2050, so we will need more and more electricity in the future. It is projected that both end-of-pipe pollution control technology and coal with low sulfur content may be used to achieve lower air pollutant emissions.

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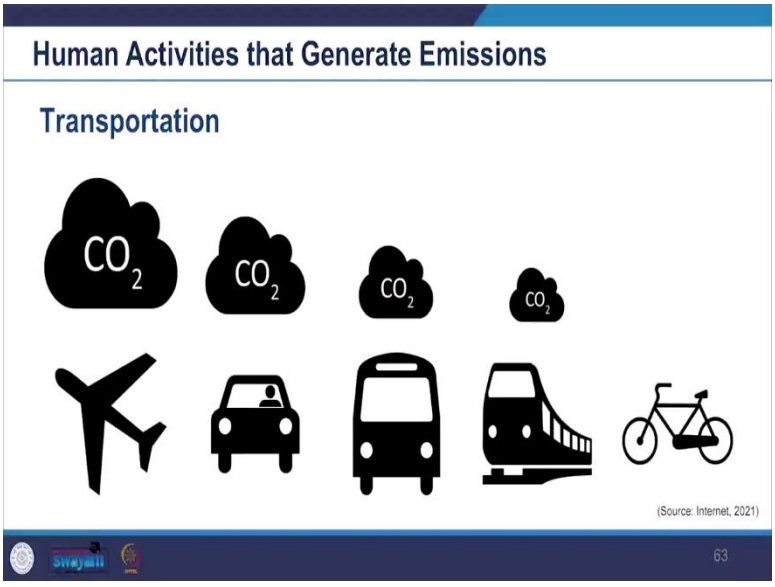

Another human activities that generate emissions is Transportation. As per the report, in all regions of the world, the transportation of people and goods is a significant source of emission of air pollutants, so we see transportation being one of another major pollutant greenhouse gases, ozone depletion substances from automobiles, air conditioning units, so most of us have been using air conditioning units in their cars and persistent bioaccumulative toxic chemicals, which is also set as PBTs, PBTs include lead and other metals, so we are seeing increase in this.

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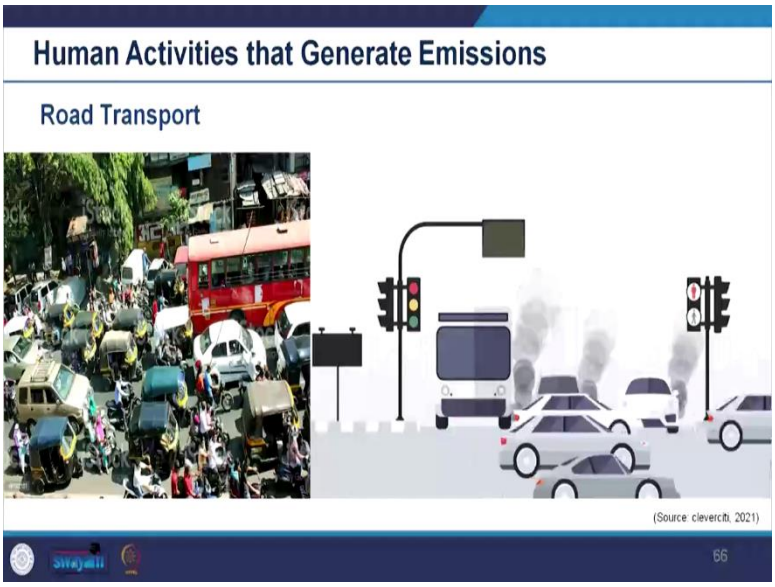

Road transport including petrol like gasoline and diesel fuel passenger cars and heavy-duty trucks account for a main portion of emissions, so road transport is also counting for that. Road traffic also contributes to emissions, the cars and trucks operate and emit pollutants near where people live and work, they have a larger impact on air pollution exposures and associated health impacts, we see.

As for the report, the total road transport activity is higher in North America and Europe than in other regions and is therefore responsible for greater carbon dioxide emissions. However, the report also indicates steady emissions for the last decade because of fuel efficiency and the introduction of vehicle emissions and fuel standards, so we have a lot of standards coming in.

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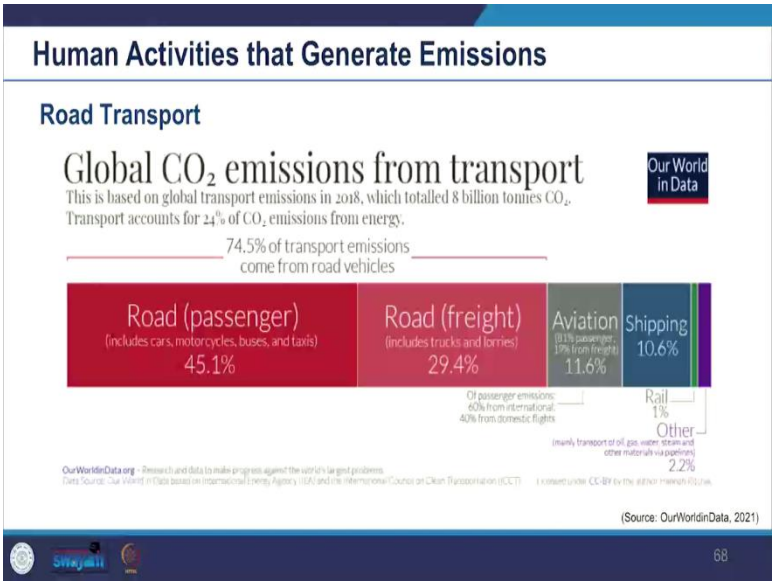

We further see that as per the report in the developing countries, road transport emissions continue to rise as vehicle use is increasing faster, so you have seen a lot of vehicles on the road now, then technological improvement despite the introduction of emissions and fuel standards. Implementation of cleaner technology is low and especially it is slow; it is said to be slow because of the trade of used vehicles from the richer countries.

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Maritime shipping is another generator we see here, maritime shipping is used to transport 80 percent of global trade, if we measure it through volume we see that it grew by more than 300 percent between 1990 to 2015 when measured by the volume. Maritime shipping typically burns the heaviest petroleum products, ships are a significant source of emissions globally, so they are affected globally as well as in the coastal regions and post cities.

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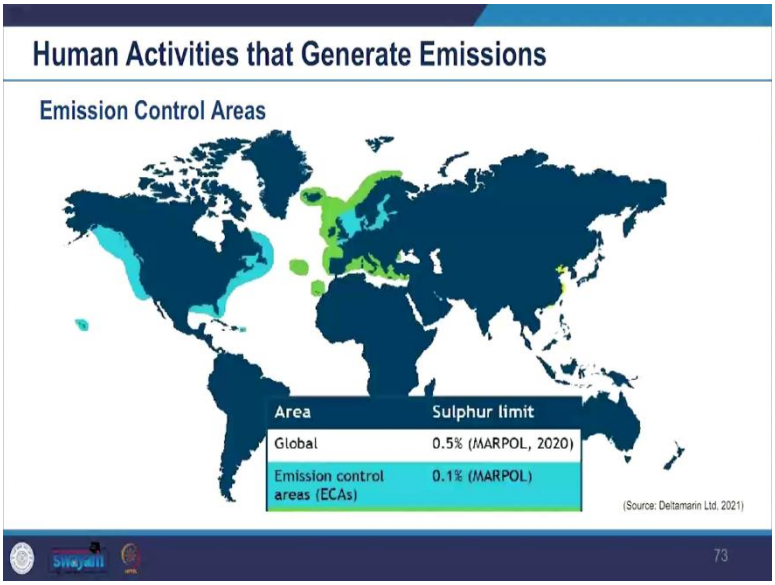

Emission control areas have been established under international law, for example, covering the North and Baltic Sea and North American coastal waters, and national laws for example, covering Chinese ports and inland waters. The International Maritime Organization has announced new emission and fuel standards that are expected to dramatically decrease shipping emissions starting in 2020.

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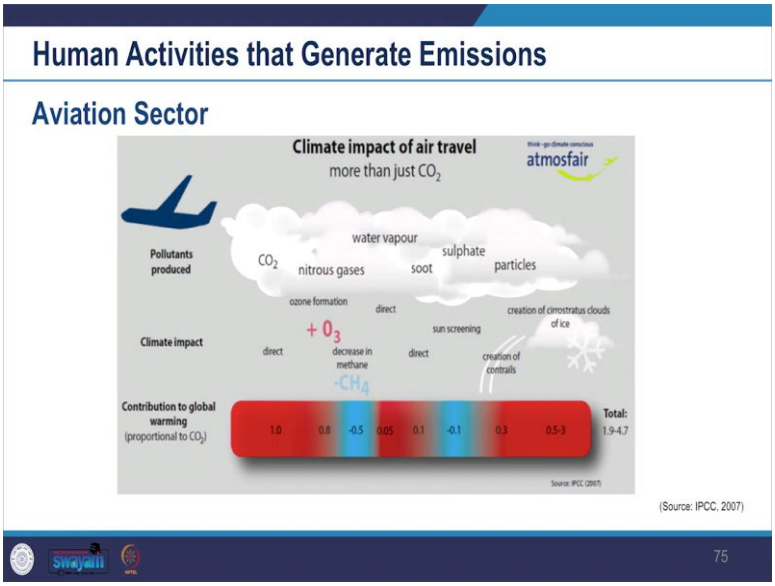

As per the report, we see another area, Aviation. Aviation is another human activity that is a growing contributor to global emissions, however, currently small accounting for less than about 2 percent, currently, it is very small compared to the percentage of 2 percent of global anthropogenic carbon dioxide emissions from fuel combustion. Between 2000 to 2016 however, we see global air passenger travel increase and the increase is in the range of 235 percent, if you see it measured in passenger-kilometers air freight increased by 174 percent, so the increase is huge. Aircraft emit pollutants

directly into the upper atmosphere, where their impact on ozone formation and climate forcing is larger than if it emitted near the surface. So, the kind of impact it is having at the upper level is higher, so we see that all these activities, how do they really, what is the status here.

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Moving on, let us look at another human activity causing emissions, the industries, so this would be very critical for us to understand. Industry includes both manufacturing and mining sectors, the industrial sector emits air pollutants, greenhouse gases, emissions of ozone-depleting substances we call ODS, and persistent bio-accumulative toxic chemicals.

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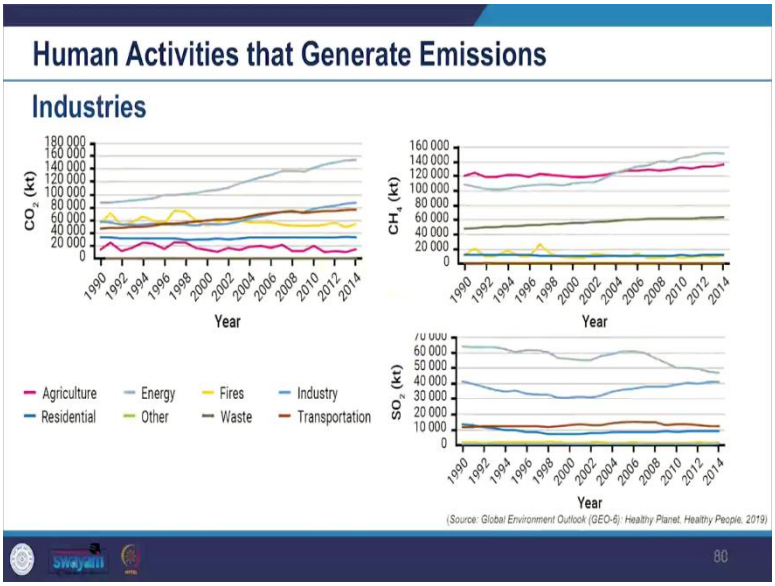

As per the report, nearly two-thirds of the historic carbon dioxide and methane emissions are attributed, they are because of the businesses including the production of fossil fuels and cement, so

from all these, we are getting all these emissions. Global emissions from industry increased for all pollutants between 1990 and 2014, except for sulfur dioxide.

As per the report, the creation of new industrial products, we see there are many more new industrial products coming nanomaterials and chemicals also pose a considerable challenge in terms of regulation and control, their emissions are often neither regulated nor quantified, leading to unknown effects on the environment's health.

We see that the other human activities for emissions include residential and commercial activities, a lot of emissions are also happening from the residents and commercial activities, the energy demand of the built environment, primarily because of the construction, heating, cooling, and lighting of residential and commercial buildings account for a large fraction of greenhouse gases emissions in the countries with developed economies in some cities in developing economies as well.

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Moving on, we see yet another as waste management, which is the source of emission, open dumping and burning of solid waste remain one the predominant in low-income countries, as per the report, and continuously be practiced in many cities in lower middle and upper middle-income countries, so it is a huge problem which we see here.

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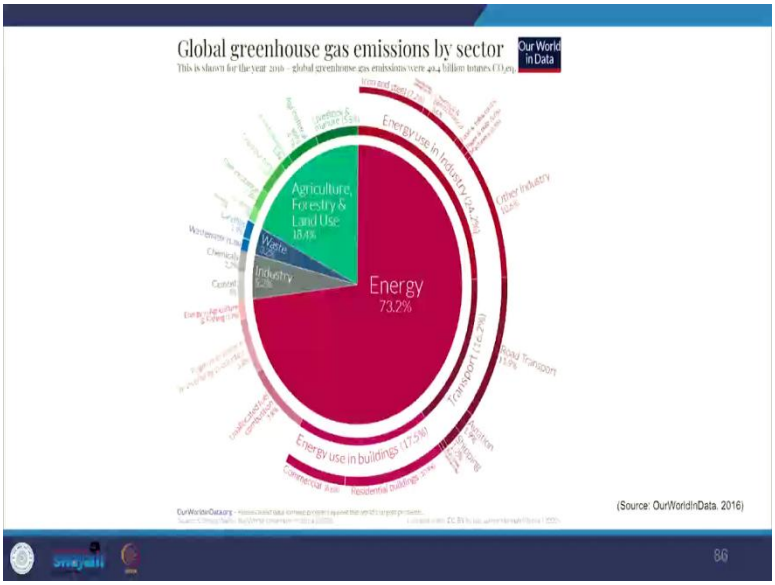

Agriculture, forestry, and other land users, so we see this as well also contribute 25 percent to the global greenhouse emissions as per the report. In developed countries, agriculture forms about 10 percent of national greenhouse gas inventories, while in developing countries, the contribution is much higher, so you can imagine the economies that are much more dependent on agriculture, so you can think about the emission levels.

The natural source also contributes to the emissions of wind-blown dust from the natural landscape and unprotected cropland in arid and semi-arid regions is the largest source of atmospheric particulate matter PM and the dominant faction of course PM in many regions such as North Africa and the middle east, so you have seen all these things.

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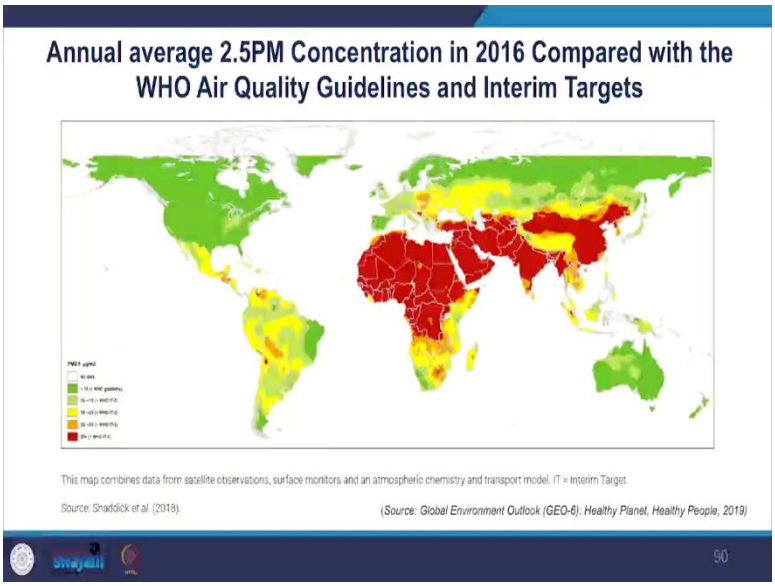

So, moving forward from here, we look at the status of the environment from a global public health perspective, and when we look at the two most important indicators. We look at our air pollutants, particulate matter PM and its components, and ground-level ozone. As per the reports globally, the highest annual average concentration of PM 2.5, so you also match these 2.5 are seen in areas affected by wind-blown sand and dust. Example. you have North Africa and West Asia, we also see fires, as in Central Africa and Latin America, anthropogenic pollution, and South and East Asia.

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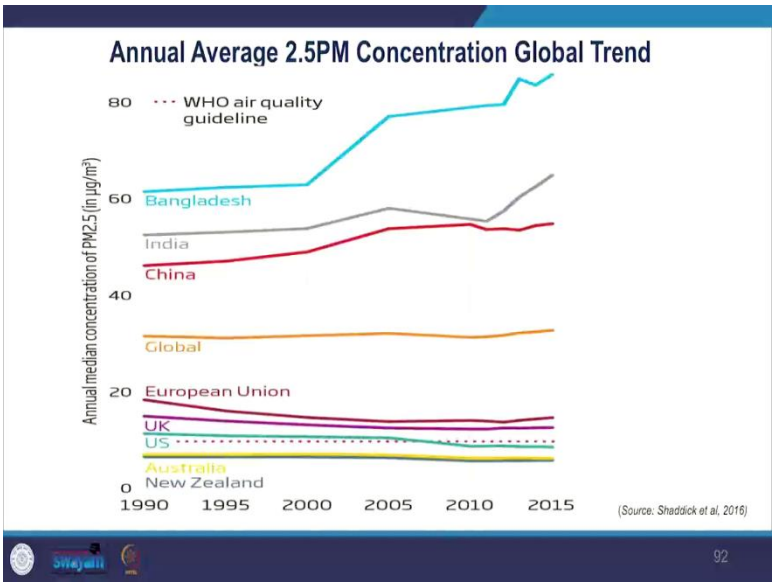

As seen in the figure, you can see here from 1998 to 2012, satellite observations suggest that PM 2.5 decreased significantly over eastern North America and increased over West Asia, south Asia, and East Asia. Ground-based measurements suggested that the trends over North America, south Asia, and East Asia are associated with changes in anthropogenic populations, this is all happening because of human activities, but the changes over West Asia due to changes in wind-blown sand and dust, so some are natural conditions which we see here.

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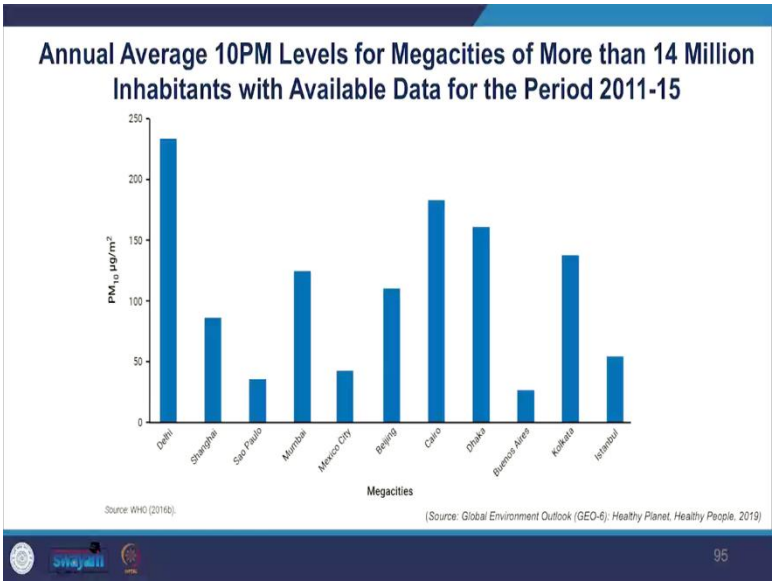

As per the reports, you further see that urban areas have higher overall levels of air pollution. we can see the data most of us live in these cities, the study shows that only 4 mega cities attend the WHO guidelines for annual average concentration of the 45 mega cities for which data were available, you can see here all the cities.

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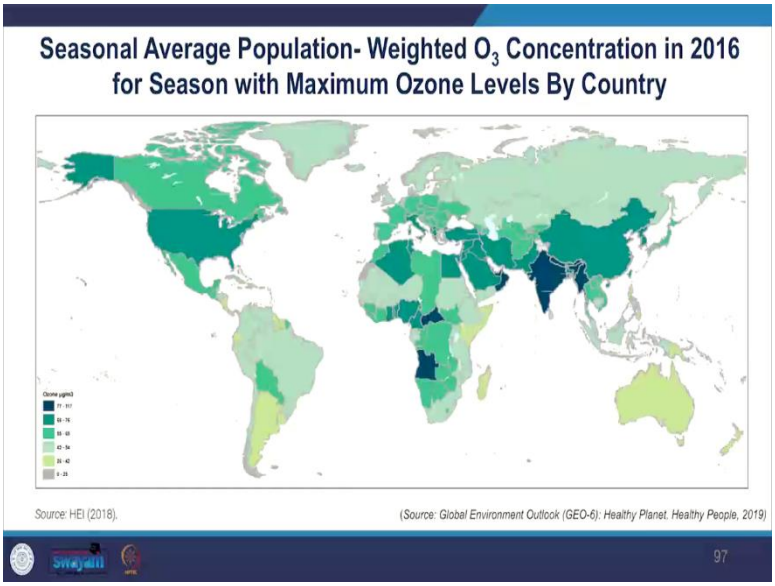

Then you look at the ground level ozone is highest in northern middle latitudes and tropics and peaks in the warm season. North America, the Mediterranean, south Asia, and East Asia are hot spots of ozone, pollution as seen in the figure, however, a high population weight ozone, concentration is also estimated in central Africa, west Asia, and southeast Asia, so you can look where we are here.

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The largest sources of particulate matter PM in the atmosphere globally on an annual basis are wind-blown sand and dust. The dust belt extends from the west coast of North Africa over the Mediterranean basin and Middle East, central and south Asia to Mongolia and China, if you look at the reasons, people influence dust sources through land clearing, so more and more, we are clearing the land and land management practices and other influence on desertification. However, there has been a significant increase observed in North America, central Asia, and Australia, we also see an increasing trend in dust over a large part of the Middle East.

From 2001 to 2012, this is particularly suggested because of the climate change. Further, we see that as per the report, the transported dust contributes to a wide range of impact, so because of all this dust, we are seeing that there is an influence on climate and precipitation, so what kind of rainfall we receive, fertilizes distance, forest, and oceans, contributes to human respiratory elements, all the sickness health issues and spreads human animal and plant pathogens for downward of the south region within the source region dust storm may damage infrastructure, interrupt transportation and communication system, so all these losses happen, so you can see here how the air dust belt is.

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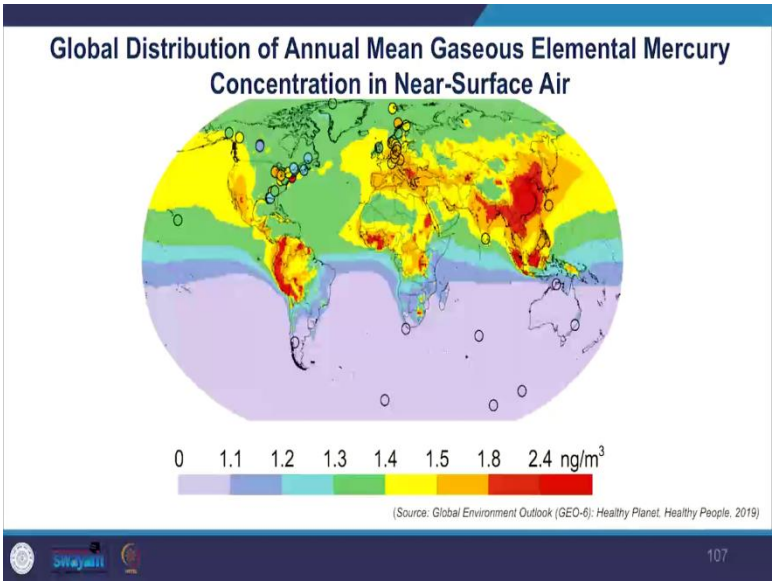

So, we further see that as per the report, fires are another large contributor to transboundary pollution, fires areas are primarily connected with land clearing or lighting, so more and more land, we are going on clearing which is leading to more fire here. Further, we look into the persistent bio-accumulative toxic substance and environment, and we see that the gaseous element mercury, which is a global pollutant, has the highest concentration in East, south, and Southeast Asia. So, you can see where we are, and in the artisanal gold mining regions of equatorial Africa and South America. In the image, we can see the global distribution of annual mean gaseous elements, and mercury concentration in near-surface air circles shown values observed on ground-based monitoring, so you can see here.

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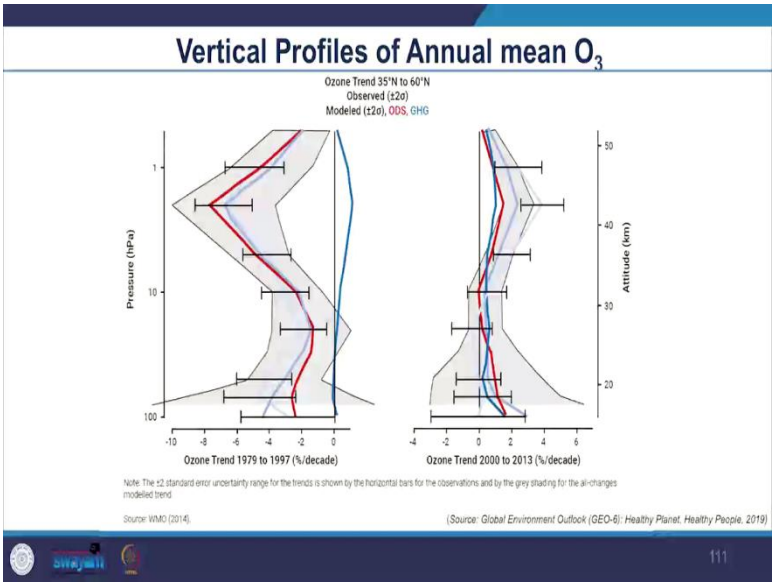

Further, regarding ozone as per the report, there are indicators that the stratospheric ozone layer is starting to recover, so we can see here there has been a reduction. Now, let us look at the impact of environment and the human, so activities that generate emissions, that threaten human health and well-being, food security, and ecosystems.

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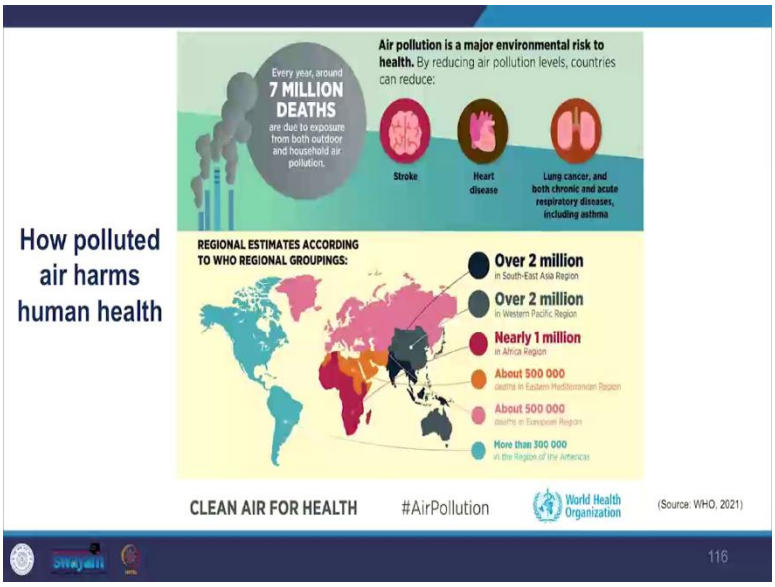

So, exposure to indoor and outdoor, air pollution was responsible for 6 million to 7 million as per the premature deaths in 2016, as per the WHO report. So, we see that as per the reports even brief periods of from minutes to hours of exposure to high concentrations of pollutants can have significant health impacts and episodes of unusually high air pollution attract public concerns so that there can be problems there.

However, serious damage to public health happens with long-term exposure, the more we are exposed to it, living in areas of high annual average exposure. So, however, it is not everything is, the levels are not yet well established. The number of deaths that happen due to air pollution varies widely among countries which reflects different populations, so death how many people die depends on the population levels, differences in population size, demography, underlying rates of disease, and socioeconomic characteristics.

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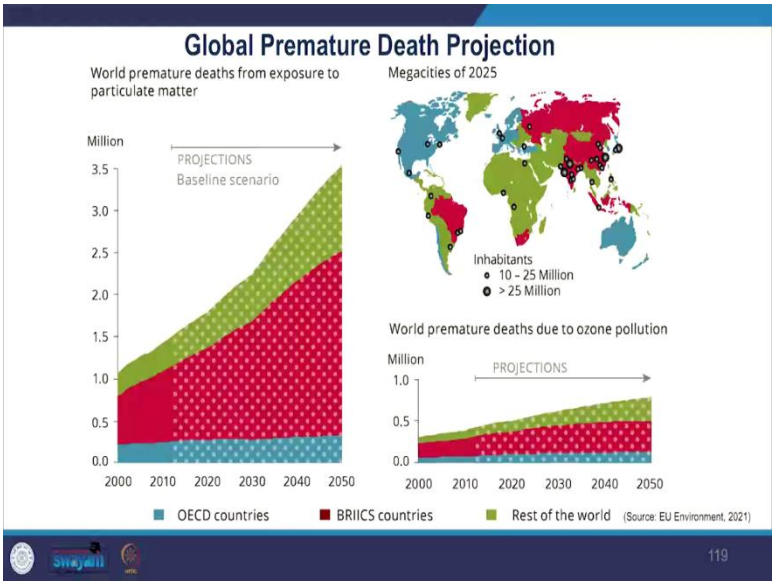

So, we see that between 2010 to 2016 deaths were because of ambient PM exposure, which increased by 11 percent globally due to increased air pollution as well as growth and ageing of the population. So, we see in 2016, 95 percent of the world's population lived in areas with levels of PM 2.5, exceeding the WHO air quality guidelines. In addition, we also see premature mortality, air pollution contributes to a wide range of chronic and acute diseases, especially cardiovascular and respiratory diseases.

The economic impact of life, years lost because of what we are losing increased health care and lost worker productivity due to air pollution are also considerable, so we are not only in health debt, but there are a lot of other losses which are happening. As per our report, the impact of PM 2.5 air pollution on labor forces in China in 2007 was estimated to create economic losses of 346 billion Yuan which was 1.1 percent of GDP. Then we also see there are a lot of recent OECD analysis estimates, combined cost of ambient and household air pollution in Africa to be 450 US billion dollars in 2013.

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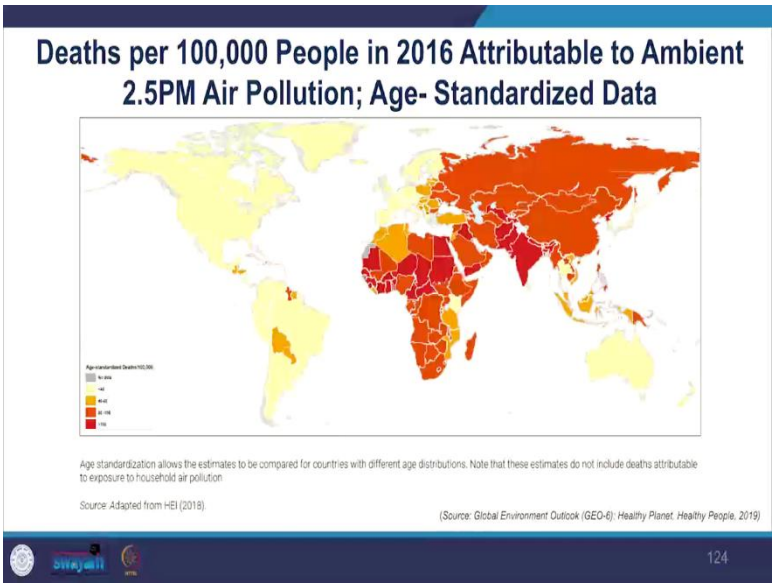

Asia has the highest absolute number of deaths in 2016 attributed to this and exposures have begun to decline in China, but increasing in parts of South Asia, so you can think of where we are right now. In the image you can see the deaths of one lakh people in 2016 because of ambient air pollution, you may know the red and the orange color to understand the level of impact here, so you see where we are located here. So, reports indicate that over the coming decade to century, adverse health effects from climate change are forecast to greatly exceed any potential health benefits.

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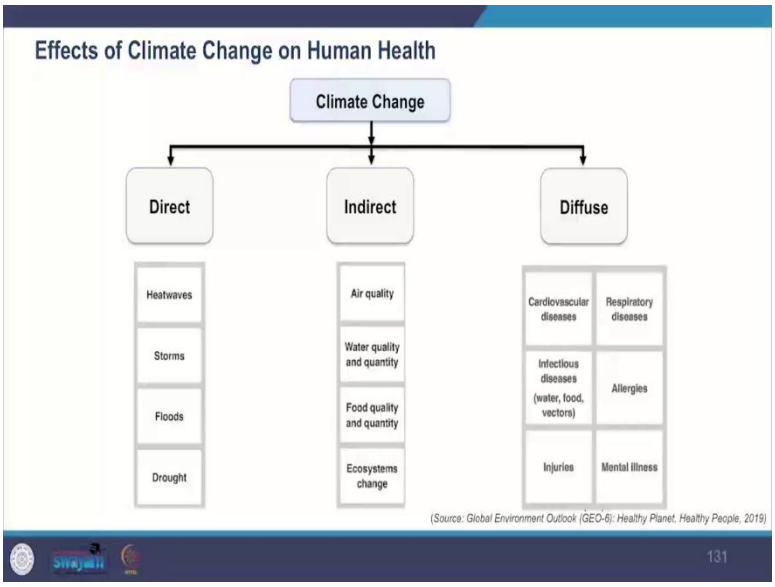

So, the effect of climate change on human health can be classified as direct heat waves and storms less direct change in disease vector ecology, reduction in the water supply, or severe air pollution, and diffuse where we can see the category of diffuse effects could have the largest burden of disease

through means such as conflict, migration, famine, and then we also see mental health effects arise from all three categories.

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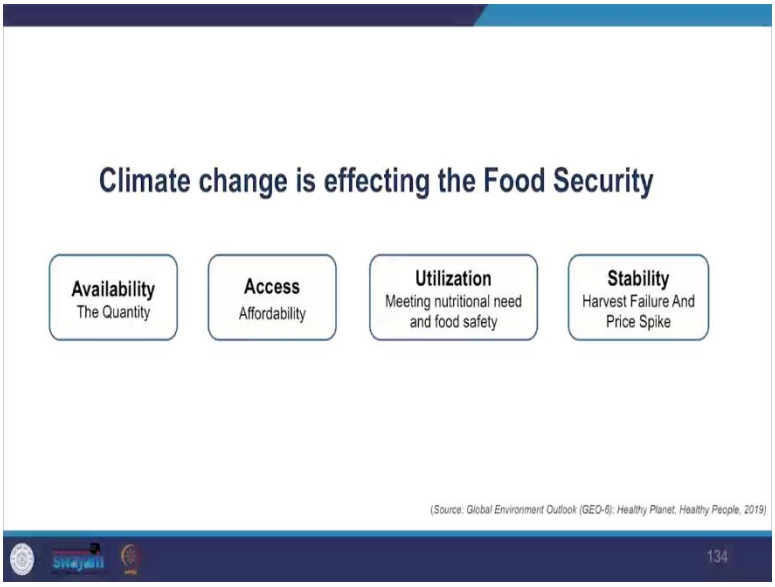

So, the health impact of changing climate will be inevitably distributed globally and we see climate change is also affecting food security, impacting the availability of the quantity, access, affordability, utilization of how much it meets the nutritional need and food safety, and then also the stability, how the harvest failure and price spike happens?

So, it has an impact on the ecosystem as well, like air pollution, and climate change. UV radiations and so on. These adverse impacts in turn affect the severe services provided to humans by those ecosystems and also the social well-being beyond the impact on human and ecosystem health and food security, These kinds of changes in the atmosphere hurt social well-being or the welfare, also because you need to invest more, and then the air pollution degrades materials also, so that also happens here and all these things. So, we have seen all kinds of statuses also impact the human and the ecosystem.

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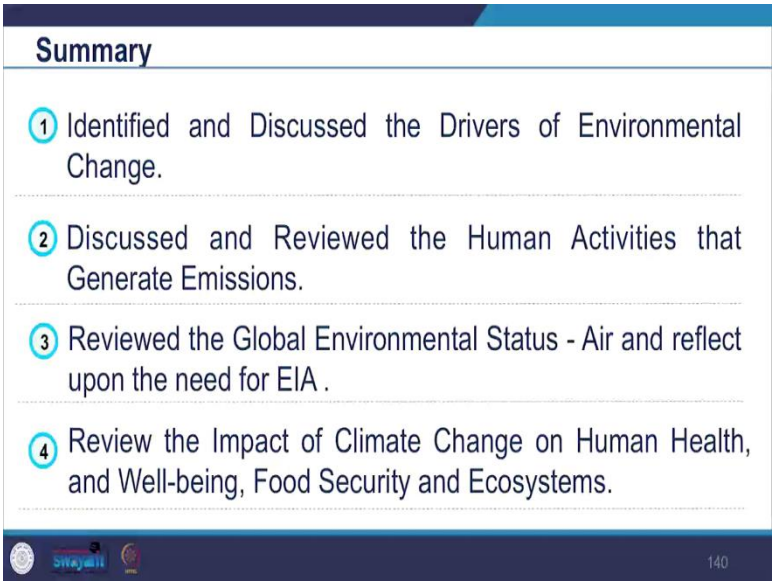

So, summarizing today's session, we see that we identified and discussed the drivers of environmental change, we discussed and reviewed the human activities that generate emissions, we reviewed the global environmental status, particular focus on air, we reviewed the impact of climate change on human health and well-being, food security and ecosystem.

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So, these were our references, the key reference was the Global Environmental Outlook 6 Introduction to Environmental Impact Assessment by John Glasson and Ricky Therivel. Here, you can see the references, our coverage has been limited as the scope of the subject, additional resources to read and watch are provided to you, and the list is given here. Please feel free to ask questions, let us know about any concerns you have, and share your opinions experiences, and suggestions. Looking forward to interacting and co-learning with you in our discourse on the subject of EIA. Thank you.