Introduction to Urban Planning
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Lecture – 29
Urbanization and Environmental Problems

Welcome to the course introduction to urban planning. Today, we are going to discuss about urbanization and environmental problems in the series of urban issues. Our key reference for today would be the World Bank Group publication based on African cities. And we will also look into London master plan and briefly touch upon urban heat island.

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So, accordingly, our coverage would include the relationship between city growth and the natural environments. We are going to study about that. Further, we are going to look at the environmental trends in African cities. We will look at Green urban development in Africa, what is the approach they are suggesting? Further, we will look at the draft London plan where they have worked on the green infrastructure and natural environment.

And also look at the sustainable infrastructure part of the London plan. And the end, we will briefly touch upon urban heat island.

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So, accordingly, our learning outcomes would be that after completion of this particular session, you should be able to differentiate or discuss upon the relationship between city growth and the natural environment. Further, you should be able to describe different environmental trends, which are happening in the urban areas specifically in the African cities.

For that, you should be able to discuss the key elements of green urban development, which I suggested. Further, you should be able to identify or describe various elements from London development plan, which are related with green infrastructure and natural environment. Likewise, you should be able to discuss the sustainable infrastructure approach which has been adopted in London plan and in the end, you should be able to define key elements of urban heat island.

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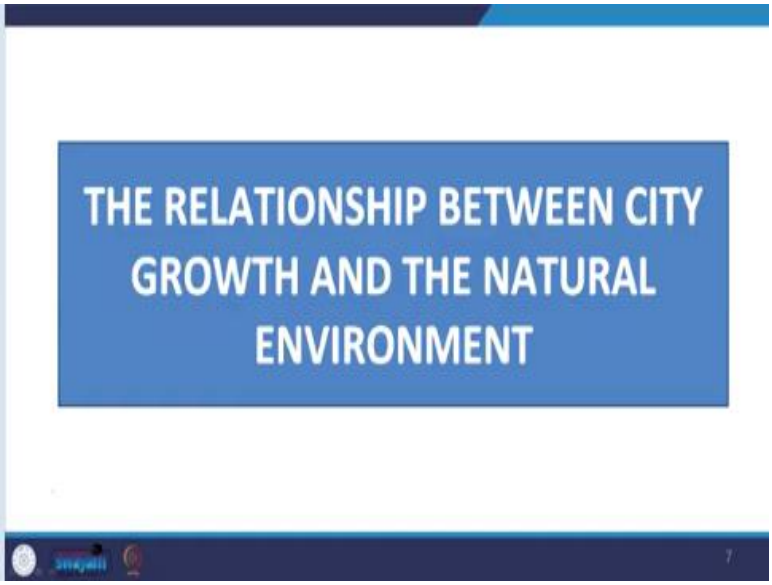

Let us first look at the relationship between city growth and the natural environment, placing the question how urban activities affect the environment. We see that urbanization means growth in population, density, expansion in area, changing economic pattern leading to change in production and consumption pattern. We had seen this before in our definition of urbanization and our lectures of first week.

As per the World Bank Group publication authored by White, Turpie, and Letley in 2017, we see that they specify that urbanization involves 3 types of activities which affect the natural environment. The first one: the expanded use and consumption of natural resources, we had discussed before also that in urban areas, our consumption of natural resource is high. **(Video Starts: 03:26)** Power consumption is high; fuel consumption is high; water consumption is also high and so on.

We see that our consumption rate in the urban areas is comparatively very high. We also witnessed transformation of natural environments like agricultural fields, we are transforming agriculture field into the built environment. Further, we see forest is also been converted into built environment in many cases. As we extend our boundaries and our needs expand. We also see generation of waste including atmospheric emissions, wastewater and solid waste.

In any open space, these activities exist in a complex interaction with one another and have mutually compounding effects. So, they all interact with each other and have together they impact the environment. Broadly given by the authors, these interaction impact the natural

environment in 3 ways. First, they affect the natural resource base of the city. Example, they may reduce the amount of fresh water available to us and also, reduce the water quality.

As discussed before the rate of natural resource consumption is influenced by the demographic characteristics and economic drivers such as population growth, increase in income and increase in living standards and growth and economic output. Second, we see that the interaction between the 3 effects, the ecosystem of the city and the volume and the value of the services these system generate.

For example, the conversion of wetlands to agriculture or to the built environment may reduce the capacity of the wetland to cleanse the water thus, reducing the value of the wetland. They together also affect the biodiversity of the cities. We may see that many species may be removed from the natural environment. You may also notice things around you. **(Video Ends: 05:26)**

Further looking into why such changes matter to us; why should it be of our concern? As for the explanation by White, Turpie, and Letley, we see that such impacts are core to the urbanization process, meaning urbanization itself is built upon such consumption and pattern. Given the situation now, urbanization is unavoidable and therefore, these impacts are also unavoidable.

They are also in a way seen as beneficial, more we consume better health, more wealth, all these are indicators of our development. Whereas on the other hand, we see that it is important for us that when we urbanized, there is subsequent decline in the environmental quality, which always has negative impact on us. Loss of environmental quality would lead to loss of economic, fiscal and welfare for the cities.

When environment will get damaged, we will get less and less from it, you and me can feel the impact of such loss of environmental quality around us. When there is water shortage, you pay increased value for the same water, you see, you and your family members health failing. And you also see that you end up paying more for the health cost. We see loss to infrastructure as well.

When there is lost infrastructure, we invest more to rebuild it. When our neighborhood is filthy dirty, we also experience loss in the property value. We get less rent for the same property because we are located in a dirty place, unhealthy place. We also see loss of recreation. We cannot play outside without compromising on our health. And we also see loss of tourism value.

Tourism may not like; tourists may not like to visit where environment is poor and this does loss of revenue to city economy happens. Further, we see authors explain the relationship between urban growth and natural environment quality over time like looking at what really happens in the longer duration. They say, cities may be on negative or positive trajectories. For any city or group of cities within a country or region a range of different scenarios, they have created certain scenarios from A to C is possible.

Under A, city is able to control and reverse the impact of urbanization activities on its natural asset base ecosystem and species and as seen in the figure, even presents a scenario in which positive feedback cycle has emerged because the cities have been able to control their environment and then they have enhanced it and an improvement in the environmental quality is becoming increasingly rapid in such kind of cities.

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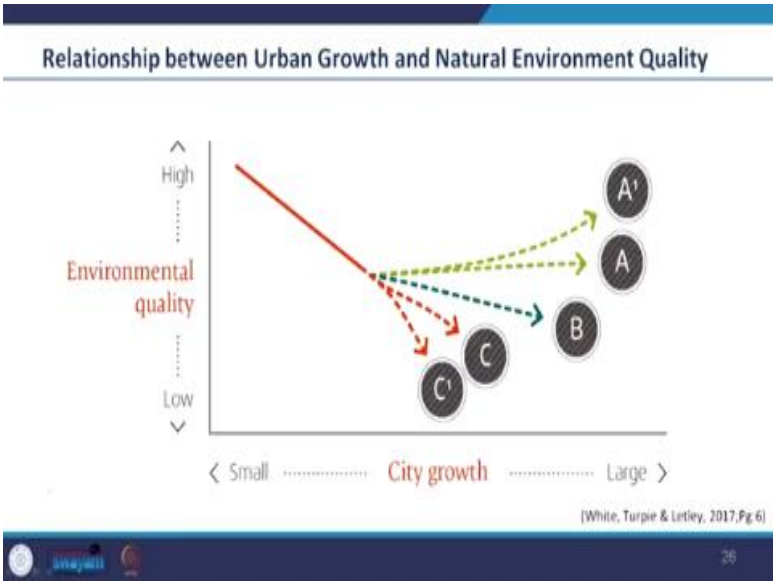

And B, the city slows but does not stop environmental deterioration. On the C, we see deterioration continues largely unchecked in the cities. Therefore, a negative feedback cycle emerges under C 1 and then deterioration and environmental quality becomes increasingly rapid. We see that cities can intervene to improve the environment and its benefits to people.

As cited by the authors here, Mexico City and London provide examples of how cities can utilize different measures to reduce their impact on the environment and at the same time, benefit their citizens with improved environmental quality. We had in particular see, the case of London in our discussion on contextualizing cities and also in case of public health. So, we know how they have handled their environment and health issues.

Mexico City was declared as worst air quality city in the world in 1990 by United Nations. The city through a series of actions such as replacing old cars, removing lead from gasoline, adopting the use of natural gas in transportation and expanding public transportation.

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The city has been able to reduce the health impacts of air pollution drastically. **(Video Starts: 10:00)** Meanwhile, London has been able to reverse the city's impact on the watershed of Thames River. So, you have seen this before as well. **(Video Ends: 10:08)** As we had discussed earlier in the class that in 1950s, pollution from the city caused oxygen levels in the river to be very, very low that the river was declared biologically dead.

Then city took steps like strict regulations that prevent dumping of pollutants into the river, they took steps for treating the water; they took steps for diversion of sewerage from the city. You can recollect the underground sea bridge construction we talked about designed by Joseph Vessel Gate. Further, the city took steps to rebuild the mud banks and also conserve the habitat and this all steps regenerated the river.

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Today, more than 100 species of fish inhabit the river and there are birds, they have all these have become a common sight.

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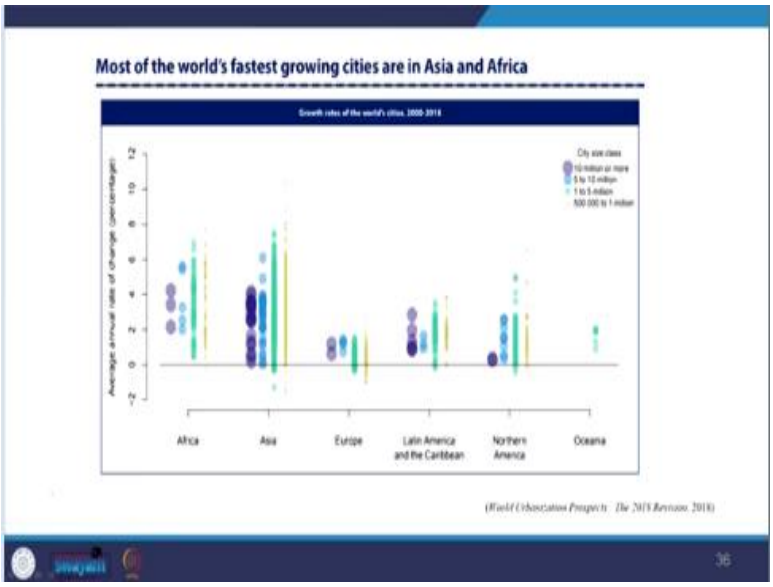

As we had seen earlier that world's fastest growing cities are in Asia and Africa from the world urbanization prospects.

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Today, we will look at cities from Africa to understand the urbanization process and its impact on environment. If cities are not managed and planned properly, you would also like to reflect or need an objective of urban planning lecture while we go through this. As per the author White, Turpie, and Letley, they identify 4 key features of urbanization process in Africa, which seems to have significant impact on the way in which city growth is affecting the natural environment.

The first one, we see is that the urbanization is rapid however, it has been late but it is very rapid in this in Africa. We also see, there is low level of industrialization, modernization and technology which also has a lot of environmental implications. We see low levels of wealth, fiscal resources and service delivery which further reduces the quality of life. Lastly, we see institutions and systems are weak.

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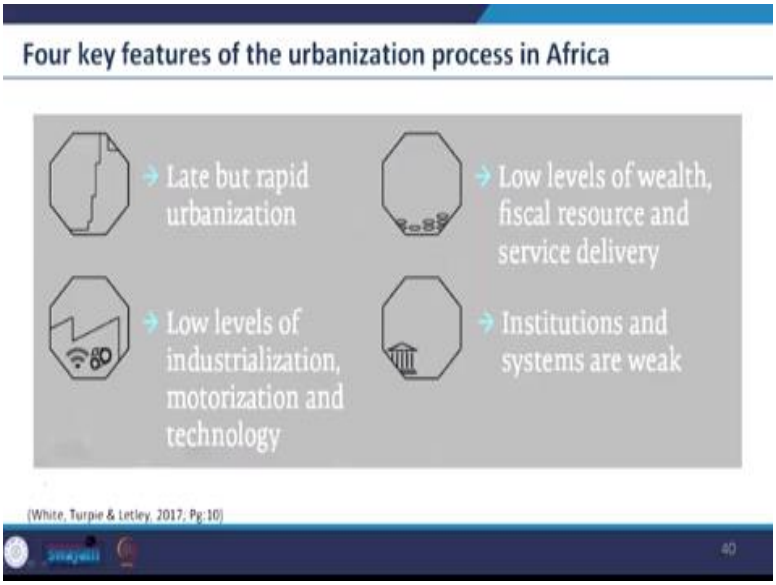

And so, the urban planning and management is also weak which has further implications on the environment and the quality of life of the people living in the cities. Looking at the first component, urbanization in Africa is late but it is rapid now. In the graph, you can see past trends and future prediction of 2055.

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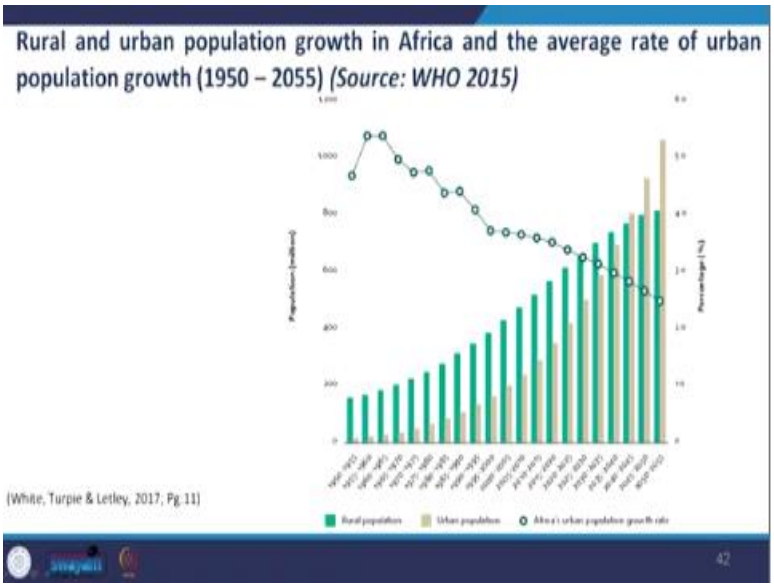

The rural population, you can see in green color, urban population in beige color, urban population growth rate in the line. You see in the graph that it is estimated that from 2040, urban population will surpass the rural population in Africa. Looking into the second key characteristics. We see that further observations have been made that Africa is urbanizing at relatively low levels of industrialization, motorization and technology.

Low level of industrialization and technological intervention leads to heavy reliance on biomass fuels in African cities, which further leads to generate high level of fine and small particulate matter measured in PM 2.5 and PM 10. In the graph, you can see PM 10 level of African countries in grey compared to cities of China in dark green, cities of South Asian countries in yellowish green, and cities of American in European in green color. The red dotted line indicates the level as per recommendation of WHO guidelines.

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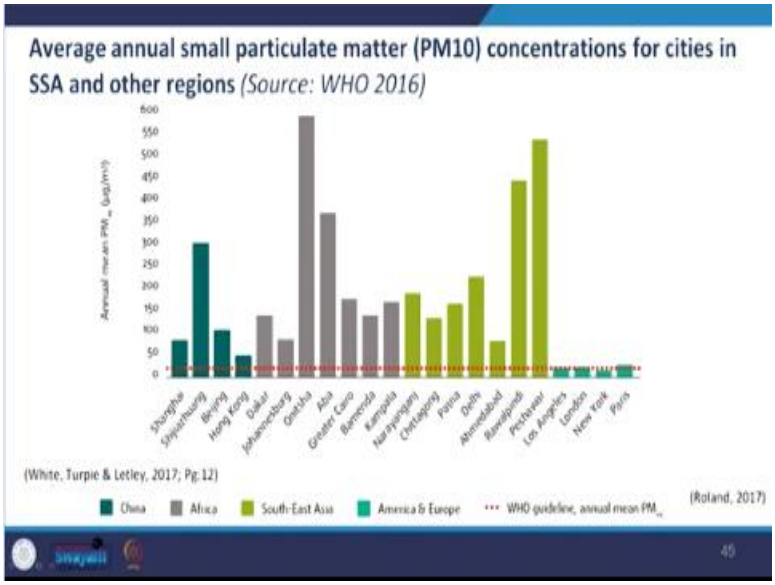

You may see how the pollution levels are extremely high, causing health and environmental repercussions. Next, we see low levels of wealth, fiscal resources and service delivery, which means despite urbanization per capita income is low. There is less resources for investments and services, which we get in urban areas are of poor quality. Africa is urbanizing at substantially lower level of wealth than other regions.

We had discussed that before as well that urbanization may not necessarily mean economic development. This is intensified by low proportion of overall capital investment into infrastructure such as housing and office buildings and roads and other things, which remains at around, the investment remain at around 20% of GDP, which is relatively very low investment.

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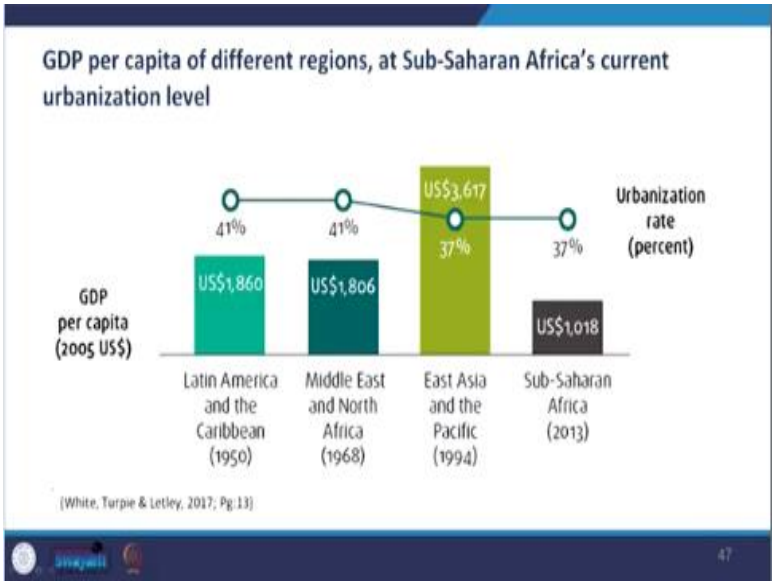

Seeing further, White, Turpie and Letley note that institutions and systems are weak. What does that mean? Institutions and systems, which are fundamental to effective urban development and management are weak in this place. If the institutions and systems are weak, then generally it is difficult to execute or enforce anything on ground for the people.

As shown by the authors, the organizations which are responsible for planning, managing and governing African cities tend to be jurisdictionally as per the area administratively given to them, broken meaning more than one authority trying to work in a place which weakens the enforcement of any kind of laws and legislation and any kind of aim and targets to be achieved on the ground.

And also further, there is lack of proper tools and planning systems to enforce all these ideas on ground.

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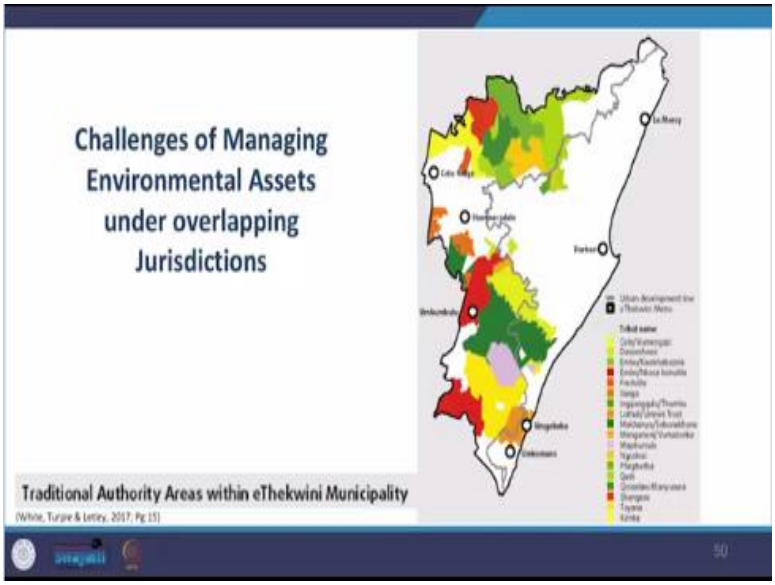

I showed in the map Durban, South Africa faces challenges in environmental management due to 2 parallel structures that govern land within a eThekwini Municipality boundary. Such kind of arrangement leads to poor management. So, we saw from the perspective of the authors White, Turpie and Letley like, what kind of urbanization is taking place in African cities.

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Now, looking at the environmental trend in African cities. So, because of this kind of urbanization, what environmental impact is happening. As we saw the urbanization trend in African cities from the perspective of White, Turpie and Letley, such kind of urbanization leads to severe impact on environment. They explain that as institutions are weak which leads to poor and ineffective planning, it further causes loss of valuable ecosystems, this is earlier process which they explained and other open space areas in and around the cities.

While a growing backlog in infrastructure investment and service delivery, major problems of pollution, flooding and overconsumption of resources so, all these happens because of the weak institutions. All these problems along with the lack of protection from invasive alien species in the environment have had major impact on ecosystems and biodiversity, which we will also see further.

Moreover, as we had seen, urbanization cause encroachment on the natural ecosystems and African cities, there is often very little green open space remaining, particularly in the poorer cities, with reference to African Green City index of 2011. The amount of all public parks, recreation areas, greenways, waterways and other protection areas accessible to the public is estimated to be below 1 square meter per inhabitant in some African cities such as Londa, Cairo and Alexandria.

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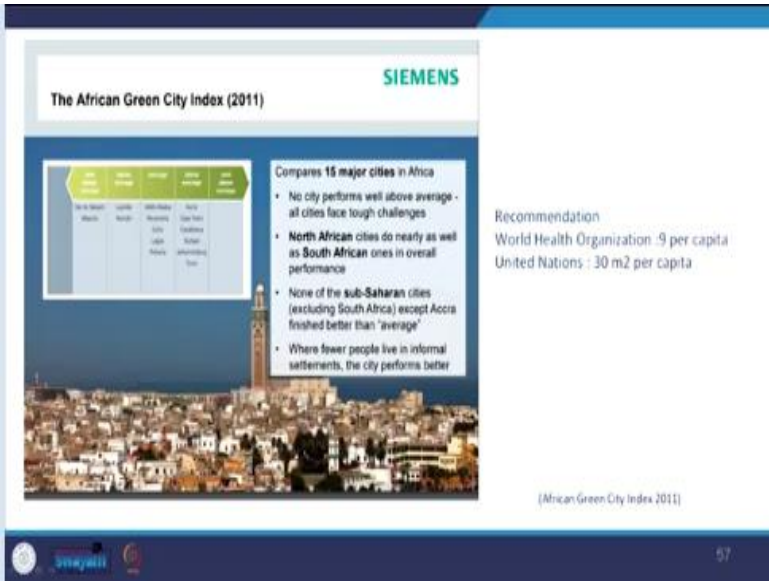

This is well below the WHO and United Nations guidelines recommendations, which like WHO recommends 9 square meter per capita whereas UN recommends 30 square meter per capita. As explained by the authors, the transformation of open space areas within African cities has come about through both formal and informal development.

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For example, in Dar es Salaam, 1000s of informal dwellings are situated along riverbanks and floodplains of the Zambezi River system, with densities increasing downstream towards the city center. Even though, there is provision for a 60 meter protected river reserve on either side of the river in the city, as it has been outlined by the Environmental Management Act of 2004 in the country, it is difficult to enforce.

You may think of why it is difficult to enforce. The reason being weak institutions, these settlements frequently get exposed to flooding and loss of human life.

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We can see the image of flood in the year 2019. Authors also show the evidence of encroachment on wetlands as they provide opportunities for alternative income. You see wetlands are very, very resourceful for livelihood purpose also. So, we see many of the

people occupied this because they get resources for harvesting, farming and brickmaking for the households.

As per the evidence is given by them in Kampala, over 60% of the population lives in the informal settlements, that is a huge percentage and encroachment into the city wetlands also happens. And now, we see only 8% of the remaining wetland area within the city boundary is still highly functional as seen in the figure. So, we see how the service which the wetland offers is reducing so, we are seeing only 8% being functional.

This indicates the reduction in the value of services as discussed by the authors. Encroachments have been of different types. The wetlands have been encroached by transportation infrastructure.

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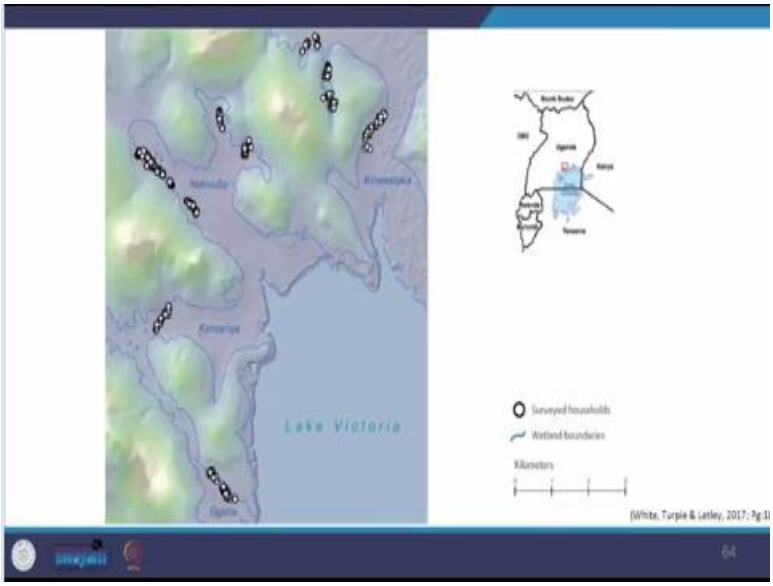

We also see industry and informal settlements there as well as the area has been trained for small scale agriculture. This happens despite prevention through legislation again, indicating weak system. Further, evidence also show reduction in the functional area of Nakivubo wetland centrally located between the city center and Lake Victoria, it has shrunk from its original extent of 500 hectares.

The reduction happened eventually we see the 500 hectare reduced to 400 hectares by 1955, then it reduced further to 280 hectares by 1990. Furthermore, it reduced down to 90 hectares in 2015. And you see how big is the reduction and you will see that 82% reduction in wetland area eventually in all these years. Each year, the number of rural poor living in the slums

within or adjacent to the wetland areas increases, resulting in degradation or loss of the wetland habitats surrounding the city along the northern shore of Lake Victoria.

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You can imagine the impacts on the water quality, fisheries and human health as well as biodiversity because of such encroachment. Moving forward, the authors also explained when people move to cities, their resource demand may change to some extent. For some, the direct dependence on natural resource may decrease as a result of increased income opportunities.

Meaning when our income increases when we move to cities, when our income increases, we have access to better source of energy then dependency of biomass fuels. The dependency can be financially as well as physically with being the resources not within the physical distance of yours. So, in African cities, there is constrained access to and there is relatively high cost of electricity and LPG, which has resulted in urban consumers relying on biomass fuel.

Imagine, so many people dependent on the biomass fuel in the urban area. This dependence would cause degradation of forest, production of high particulate matter concentration and lead to high carbon emissions. As documented in the report, the study shows 3 distinct waves of forest degradation originating from Dar es Salaam, as shown in the figure for high value timber, medium value timber and then for the charcoal.

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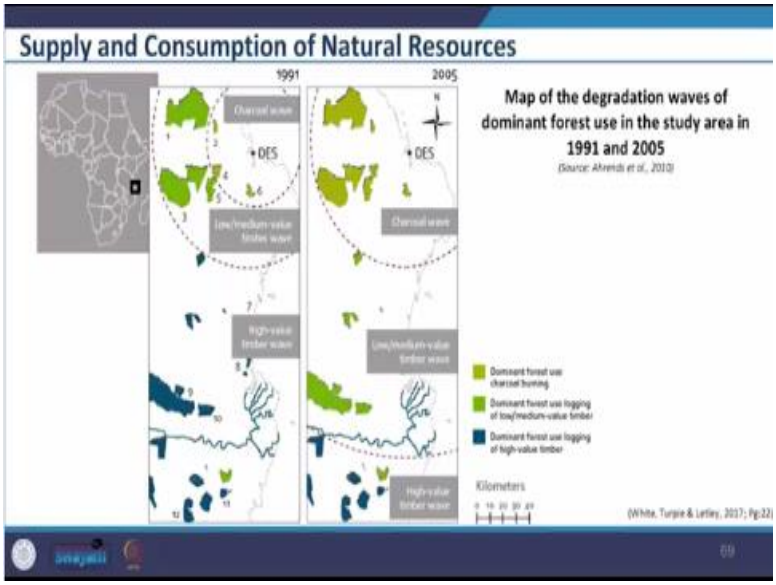

And you can see the transition from 1991 to 2005. The Zone of impact of these activities extended significantly. You may note that the rings are getting bigger and bigger. Much of the urbanization in Africa has occurred in the coastal area. So, you can see another level of degradation happening, leading to concentrated pressure on coastal mangroves and fishery resources. You can visualize the long term damage to the environment and to the human.

Furthermore, we see that urbanization also leads to increasing per capita demands for water and provision of adequate safe water supplies. We see that water is a major concern in most cities. This is creating challenges in many cities since much of the continent is arid and semi-arid, if you may. Look at the geography here. And 41% of the African countries are water stressed.

Many African cities have relied on large scale inter base in water transfer to do to meet demand so far. Water supply problems are worsened with the inputs of nutrients, eroded sediments from catchment areas that increase the cost of water treatment. So, when such kind of pollution happens, one the water is less; then the other is the cost of treating such water because of the pollution which we are creating also rises up.

So, we see that such kind of things mixed with the loss of natural capital assets such as Riparian forest and wetlands that play a role in improvement of these effects are also reducing. We are also losing them. So, such kind of mixed thing worsens a situation for water supply. In the coastal cities, excessive pumping of aquifers is also happening, which has resulted into contamination of the groundwater resources.

And there is alarm water samples from Mikocheni, Oyster Bay and Msasami, Masaki and the central areas of the city show elevated chloride. So, you see from some of the samples collected, the level of pollution is high, high level of chloride, sulphate and sodium concentration and over 50% of the samples, they were brackish in color, these problems will be further intensified by the climate change.

So, we are living the climate change and such kind of things are going to intensify with the climate change. Most of the African cities are characterized by high level of pollution. Air pollution is linked to the large proportion of households that rely on wood fuel for energy as we have already seen as well as industrial emission. We are seeing industrial emission because as we had mentioned that, we are low technology here.

We are not yet motorized, so, that way we see emission also industrial emission also contributing towards pollution. We also see fertilizers use in the urban and Peri-urban agriculture and also, there are problems of transportation and congestion. According to the latest urban air quality database released by WHO, 98% of the cities in low and middle income countries with more than 1 lakh inhabitants do not meet WHO air quality guidelines.

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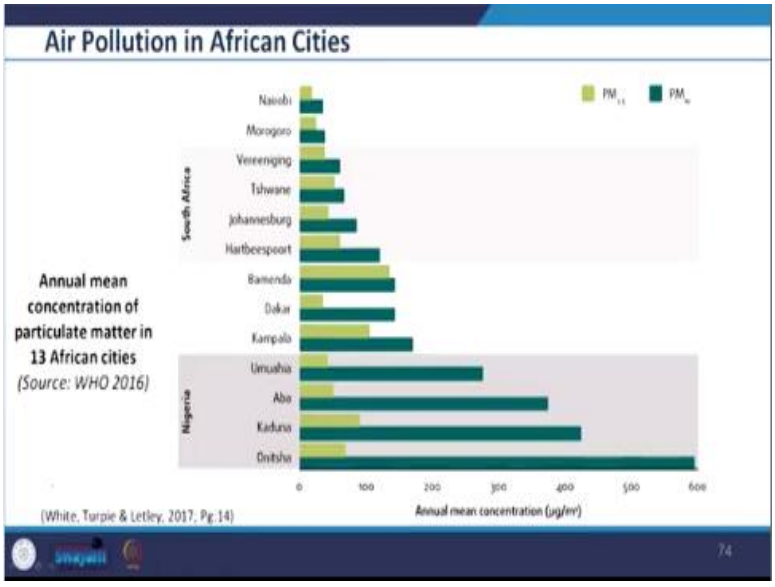

The situation is particularly bad in Nigeria where 4 of the worst cities in the world for air pollutions are located.

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According to WHO, Onitsha in Nigeria is the world's most polluted city, when measuring small particulate matter PM 10 concentration, with concentrations being 30 times higher than the WHO recommended levels.

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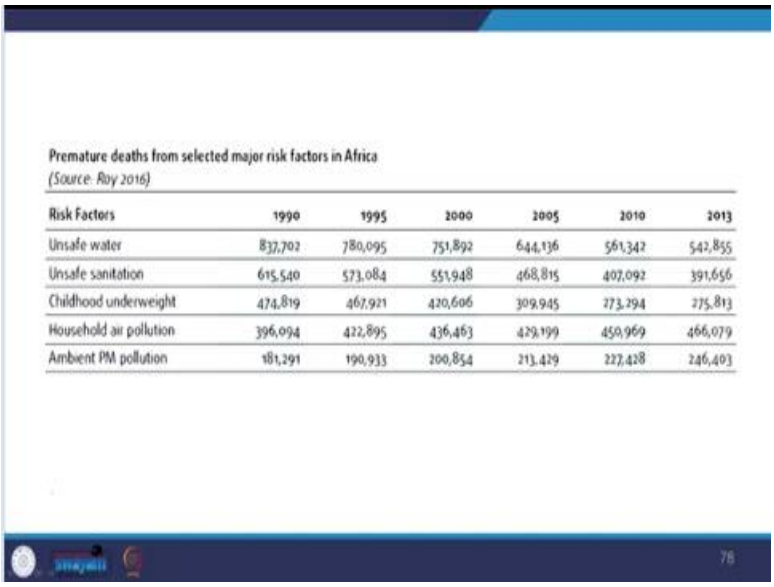

Premature deaths from selected major risk factors in Africa
(Source: Roy 2016)

Risk Factors	1990	1995	2000	2005	2010	2013
Unsafe water	837,702	780,095	751,892	644,136	561,342	542,855
Unsafe sanitation	615,540	573,084	551,948	468,815	407,092	391,656
Childhood underweight	474,819	467,921	420,606	309,945	273,294	275,813
Household air pollution	396,094	422,895	436,463	429,199	450,969	466,079
Ambient PM pollution	181,291	190,933	200,854	213,429	227,428	246,403

Water pollution is linked to inadequate sanitation as well as industrial effluent and agrochemicals. You may see table showing premature death due to water sanitation and air pollution.

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In the picture, you can see traffic problems in Dar es Salaam.

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Solid waste problems are linked to low investment in waste collection services. Most of these problems are increased by lack of enforcement of existing regulations. The authors also identify hydrological changes, when we see that more and more building roads, roofs, paved areas and other hard surfaces are built in the urban environment that prevents rainfall from infiltrating the soil, which leads to increasing rate and volume of runoff during any given rainfall situation.

So, what will happen when a lot of water in a high speed is going to run through the city. So, this will have major 2 impacts. First, existing river channels will become eroded downwards, or laterally, which impacts habitat integrity and creates problems for property owners and city

managers. You must have seen in many cases. Second, you would also see flood inundation areas increases more and more flood water comes into this urban area and the areas around, putting more people at risk.

Frequent floods not only result in damage to property and direct loss of life, but it also disrupts the traffic expose people to health risk. It stops many things beep up, students are not going to be able to go to school, people are not able to go to work and so on. So, a lot of things happens with the frequent floods.

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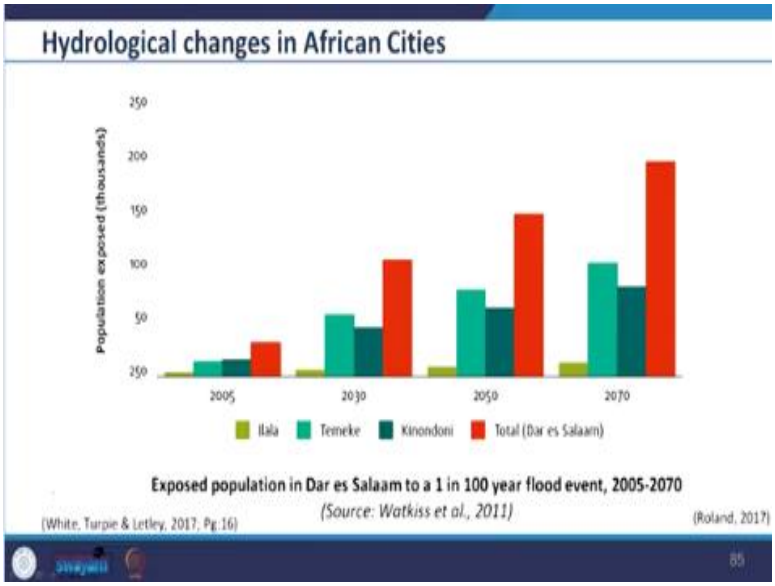

And if they are not properly managed, these risks will increase over time because we are in the time of climate change. Also, document the problem of introduction and qualification of invasive species. We see that invasive alien species which means invasive alien species are the plants, animals, pathogens and other organisms that are non-native. So, they do not belong from this place.

They have come from some other place to the ecosystem and which may cause economic or environmental harm or adversely affecting human health. So, these are animals, pathogen and plants that are intentionally or unintentionally introduced from other areas and which are able to spread and multiply in absence of their natural predators or other limiting factors causing damage to environment, economic and human health.

They pose a serious threat to biodiversity and our growing drivers of species extinction. Because of these, a lot of species are extinct and authors document Durban, located within

the global biodiversity hotspot, they indicate that Durban has been invaded by at least 130 alien plant species so, many plant species have been seen in Durban, for example, Spanish reeds, which introduced from the Mediterranean had a major impact on river and streams.

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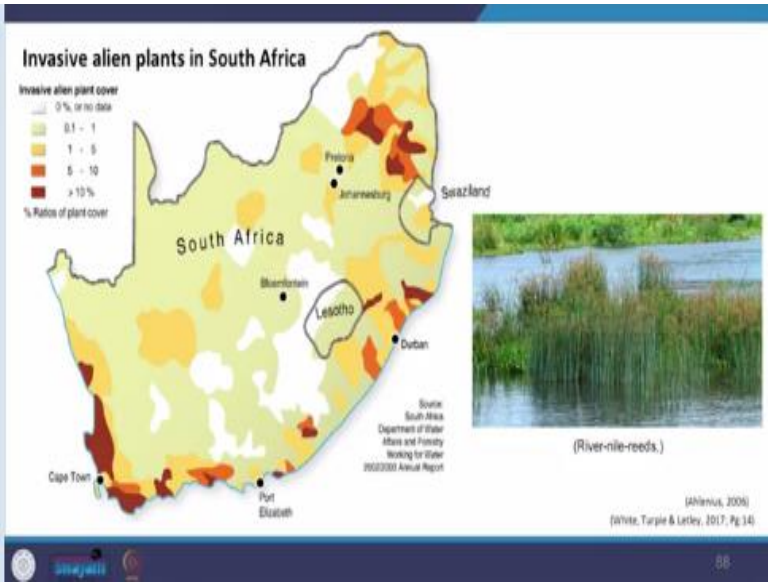

These reeds are easily dislodged during floods and as a result cause severe blockage of waterways and culverts increasing the flood damage so, you can see how dangerous these could be. In the map, you can see invasive species along the river shown in the blue line. On the right, you can see the picture of Spanish reeds in the river Nile. Furthermore, authors document loss of biodiversity in African cities, human activities are accelerating.

So, you see we are working more and more on it, expanding more, increasing all our consumption, which has resulted in degradation of and loss of biodiversity at a very different rate. Because of that, there is transformation inhabitat. And we see urban expansion and land use conversion over exploitation of resources, we use more and more of water. We use more and more of forest wood, there is also hydrological alteration, there is also loss of impervious land, because of the built up area.

We also see invasive alien species coming in. We also see level of pollution coming in. So, all these have created loss of biodiversity. These pressures are particularly severe in African urban environment as discussed and this is also going to further increase in this time of climate change. Biodiversity is also affected by approach taken to greening cities. So, as we take interventions, our biodiversity may also be affected.

Like you can see in Addis Ababa, Ethiopia, only 10 to 40% of the trees planted have been indigenous trees, whereas in traditionally, in Durban where 97% were indigenous species, many cities are situated within global biodiversity hotspot, including Durban, Cape Town and several cities around the Indian Oceans and West African coast as you can see, in different colors in the map here.

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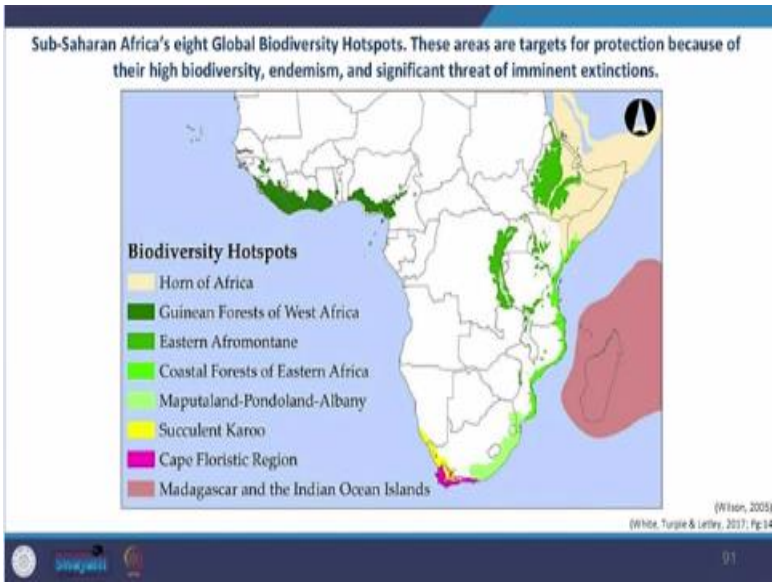

Authors also identify increasing vulnerability to climate change. We see that global climate change is clear. With the increasing temperature, changes in the rainfall pattern, rising of the sea level and increased incidences of storms and floods. These changes which are already observed are expected to lead to changes in biodiversity and ecosystem functioning. Changes in water availability increased severity of droughts and floods increases in heat related illness and impacts on agriculture and energy production.

Further, we see that as per the evidence is given by the authors, 30 African countries, it is found that 2 thirds of the cities are warming faster than the world as a whole. This trend is expected to continue placing challenges on both current and future development progress in African cities, especially given that African contains 7 of the 10 countries that are considered that most threatened by climate change globally such as Syrah Leone, South Sudan, Nigeria, Chard, Ethiopia, the Central African Republic and Eritrea.

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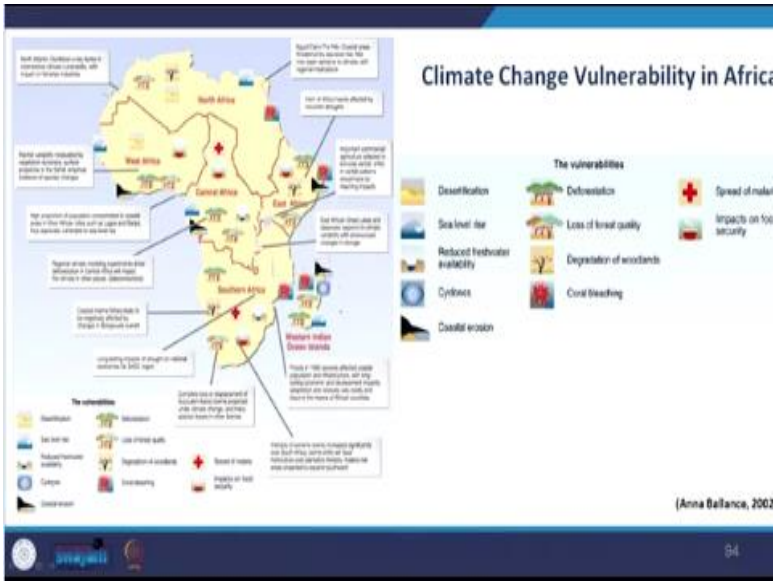

So, we see how badly we can damage our environment and impact our health and cause further loss to our economic gain.

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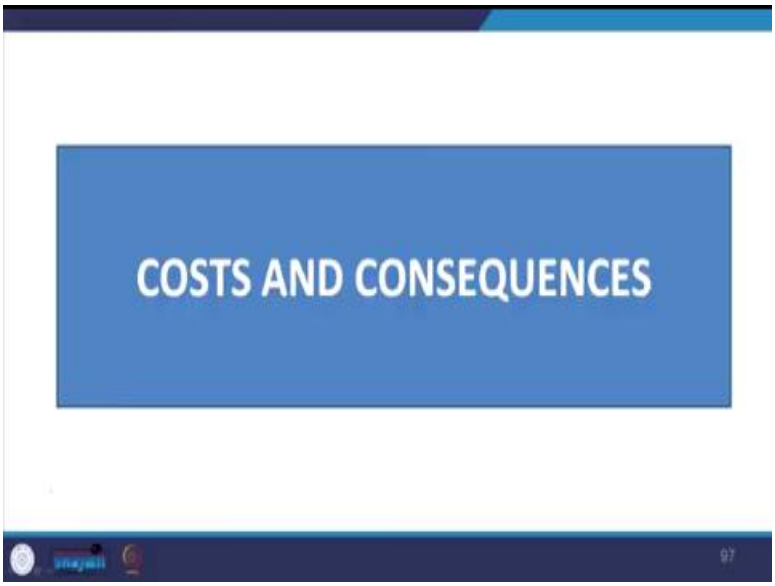

Now, let us try to understand the costs and consequences of these. First, we see there are economic consequences as given by the author arresting the environmental degradation is expensive and it is also complex. It is not simple, as they usually go hand in hand with poorly maintained buildings and infrastructure, poorly organized street, then the commercial activities as well as poorly organized transport activities and high level of crime.

So, neglect of the city environment also means that they lack the enhancement, one sees in developed cities such as roadside verge trees and gardens. So, greener and cleaner cities are likely to have healthier and more productive cities as well as being more attractive to

property developers and buyers, international business and tourism. So, deterioration of the environmental quality arising from urbanization is adversely affecting health, income, productivity and the quality of life in African economies and cities.

We see that the investment made in global welfare to take care of the losses resulting from the exposure to household and ambient air pollutions are estimated amount to some US dollar 5 trillion in 2013. With welfare losses in Sub Saharan African equivalent to 3.8% of the regional gross domestic product, the overall economic loss resulting from lack of access to safe water and basic sanitation is estimated to be at a rate of 28 billion per year or around 5% of GDP in Sub Saharan African.

So, you see how expensive it is to bare that cost. Healthcare cost also, you see, is high and loss in labor productivity because of the mortality, morbidity is also high. So, therefore, the healthcare costs and the loss in labor productivity from mortality and morbidity due to the contaminated water is estimated to cost the Uganda economy between 22 to 35 million US dollar every year.

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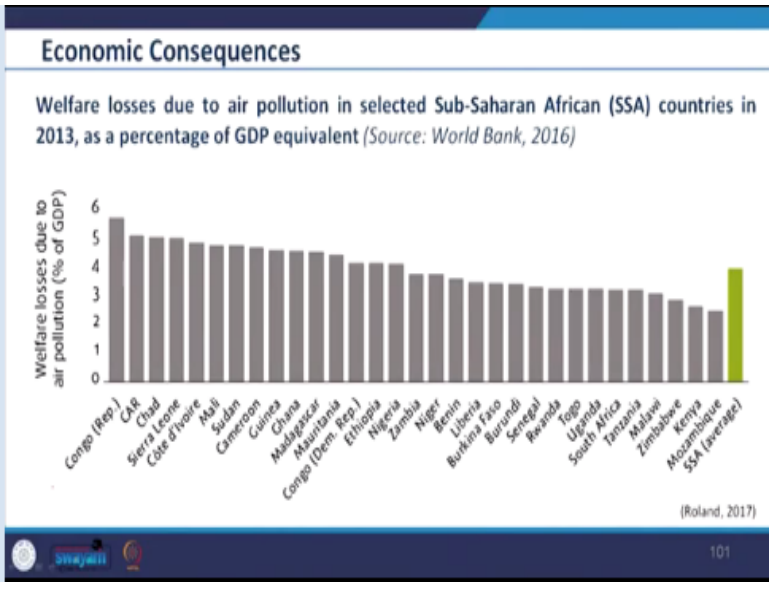

Others also show the fiscal consequences. Local authorities in African cities are confronted with widening gaps. So, now, there is more people who need water, there are less resources. So, they struggle with such kind of challenges. And urban, we see that we still maintain substantial areas of green open space property owners pay a premium for being close to natural and semi-natural open space area that are in good condition.

This additional property value translates to additional tax revenue amount to about 27 million US dollar per year, which is at least 5% of the total property tax income to the municipality. This amount does not include similar benefits that could be attributed to the city's well maintained beaches. More importantly, it does not include the premium that people are prepared to pay to live in Durban rather than any other city that could be ascribed to the overall environmental qualities of this attractive city.

You also see the social consequences as authors mentioned here, environmental quality has a bearing on health.

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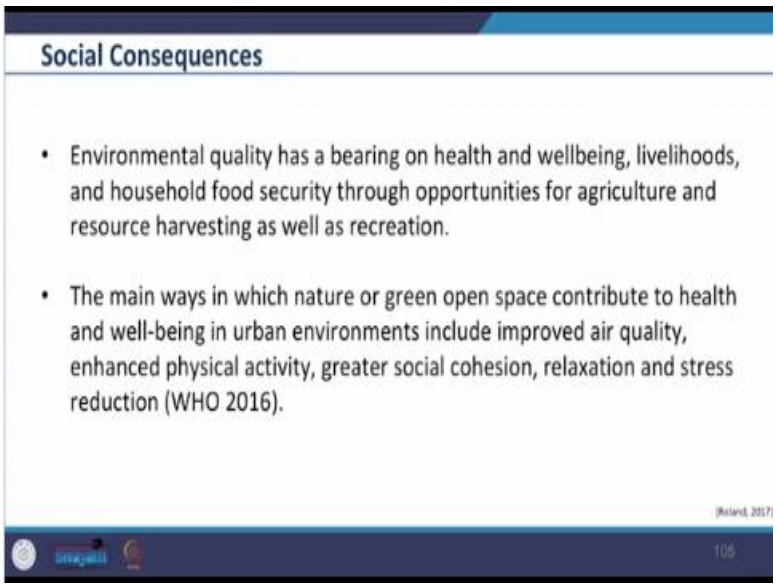

So, if our quality goes down, there are health repercussions and repercussions on our well-being livelihood and households' food security. So, those all repetitions are also there. We see that most of the urban residents in Africa face numerous health challenges. The first challenge relates to the lack of development and inadequate services including safe drinking water and acceptable sanitation, affecting poverty levels, malnutrition and the spread of infectious and parasitic diseases such as dysentery, diarrhea and cholera.

These problems are increased by flooding. The other challenges relating to health condition arising from newly modernizing society and changing lifestyle include cancer, obesity, cardiovascular disease, diabetes, chronic respiratory disease caused by unhealthy diet, physical inactivity, air pollution and exposure to toxins and waste. Poorly planned open environment tend to discourage physical activity and promote unhealthy food consumption.

So, all these lead to poor quality of life. We also see overcrowding, high volume, traffic, poor air quality and lack of safe public open spaces; recreational areas contribute to the overall low activity levels in African cities. The other challenge which we see relating to emerging disease, such as mental health and psychiatric disorders associated with poor living conditions and overcrowding and socio cultural changes.

So, all these kinds of things are happening in our environment. So, you see what economic and social cost we pay because of environmental degradation due to unplanned and non-sustainable urban planning.

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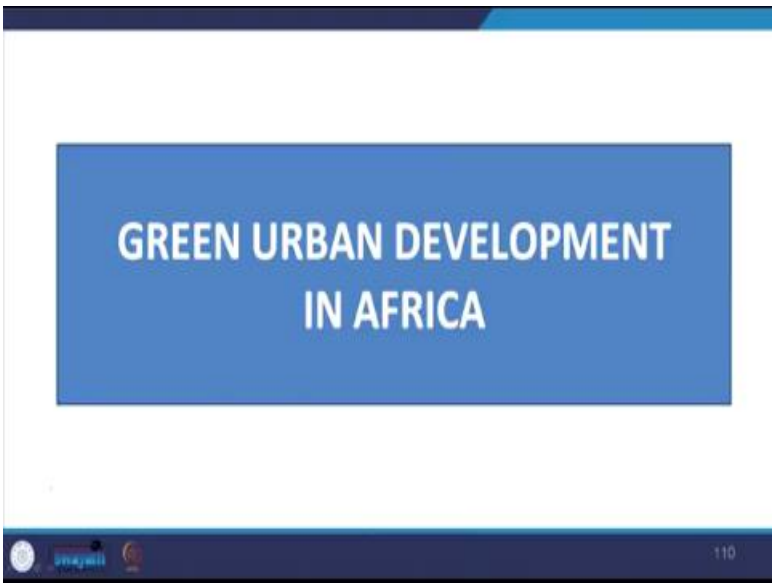

Now, seeing what could be done in such a situation. One, they can learn from the other countries. These are suggestions made by the authors. The cities may go for green urban development. Green urban development is an approach that aims to minimize the impact of urbanization on the environment and enhance environmental values. The approach is advocated to increase rather than limit the development potential of cities.

So, it does not stop the cities to grow, but it enhances their opportunity. It is also vital for global welfare. We see their general element of green urban developments as outlined in the figure. The key elements which we see that tackling the problems of air, water and solid waste pollution through provision of solid and liquid waste management services and enforcement of appropriate regulation to control effluence.

And emissions from a wide variety of sources, replacing natural with this services in a more environmentally friendly manner, tackling water and energy consumption, investing in greening measures, securing the protection, restoration or rehabilitation of selected natural areas in order to maintain biodiversity and valuable ecosystem services.

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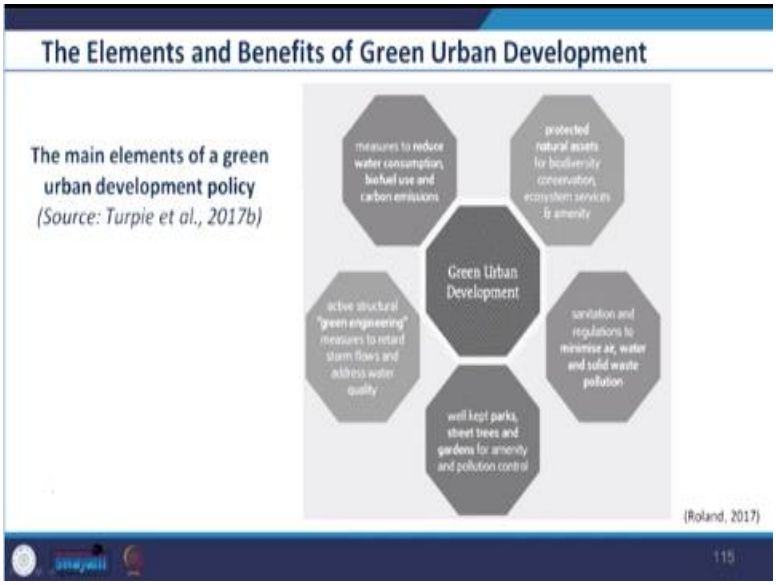

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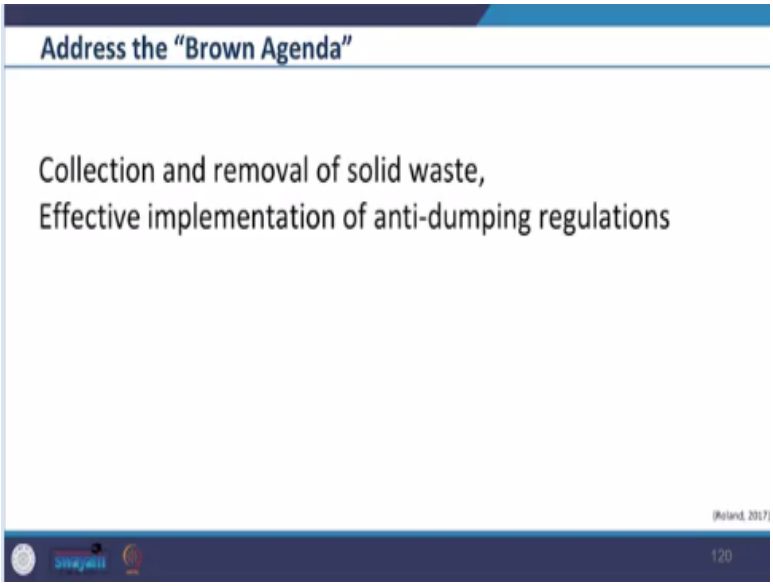

They also need to address the brown agendas like collection and removal of solid waste and the effective implementation of anti-dumping regulations.

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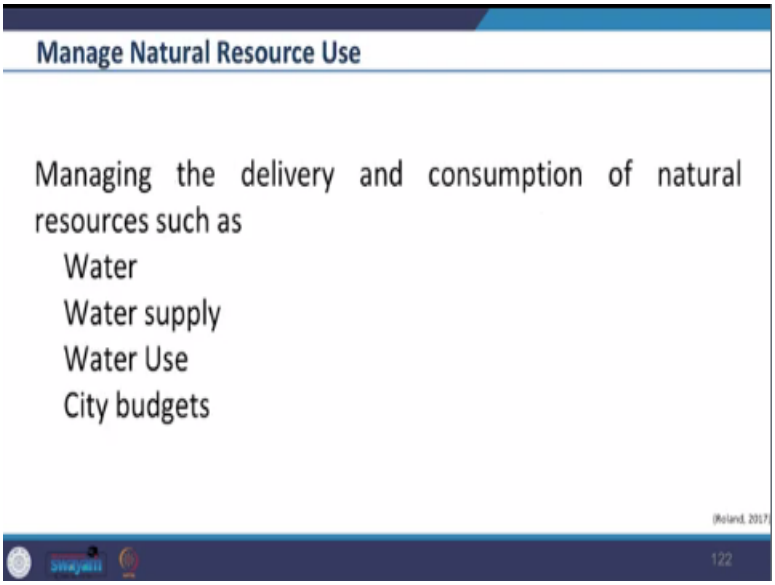

They also need to work on managing natural resource, use how they are consumed.

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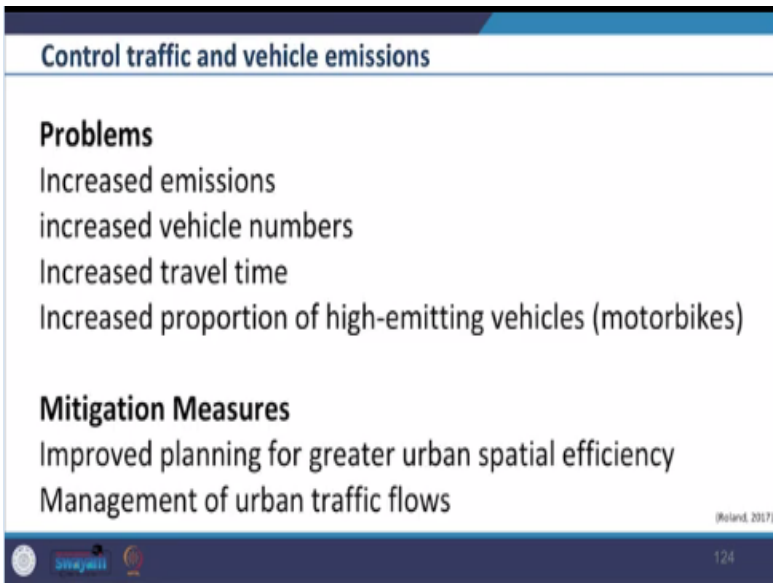

Further, they need to control the traffic and vehicle emissions. The majority of African cities need to address growing congestion problems that have led to increased emissions through increased vehicle numbers, travel time and increased proportion of high emitting vehicles such as motorbikes, improve planning for greater urban spatially efficiency and management of urban traffic flows. These all are required to mitigate these mitigate these emissions.

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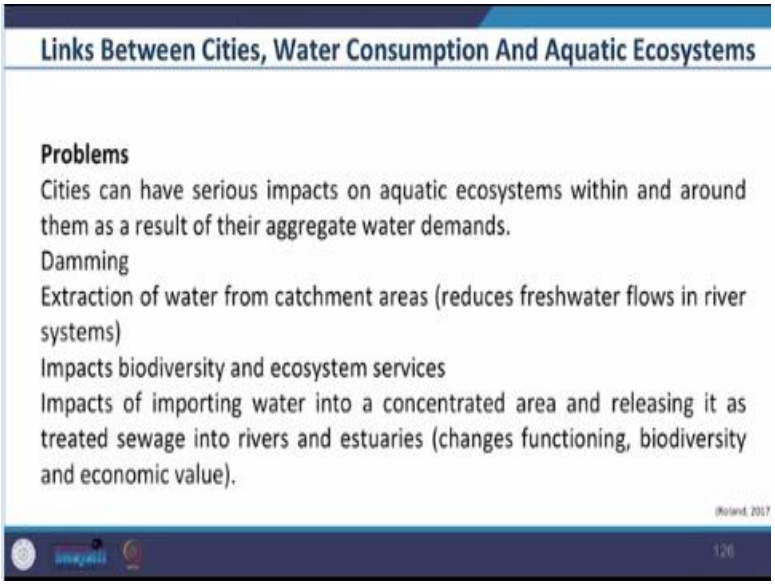

Further, they need to establish link between cities, water consumptions and aquatic ecosystems.

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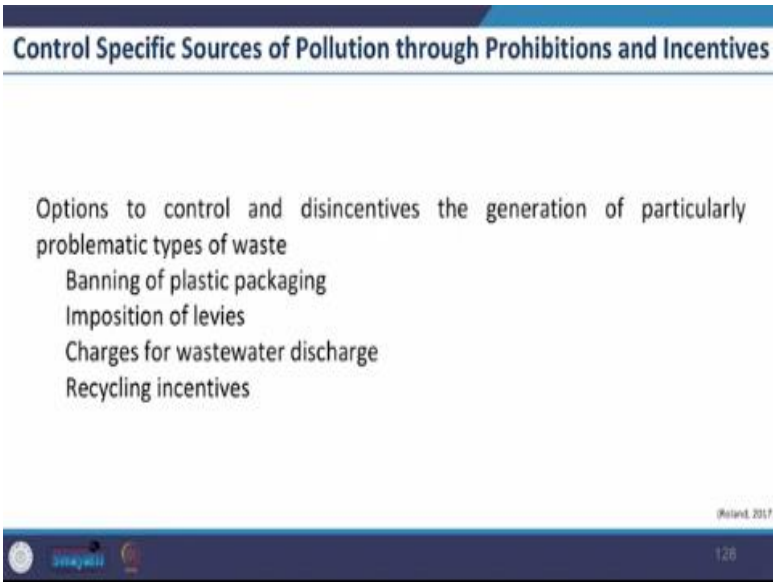

Likewise, they need to control specific source of pollution through prohibition and incentives.

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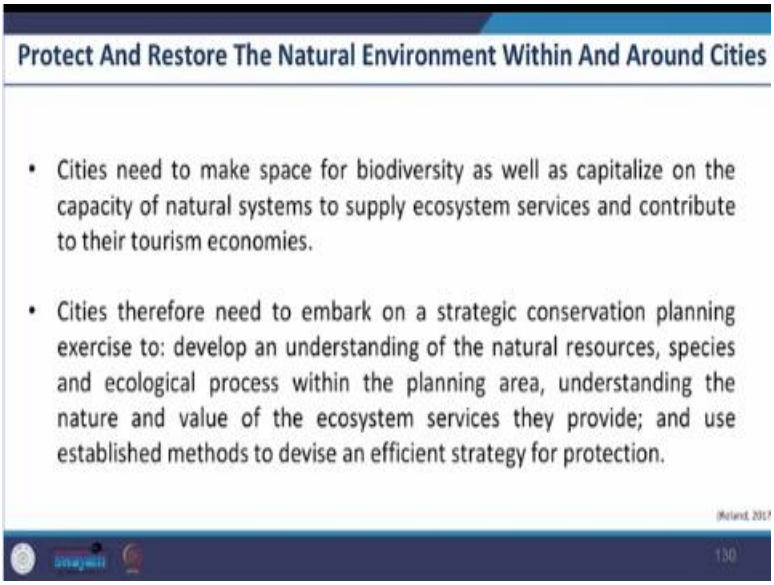

Likewise, they are required to go for protection and restoration of the natural environment within and around the cities.

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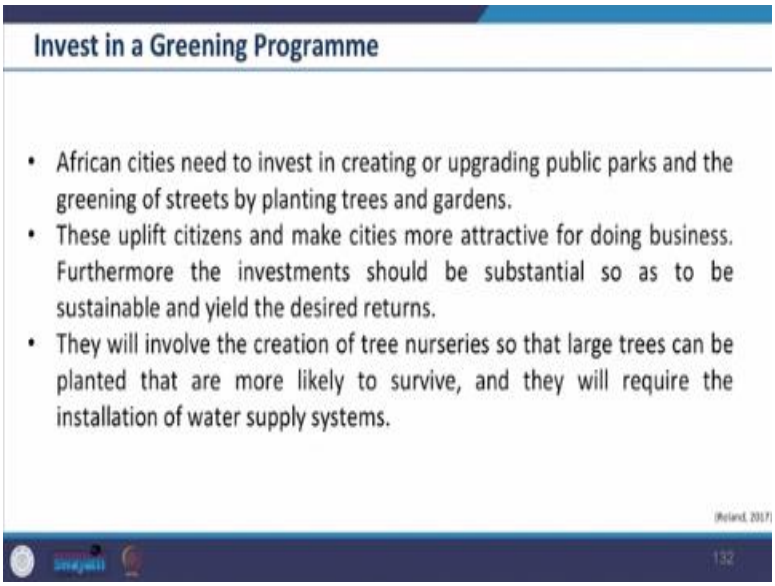

Further, they need to invest in the greening program.

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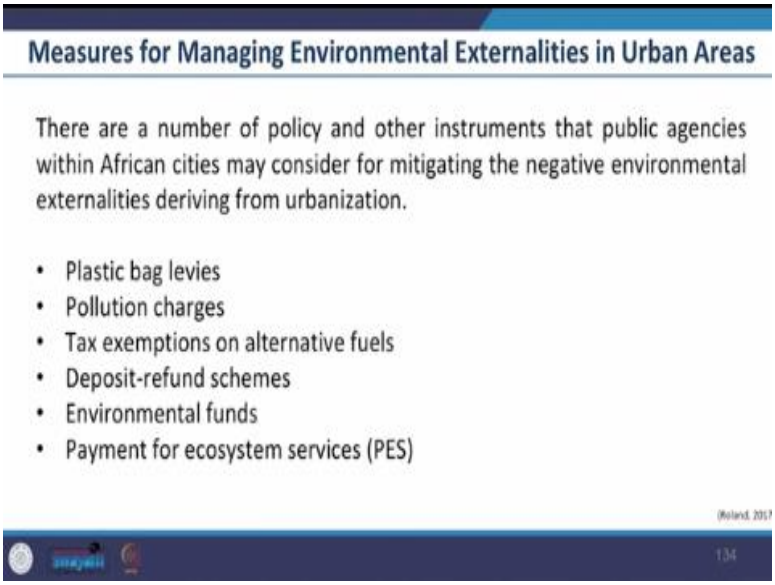

Likewise, they need to take measures for managing environmental externalities in the urban areas, such as removal of plastic bags, implementing pollution charges, tax exemptions on alternative use of fuels, deposit refund schemes, environmental funds payment for ecosystem services, all kinds of these interventions need to be taken care of. So, this is what we looked at African cities, we are just to what kind of implication urbanization has on the environment if it goes unplanned and unregulated.

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Now, we will look at London plan, draft master plan to understand various initiatives and integration with urban planning process. Report is provided in the reference for your detailed study. We see that in the master plan, they focused on green infrastructure; they develop London's green belt, which we had also seen before. They created metropolitan open land;

they also integrated the master plan with the boroughs which is like for us the zones or the wards. So, they integrated with the local area plan.

Likewise, they created strategy for local green and open spaces. Further, they also developed open greening strategy.

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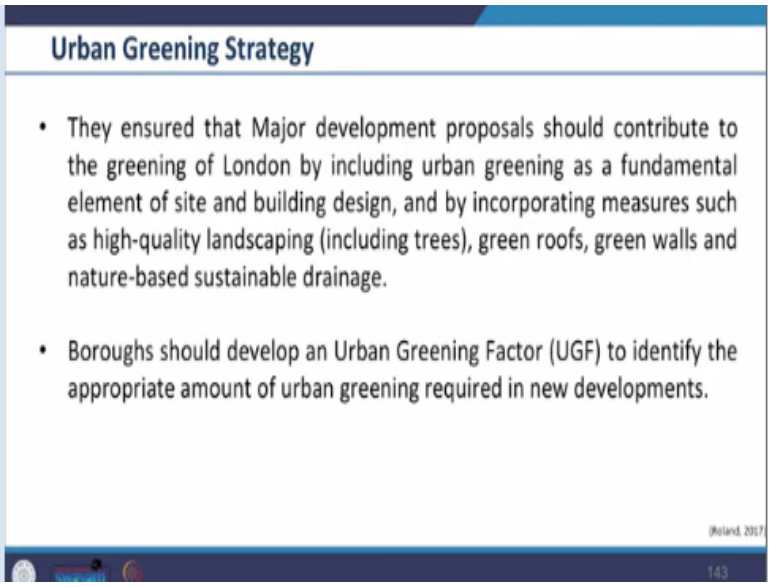

They ensured that major development proposal contribute to the greening of the London by including urban greening as a fundamental elements of site and building design and by incorporating measures such as high quality landscaping, green roof, green walls and nature based sustainable drainage. So, all these was done and at the local area level planning at the borough level planning, it was ensured that the urban green factor, UGF may be identified with appropriate techniques to reach to the larger goal.

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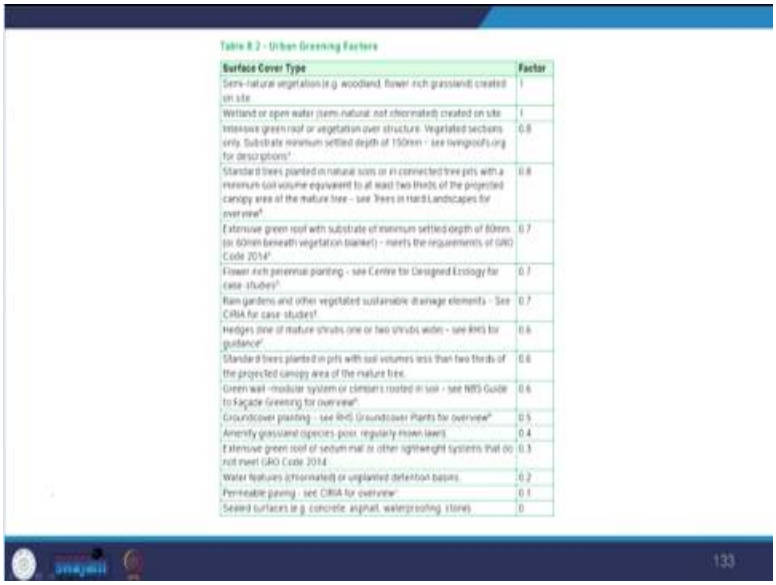

Urban green factor is based on the factors tailored to use the local circumstances. In the table here, you can see how they have calculated; what kind of intervention would be given; what kind of factor they have ensured biodiversity and access to nature and also integrated with the local area plan sites for importance for nature. Conservations are identified; attempts have been made to protect them.

Further, we see protection strategies have been developed for trees and woodlands. Further, see that master plan targets to promote food growing and it integrates it with the local area planning.

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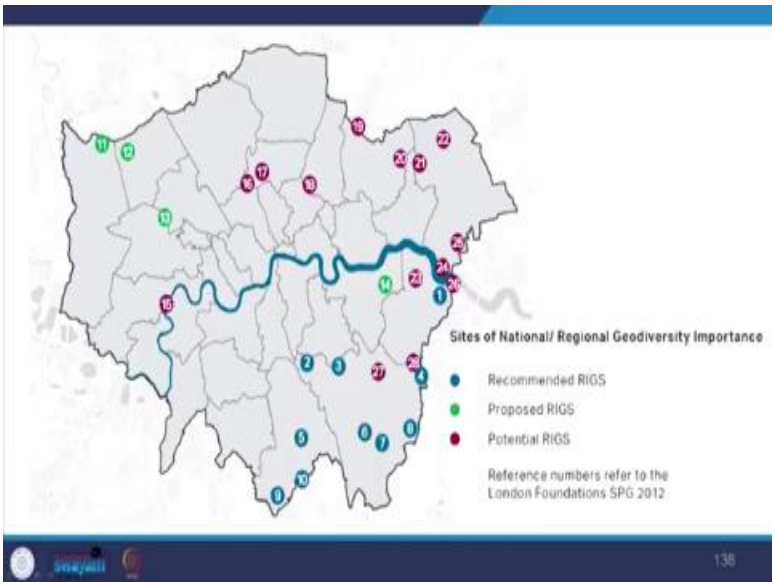

We also see that they identify geo-diversity and aligned with the local area plan accordingly.

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Further, they have prepared the plan for sustainable infrastructure. We look at the components of the sustainable infrastructure.

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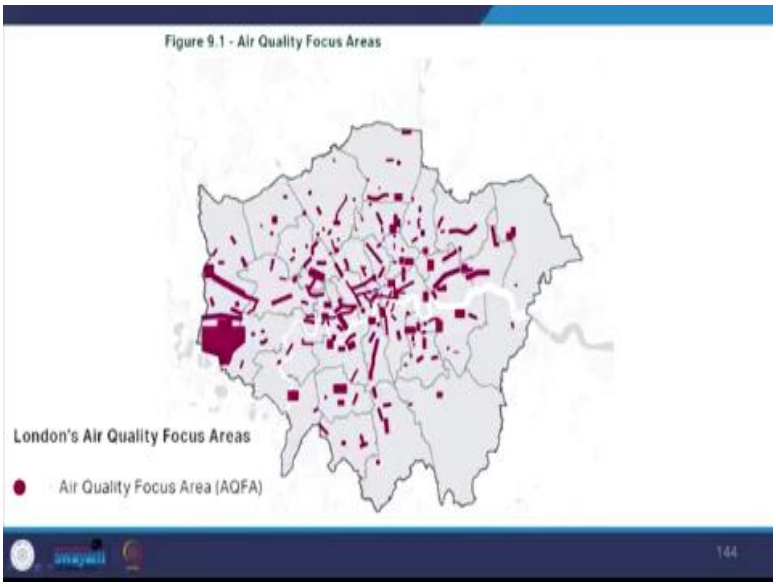

We see that they have worked for improving the air quality, different strategies have been worked out. Further, we see that they have worked out for minimizing greenhouse gas emissions. So, you see how the master plan of the city is linking to the larger goals here. They have also worked out strategy for developing energy infrastructure.

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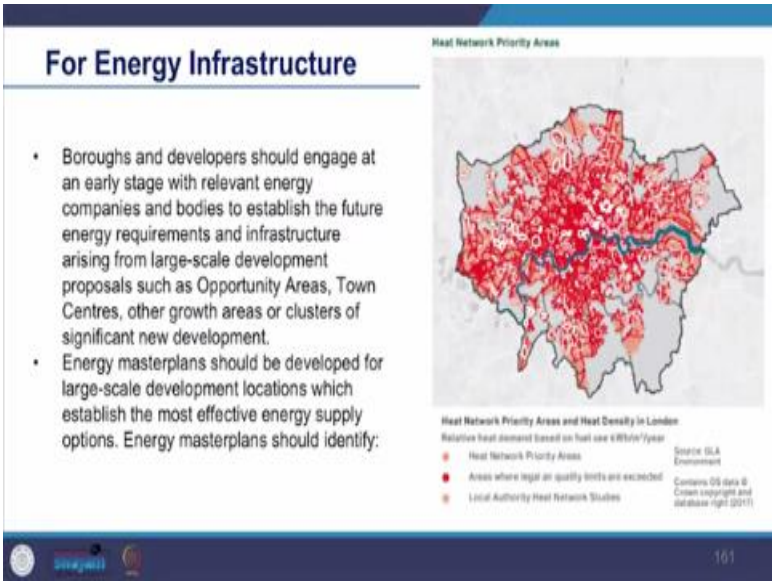

Likewise, we see how they intend to manage heat risk. So, they are looking at developing proposal which would minimize the internal heat gain and the impact of urban heat island through design layout orientation and material.

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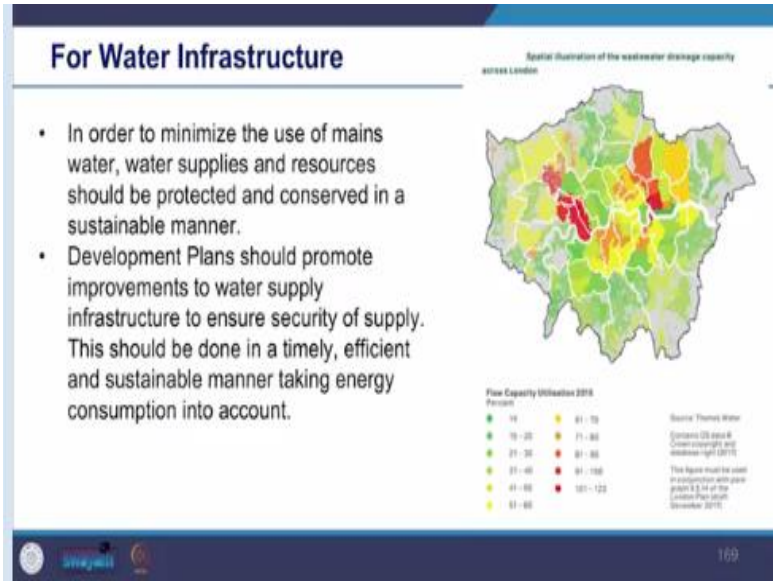

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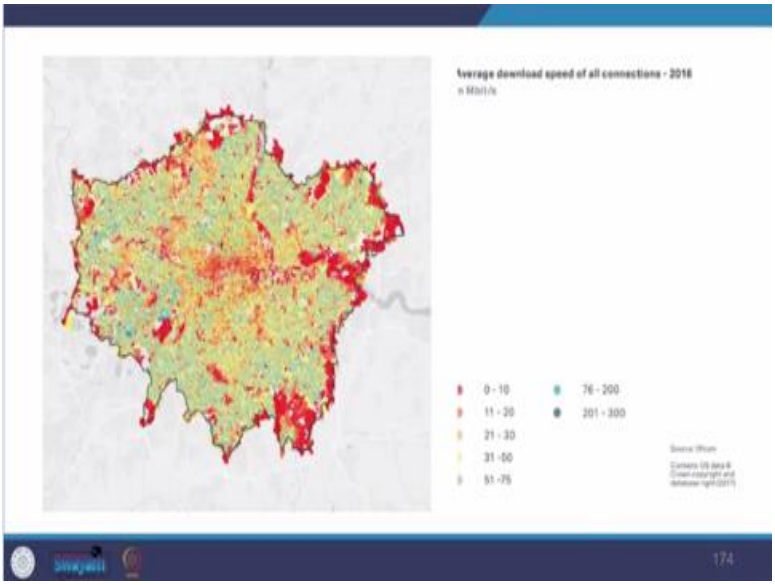

We see that they have detailed proposal on water infrastructure as well as they have worked out proposal for digital connectivity infrastructure. Likewise, we see, they have a **(()) (46:21)** details for reducing waste and supporting the circular economy. Likewise, we see, they are working for waste capacity and net waste self-sufficiency for this city. They also have strategy to safeguard waste sites.

Furthermore, they have strategy for flood risk management, as well as for sustainable drainage including rainwater harvesting and filtration techniques and green roofs.

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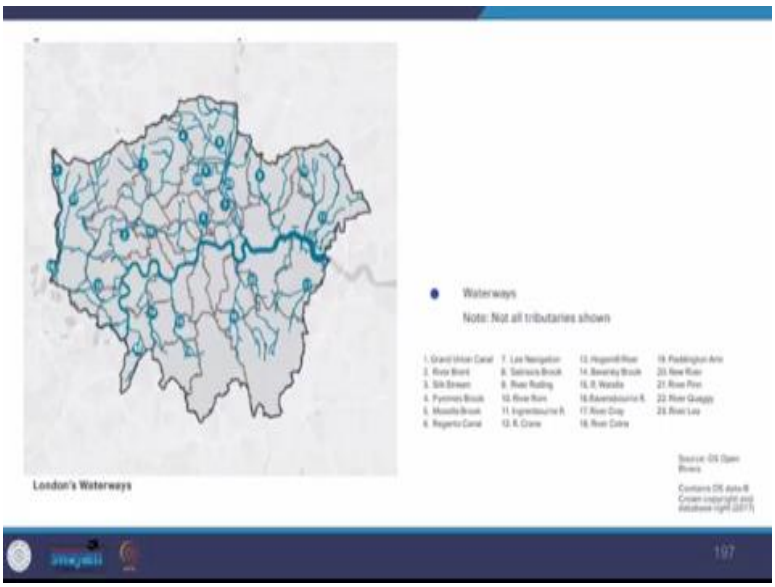

We see that they have strategies for waterways, which play a very strategic role. Waterways have been also used for generate for recreational purpose. So, this was about these strategies what London master plan is taken care of. Likewise, you may also review the draft tele

development plan of 2041 which is out for public review. You may also see in that how they have addressed the environment in the similar lines.

The reference and the readings have been given to you in this. Now, we will try to understand factors causing the environmental pollution in urban areas that is urban heat island.

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We are going to discuss about its cause and effect on urban planning. Just to understand the definition, the urban heat island is a phenomenon in which an urban area is warmer than its surrounding suburban and rural areas. Many urban and suburban areas experienced elevated temperatures compared to their outlying rural surroundings. This difference in temperature is what constitute an urban heat island.

So, you had seen how London is also planning to counter it and many of the cities are facing urban heat island problem. The urban heat island is defined as temperature difference between the urban and suburban areas and the rural areas in the same region.

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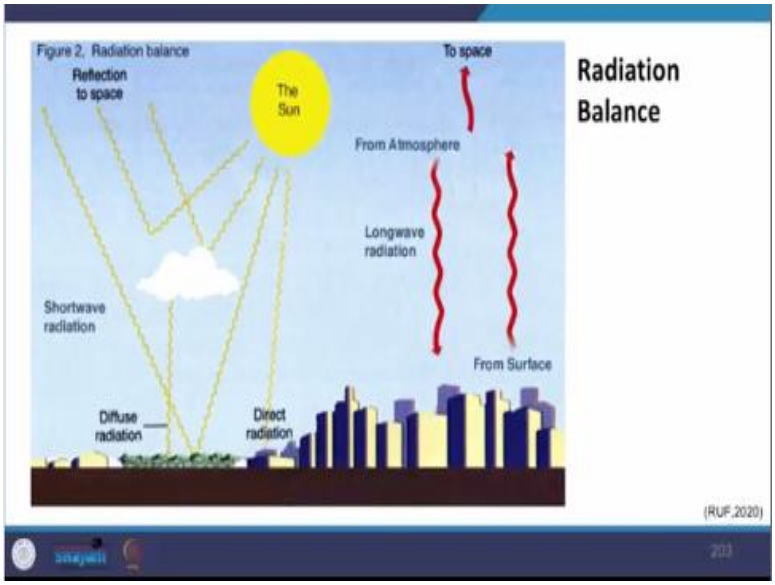

As you can see in the image here, urban areas are usually warmer than their rural surroundings, a phenomenon known as heat island effect.

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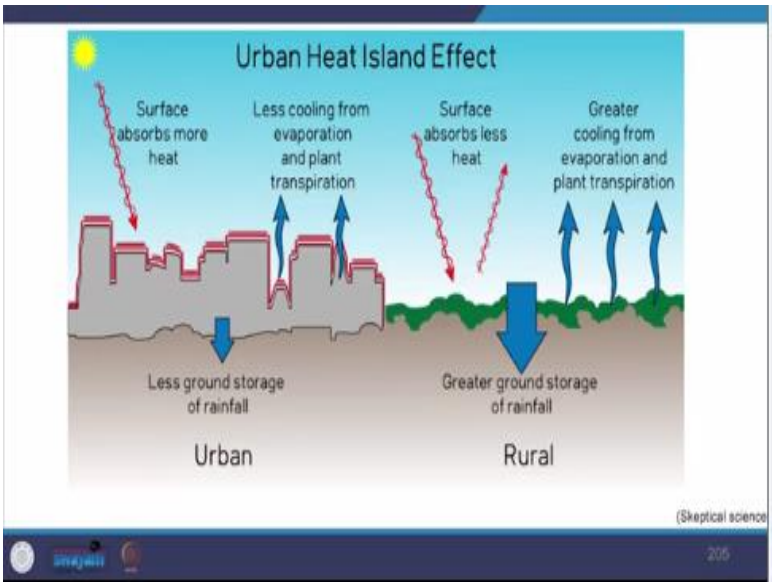

As it is developed more vegetation is lost and more surfaces are paved or covered with built buildings or covered with buildings, the change in the ground covers result in less shade and moisture to keep urban area's cool. So, urban heat island phenomenon as an island where the hot surface air is concentrated in urban areas and will progressively decrease in surrounding temperature in suburban and rural areas.

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Looking at the facts about urban heat island, we see that urban heat island occurs both during the day and the night. But according to the research, the maximum intensity of heat island occurs 3 to 4 hours after the sunset. So, you must have realized that how do you feel very warm in the late in the evening. This is because cities retain much of its heat in roads, buildings and other structure that prevents them from cooling down.

The factors that affect the occurrence and intensity of heat island can be broadly classified into 2 categories. First category is meteorological factors including wind speed and direction, humidity and cloud cover. Second, you will see basically the product of city design such as density of built up area, aspect ratio, sky view factors SVF and construction material.

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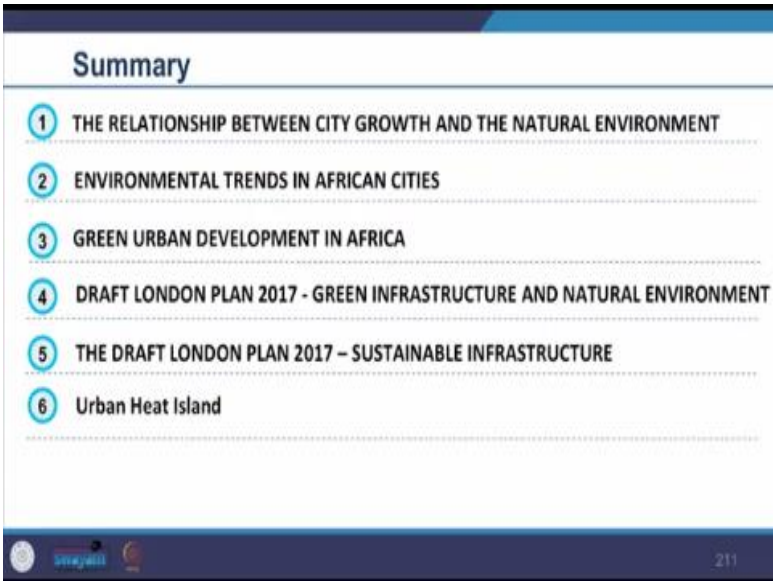

So, summarizing today's session, we have seen the relationship between city growth and the natural environment. We also saw the environmental trend in African cities. We saw various things which Africa probably needs to do for green urban development. Further, we saw very briefly what interventions London is taking for its city with respect to green infrastructure and natural environment.

We also saw what intervention London is taking for sustainable infrastructure. We also saw the definition of urban heat island. For the environment, we would be further looking into details in the legislation component.

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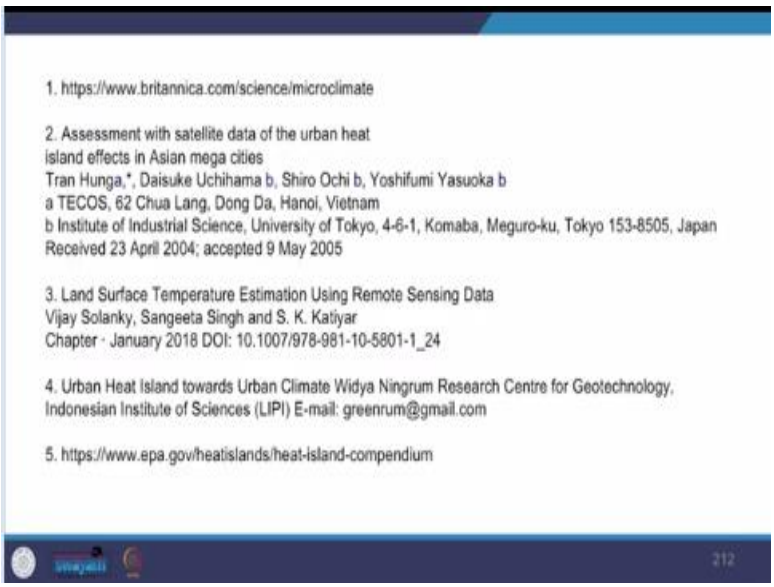

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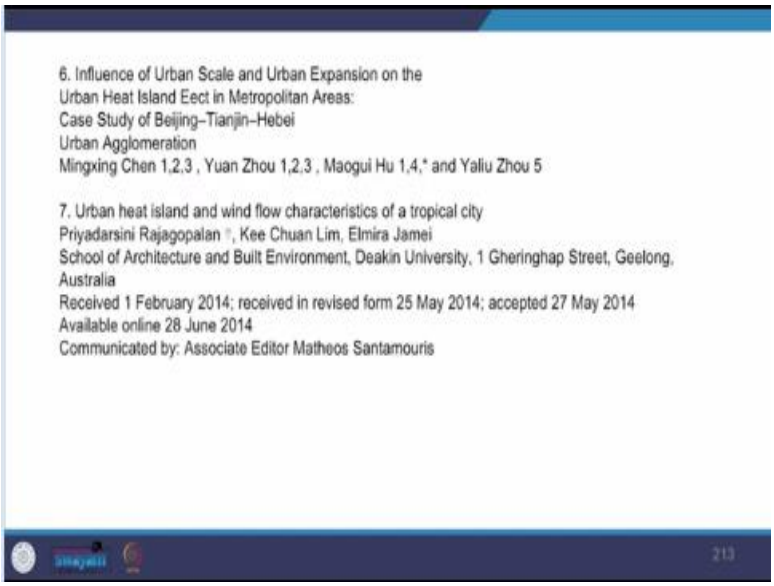

Our coverage was limited with the scope to make you aware of the topic. There are enormous readings and movies available to explore.

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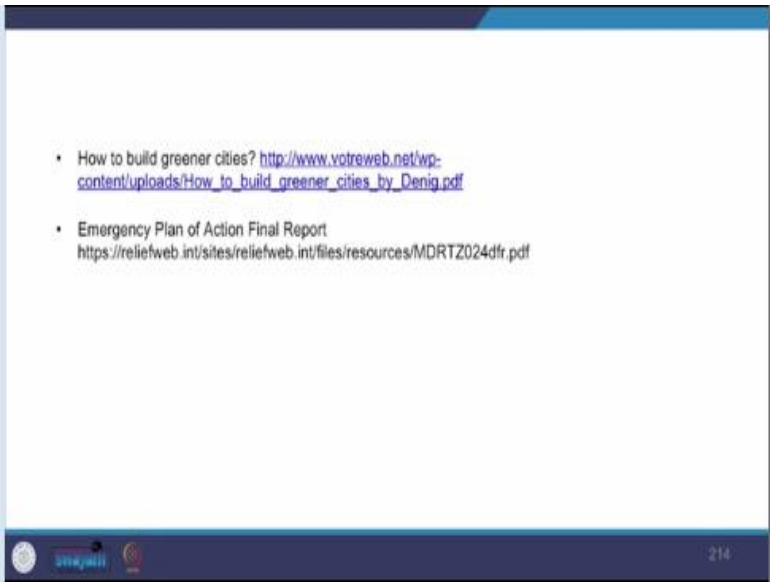

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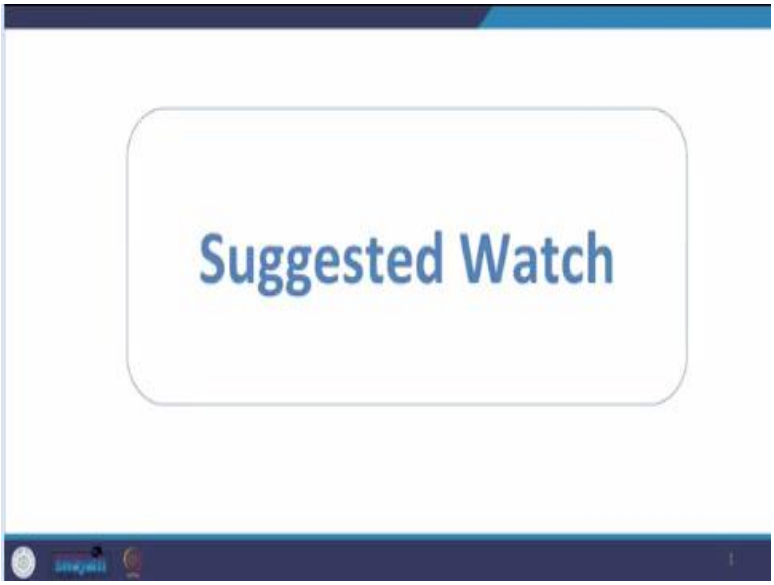

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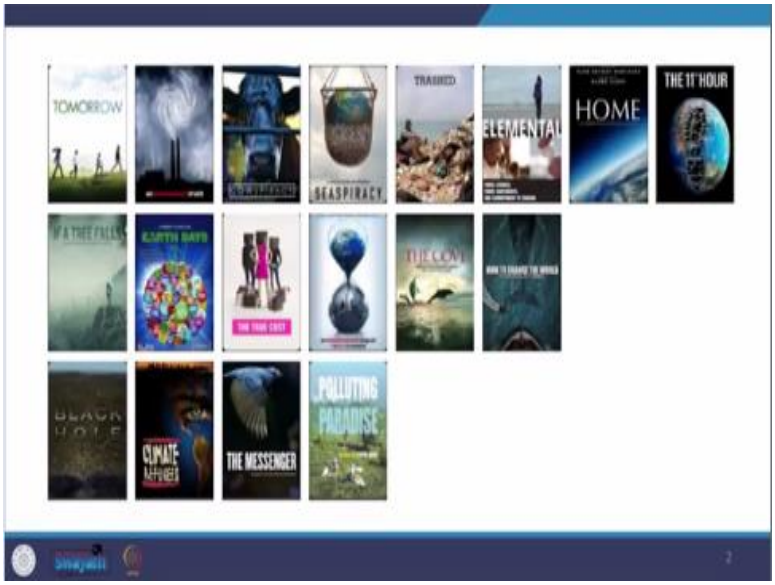

Few are suggested here. This is not an extensive list. You may feel free to suggest more from your experience.

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Please feel free to ask questions. Let us know about your concerns. You have to share your opinion, experiences and suggestions; looking forward to interacting and co-learning with you while exploring cities and urban planning. That is all for today. Thank you.