Availability and Management of Groundwater Resources
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Lecture – 57
Impact of Climate Change on Water Resources (Contd.,)

Welcome you all in the part 3 of the module 12 impact of climate change on water resources. So, we have seen the adverse effects of climate change on the water resources in the previous parts of the lectures.

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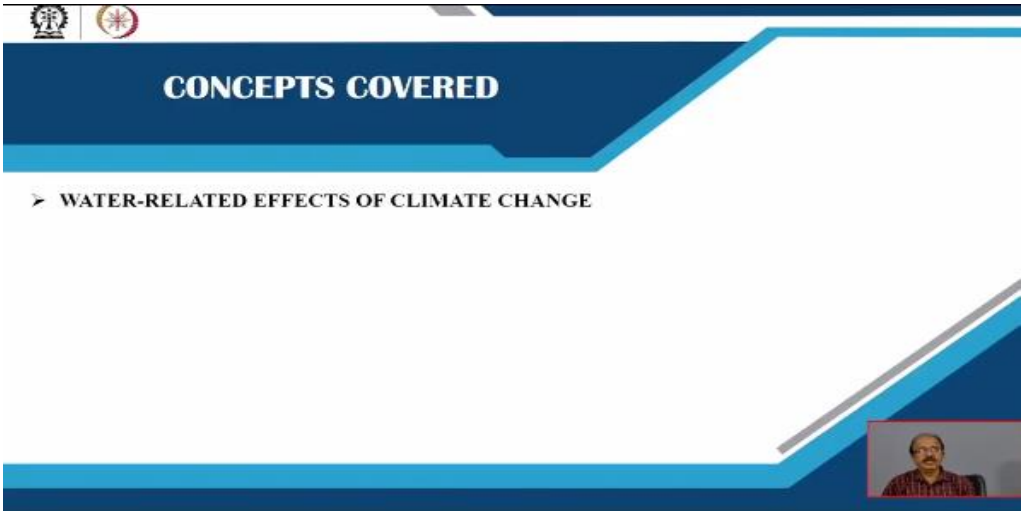

Now, in this part, I will discuss the water related effects of climate change.

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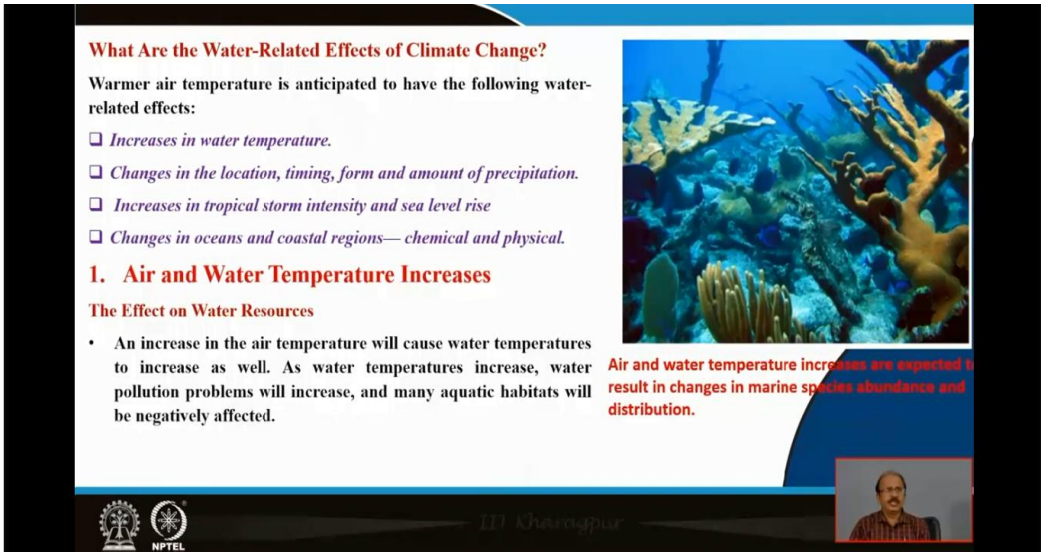

Generally, the because of the warmer air temperature some of the water related effects are as first one is increase in water temperature, second is the changes in the location timing form and amount of precipitation. Third is the increase in tropical storm intensity and sea level rise and the fourth is the changes in oceans and coastal regions chemical and physical characteristics. So, because of this climate change, generally warmer air is anticipated with the following effects as discussed.

So, first I will take the air and water temperature increasing if the increase in air and water temperature then what will happen or what will be the effect on water resources. So, an increase in the air temperature will cause water temperatures to increase as well. As water temperature increases, water pollution problems will increase and many aquatic habitats on habits habitats will be negatively affected.

So, because of the increase in air temperature we have seen that the water temperatures are also increasing and because of the increasing in the water temperatures the water pour problem pollution problems originates and by this, what we are noticing that aquatic habitats get disturbed. So, they are many more aquatic lives they become disturbed and even they die also. So, air and water temperature are expected because of the climate change in marine species abundance and distribution the figure is also mentioned here in this figure it can be seen.

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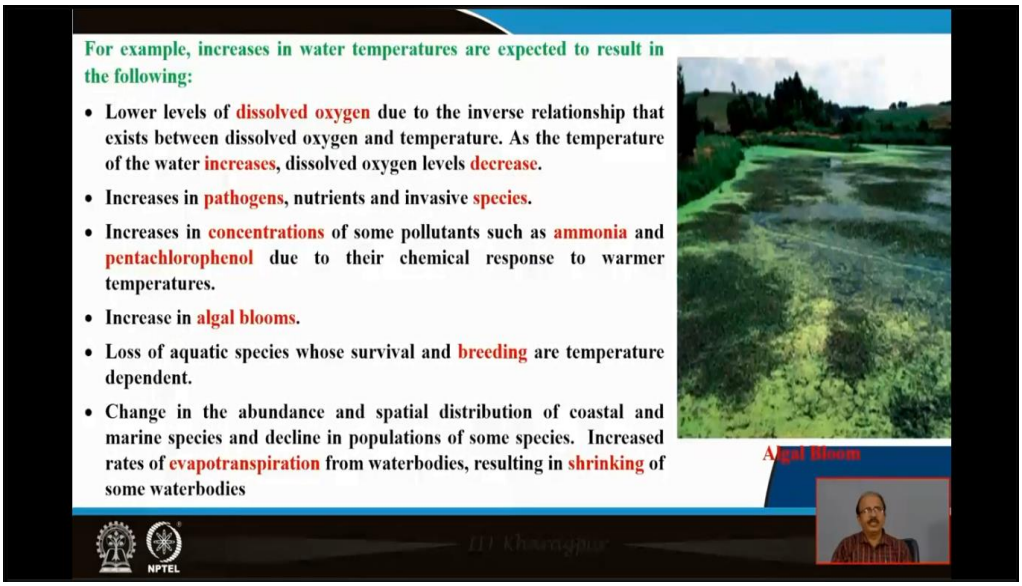

Now increase in water temperature are expected the following others results also as lower levels of dissolved oxygen due to inverse relationship that exists between dissolved oxygen and temperature as the temperature of water increases, dissolved oxygen level DO levels decrease so, that if the temperature will increase the DO will decrease. So, increase in pathogens, nutrients and invasive species, increase in water temperature.

These all are happening because of the increase in water temperature increasing concentration of some pollutants such as ammonia and pentachlorophenol due to their chemical response to warmer temperatures. Next is the increase in algal blooms because of the increase in water temperature. It has been noticed that increasing algal blooms also taking place loss of aquatic species whose survival and breeding are temperature dependent.

So, because of the high temperature high water temperature may be the loss of the aquatic species take place changing the abundance and the spatial distribution of coastal and marine species and decline in population of some of the species. So, increased rates of evapotranspiration from water bodies, resulting in shrinking of some of the water bodies or catchment sector. So, this is the effects of climate change because temperature is increased temperature increasing so, increase in water temperatures take place.

And because of the increase in water temperatures so many we have seen lower levels of the DO then increase in pathogens, nutrients and invasive species, increasing algal blooms. So, lots of other adverse effects are noticed because you have the high water temperatures.

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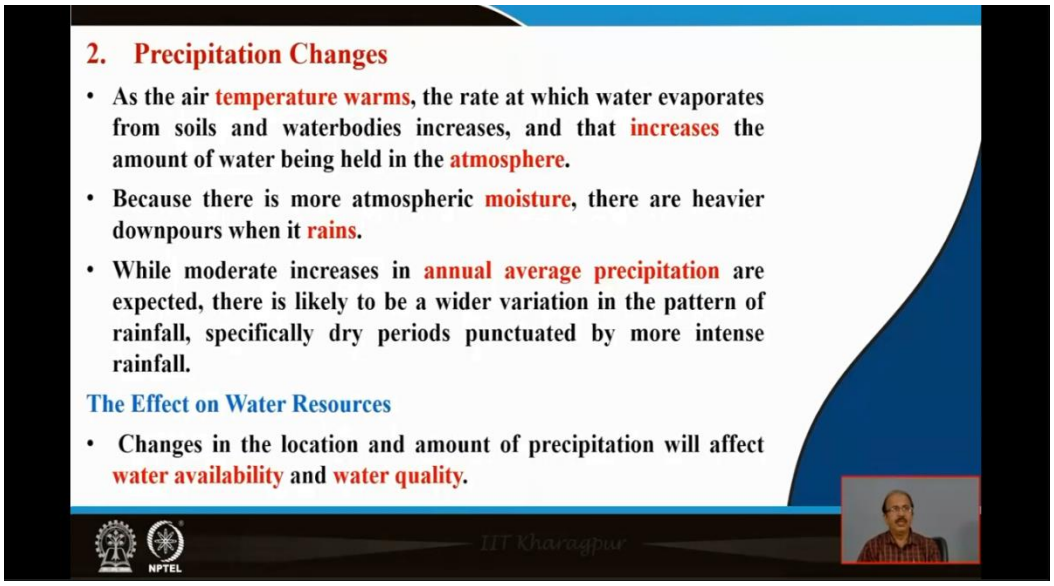

Now, precipitation changes the pattern the erratic pattern of the precipitation we are noticing. As the air temperature warms, the rate at which water evaporates from soil and water bodies it will increase. So, because of the increase in the air temperature, the evaporation rate and transpiration rate from the soil from the surface water bodies as well as the planet's surface will increase and that increases the amount of water being held in the atmosphere.

So, it will increase the amount of water in the atmosphere, because there is more atmospheric moisture, there are heavier downpours when it rains. while moderate increase in annual average precipitation are expected very likely to be a wider variation in the pattern of rainfall, especially dry periods punctuated by more intense rainfall, this is generally being noticed in general, then, what is the effect on water resources changes in the location and amount of precipitation will affect the water ability as well as water quality.

So, in both the sector in the water ability sector as well as the water quality sector both will get affected by the change in the climate changes or change in the precipitation pattern of the area.

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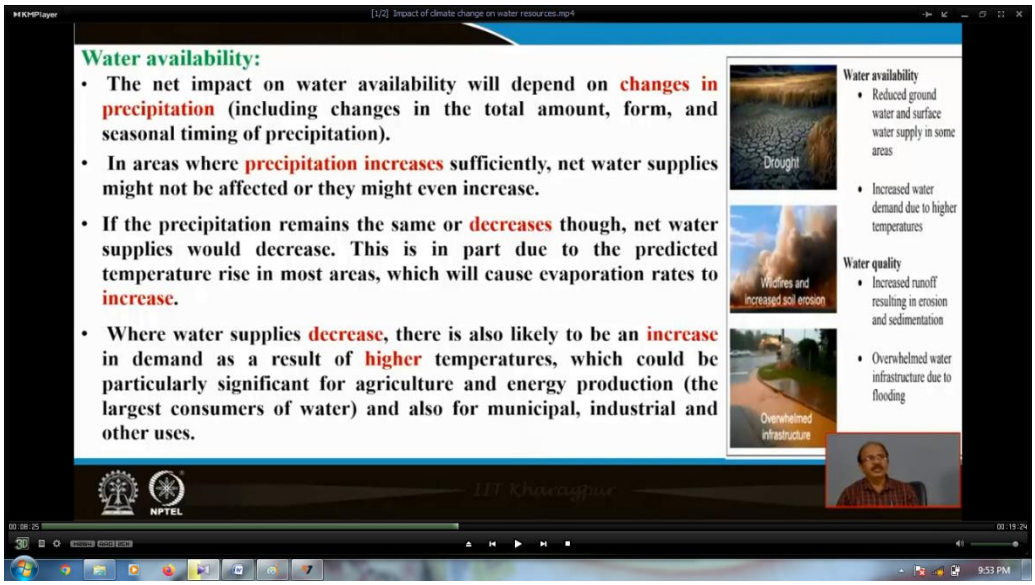

Now, water ability, the how it will affect the water ability, the net impact on water ability will depend on changes in precipitation, including changes in the total amount form and seasonal timing or presentation. So, in areas where precipitation increases sufficiently, net water supply might not be affected or they might even increase if the precipitation will increase the net water supplies might be even increase. If the precipitation remains the same or decreases, then what will happen net water supplies would decrease.

This is in part due to the predicted temperature rise in most areas, which will cause evaporation rates to increase. So, this generally happens if the precipitation remains the same or decrease, then the net water supplies of the area would decrease. And the predicted this is a part in part of the predicted due to the predicted temperature rise in most area, which will cause evaporation rates to increase. Where water supplies decrease, there is also likely to be an increase in demand as a result of higher temperatures.

Higher temperatures, which could be particularly significant for agriculture and energy production the largest consumers of water and also for municipal industrial and other uses. So, where water supplies generally decrease, there is also likely to be an increase in demand as a result of high temperatures, which particularly significant for agriculture energy production. So, in this way, the ability of water also get affected by the change in the climate.

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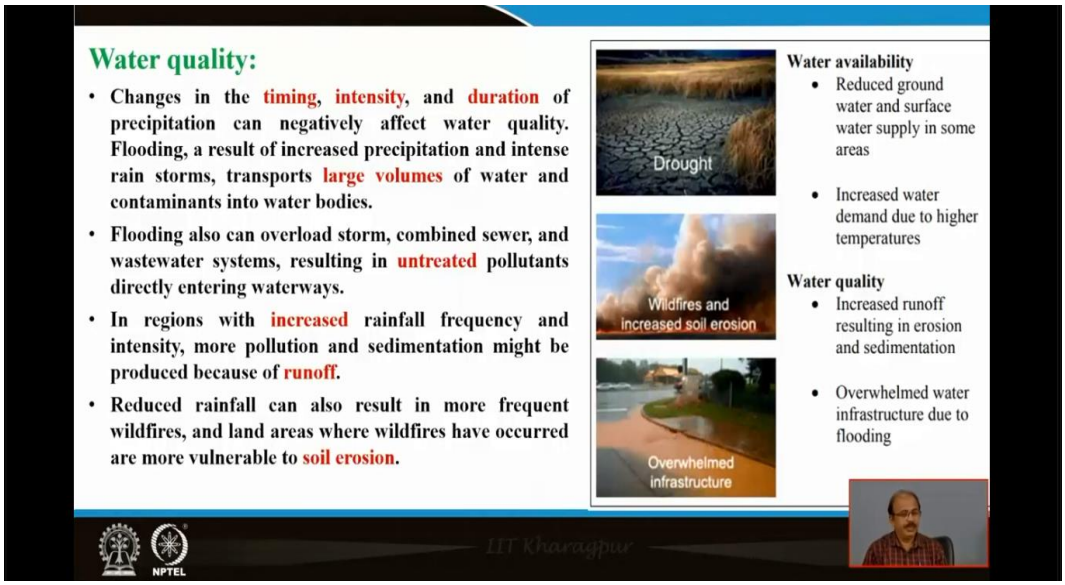

Now water quality, how it is affected, changes in the timing, intensity and duration of precipitation can negatively affect the water quality. If the intensity will change, the duration will change you say precipitation will change definitely the water quality will get affected flooding as a result of increased precipitation and intense rain storms transports large volume of water and contaminants into the water bodies. So in this way the contamination are increasing in the water bodies because of the high precipitation increased precipitation.

Flooding also can overload storm combined sewer and wastewater system resulting in untreated pollutants directly entering the waterways just entering into the waterways. In regions with increased rainfall frequency and intensity, more pollution and sedimentation might be produced because of runoff. So this is important because in regions with increased rainfall frequency, generally more pollution and sedimentation has been noticed. And because of this because of runoff only might be produced because of runoff.

So reduce rainfall can also result in more frequent wildfires and land areas where wildfires have occurred are more vulnerable to soil erosion. So, these areas are very, very vulnerable to soil erosion also. So in this way because of the climate change the water availability as well as water quality, both are being affected by the change in the temperature or precipitation pattern on the Earth's surface.

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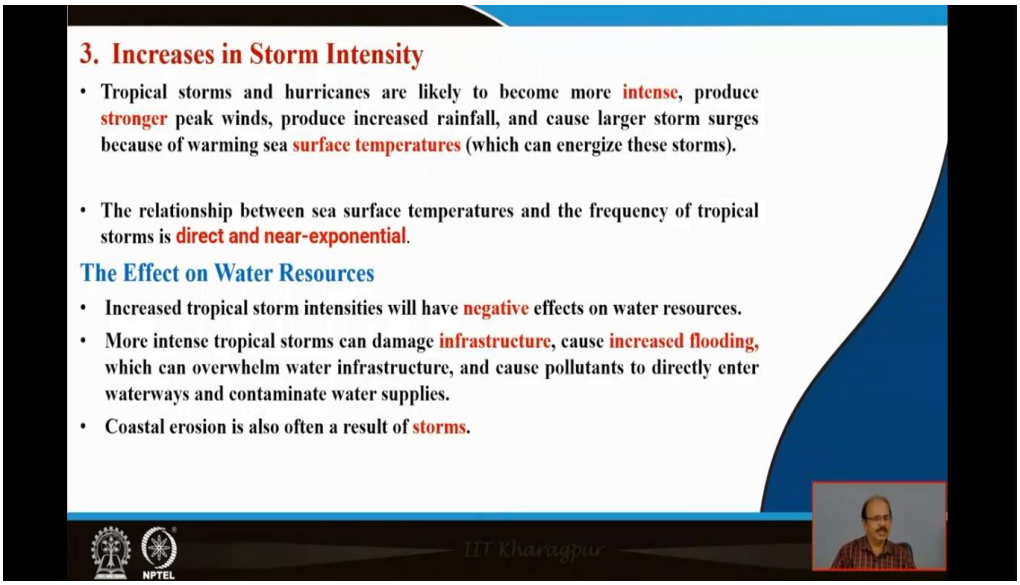

Now, the third is the increase in the storm intensity, so, tropical storms and hurricanes are likely to become more intense, produce stronger peak winds, produce increased rainfall and cause the larger storm surges because of warming sea surface temperature. So, the relationship between sea surface temperature and the frequency of tropical storms is direct and nearly exponential. Now, what is the effect on water resources? Increased tropical storm intensity will have negative effects on water resources.

More intense tropical storms can damage infrastructure causes increased flooding, which can overwhelm water infrastructure and cause pollutants to directly inter waterways and contaminate the existing water supplies of the area. Coastal erosion is also often a result of storms. So, because of this increase in storm intensity, generally the more intense tropical storms are damaging the infrastructure and also enhancing the risk of flooding in the area.

And in this way, this coastal erosion is also taking place because of the intense tropical storms because of the change in the climate change.

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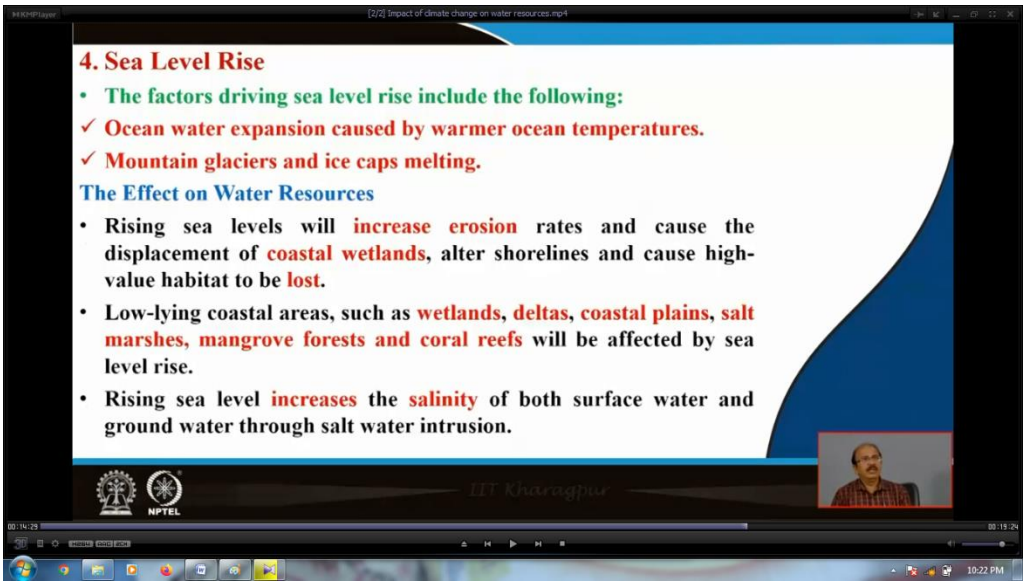

Now, next is the sea level rise. The factors driving the sea level rise generally includes oceanic water expansion caused by warmer ocean temperatures. So, the water expansion they will cause because of the warmer ocean temperatures and melting of the mountain glaciers and ice caps. So, because of these 2 factors, generally it is giving rise to sea level rise then what is the effect on water resources?

Rising sea levels will increase the erosion rates and cause the displacement of coastal wetlands after altering the soul lines and also causes loss to the high value to the habitat or high your valued habitat generally these are also lost. So because of the high rising sea levels generally increasing erosion rates take place, and it caused the displacement of the coastal wetlands altering the shorelines and causing the high value habitat to be lost.

Whereas low lying coastal areas such as wetlands, deltas, coastal plains, salt marshes, mangrove forests and coral reefs, these are getting affected also by the rising the sea level. So low lying coastal areas also getting affected because of the change in the climate change because of the climate change, and this because of the climate change only the sea level generally rising also rising sea level increasing the salinity of both surface water and groundwater through saltwater intrusion.

So because of this rise in sea level, it is increasing the salinity of both surface water and groundwater through saltwater intrusion.

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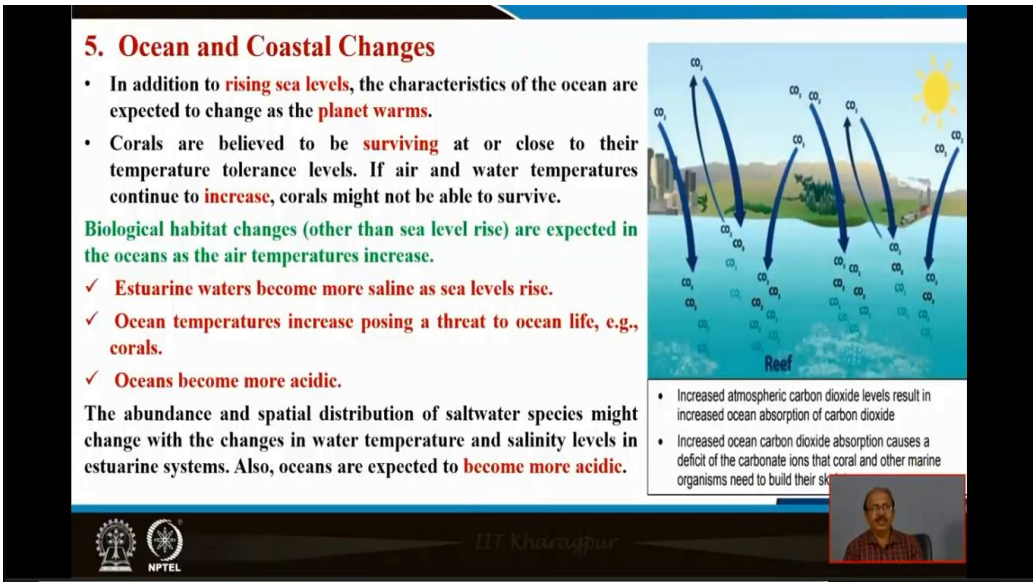

Next is the ocean and coastal changes. So in addition to the rising sea levels, the characteristics of the ocean are expected to change as the planet warms. Corals are believed to be surviving at or close to their temperature tolerance levels. If air and water temperature continue to increase the corals might not be able to survive. Therefore, biological habitat changes are expected in the oceans as the air temperature increases.

Estuarine water becomes more saline, as sea levels rise will take place, ocean temperature increases posing a threat to ocean life as well. Example is corals oceans are becoming more acidic also, the abundance and spatial distribution of saltwater species might change with the changes in water temperatures and salinity levels in the estuarine systems. Therefore, oceans are expected to become more acidic because of the climate change issues. These are the some of the interesting facts.

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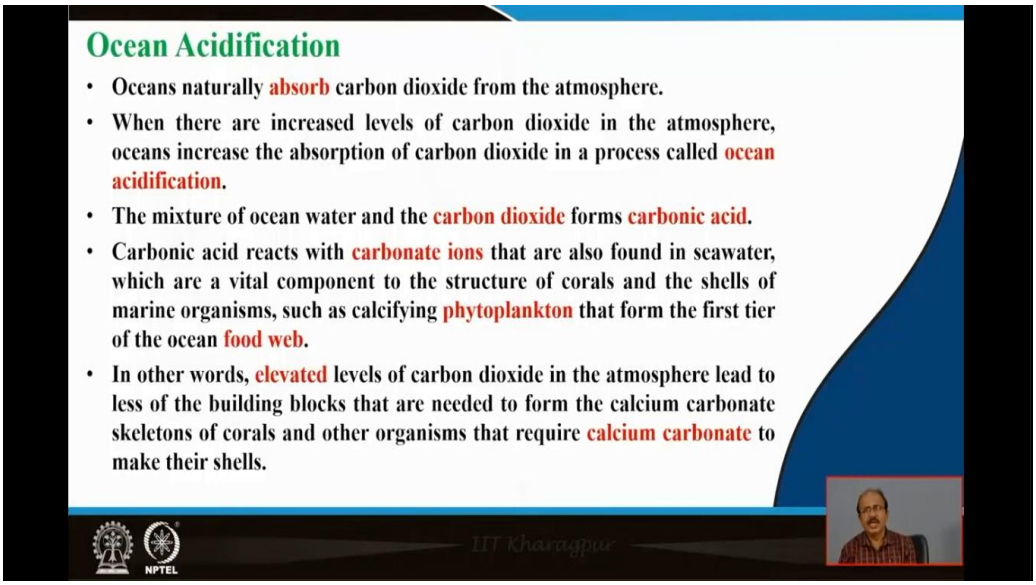

Now, ocean acidification few points we must know oceans naturally absorb carbon dioxide from the atmosphere. When there are increased levels of carbon dioxide in the atmosphere, ocean increase the absorption of carbon dioxide in a process called ocean acidification. The mixture of ocean water and the carbon dioxide forms the carbonic acid. Carbonic acid reacts with carbonate ions that are also found in seawater, which are a vital component to the structure of corals and the shells of the marine organisms.

Such as calcifying phytoplankton that form the first tier of the ocean food web. This is the first tier ocean food web. In other words, elevated levels of carbon dioxide in the atmosphere lead to the less of the building blocks that are needed to form the calcium carbonate skeleton of corals and other organisms that require calcium carbonate to make their shells. So, elevated levels of CO_2 in the atmosphere lead to the less of the building blocks that are needed to form the calcium carbonate skeleton of corals. And other organisms that require calcium carbonate to make their shells.

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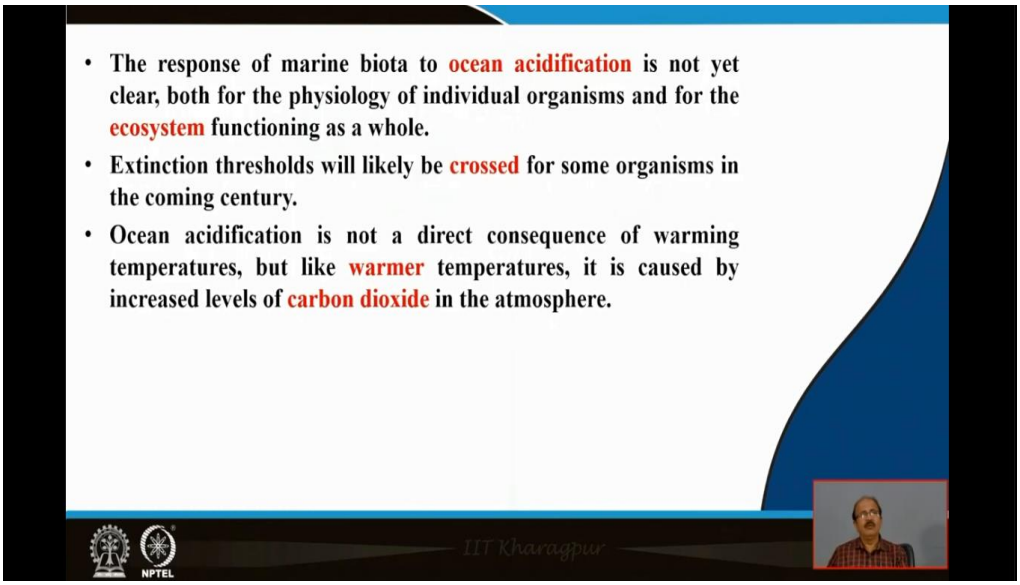

Now, the response of marine biota to ocean acidification is not yet clear. It is not clear both for the physiology of individual organisms and for the ecosystem functioning as a whole. Extinction thresholds will likely to be crossed for some organisms in the coming century. Ocean acidification is not a direct consequence of warming temperatures, but like warmer temperatures, it is caused by increased level of CO_2 in the atmosphere after knowing this much about the effects of your acidification of the soil water, ocean water.

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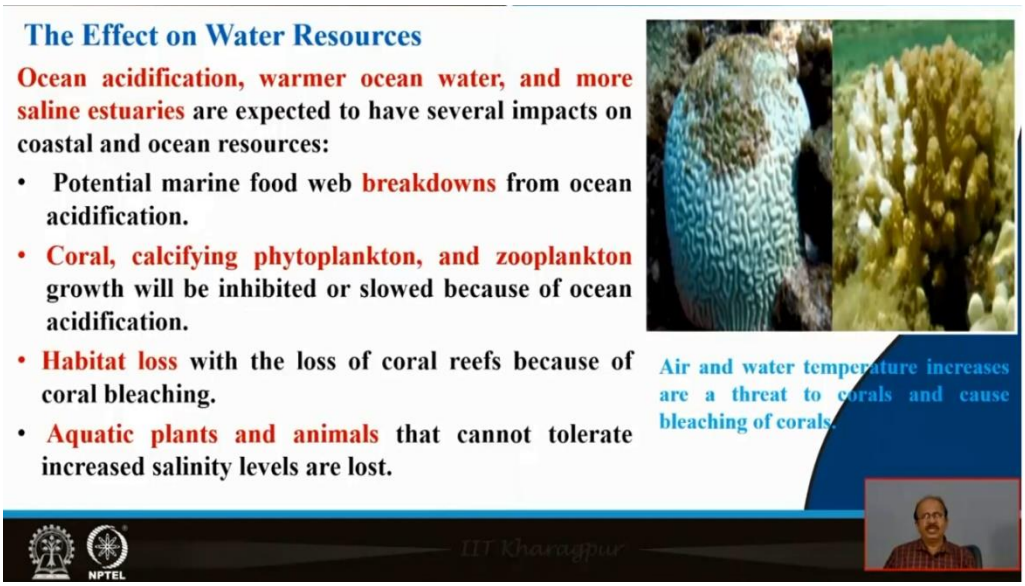

Now what are the effects on water resources? Oceans acidification, warmer ocean water and more saline estuaries are expected to have several impacts on coastal and ocean resources. First is the potential marine food web breakdown from ocean acidification. The coral calcifying

phytoplankton and zooplankton growth will be inhibited or slowed because of the ocean acidification habitat loss with the loss of coral reefs because of coral bleaching.

And aquatic plants and animals that cannot tolerate increased salinity levels are lost. So, in this way, we are noticing that air and water temperature increases are a threat to corals and cause bleaching of corals. So, the generally this is the main impact because of the change in the climate to the water resources. Thank you very much to all.