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GIS in Ag-Essentials and Applications

Our Agriculture Practices and Lessons

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Welcome to the agMOOCs course on GIS in Agriculture Applications.
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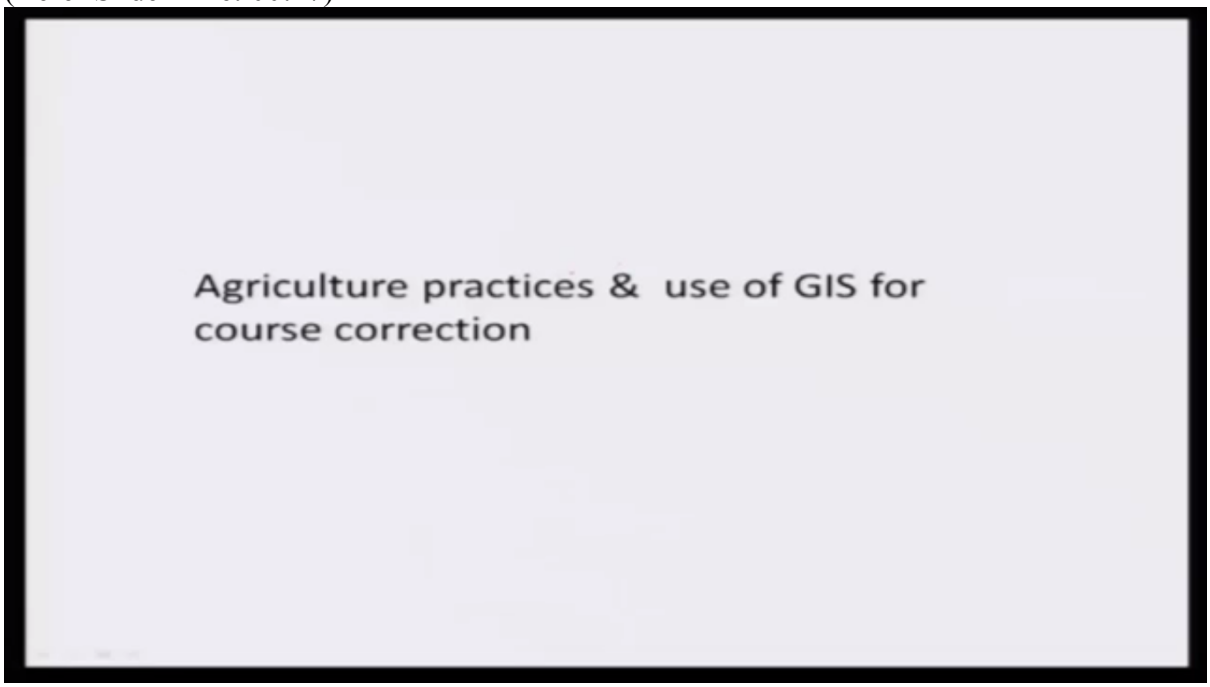

Now welcome to this lecture on application practices in application practices and use of GIS for course corrections.
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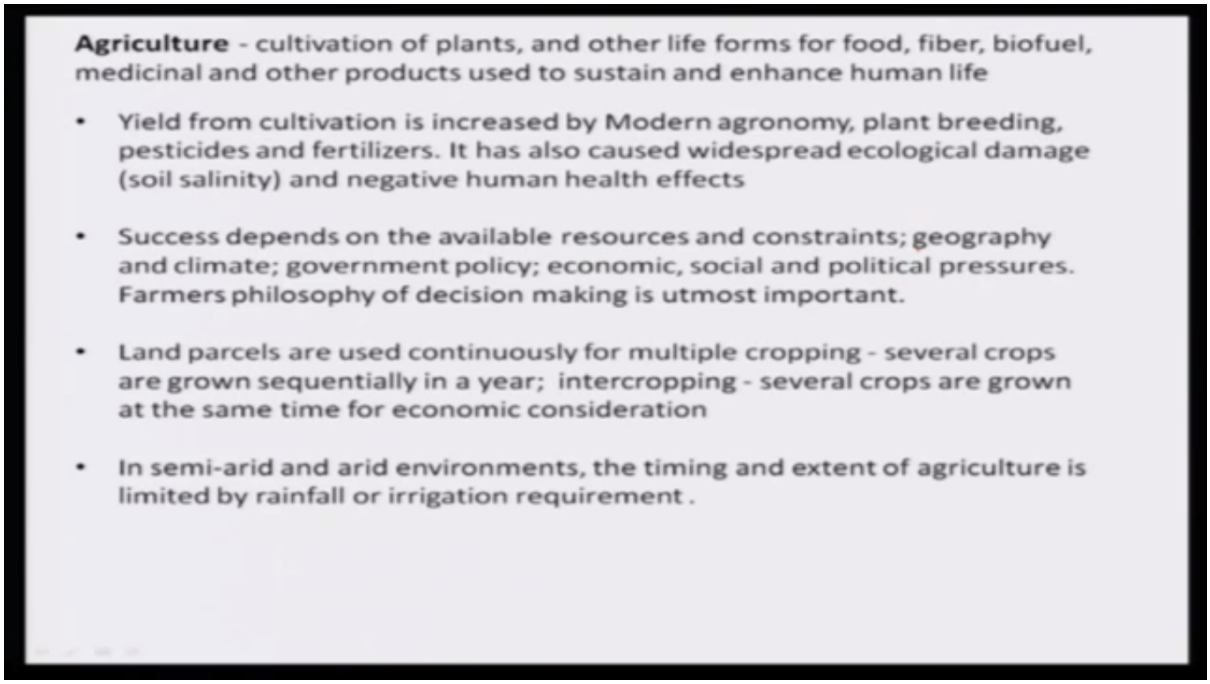

When you want to talk about agriculture, let us have our perception very clear. Agriculture, what is mean by agriculture here in this course is given is cultivation of plants, and other life forms for food, fiber, biofuel, medicinal and other products used to sustain and enhance the human life. So with this background, we try to proceed with this course.

The yield from the cultivation is increased by a modern agronomy, plant breeding, pesticides and fertilizers. It has been these practices enhanced practices for enhanced crop field has given some amount of ecological damages as well as human health effects.

The success of crop production depends on the resources and the constraints: geography and climate, government policy, economic, social and political pressures. But the farmer's philosophy of decision making is almost important.

Now the land parcels, which are used continuously for multiple cropping, multiple cropping in the sense several crops are grown subsequently in a year, as well intercropping, there are several crops which are grown at the same time for economic considerations.

In semi-arid and arid environments, the timing and extent of agriculture is limited by rainfall, natural, irrigation requirements. If there is availability of water, then the irrigation is provided to this.

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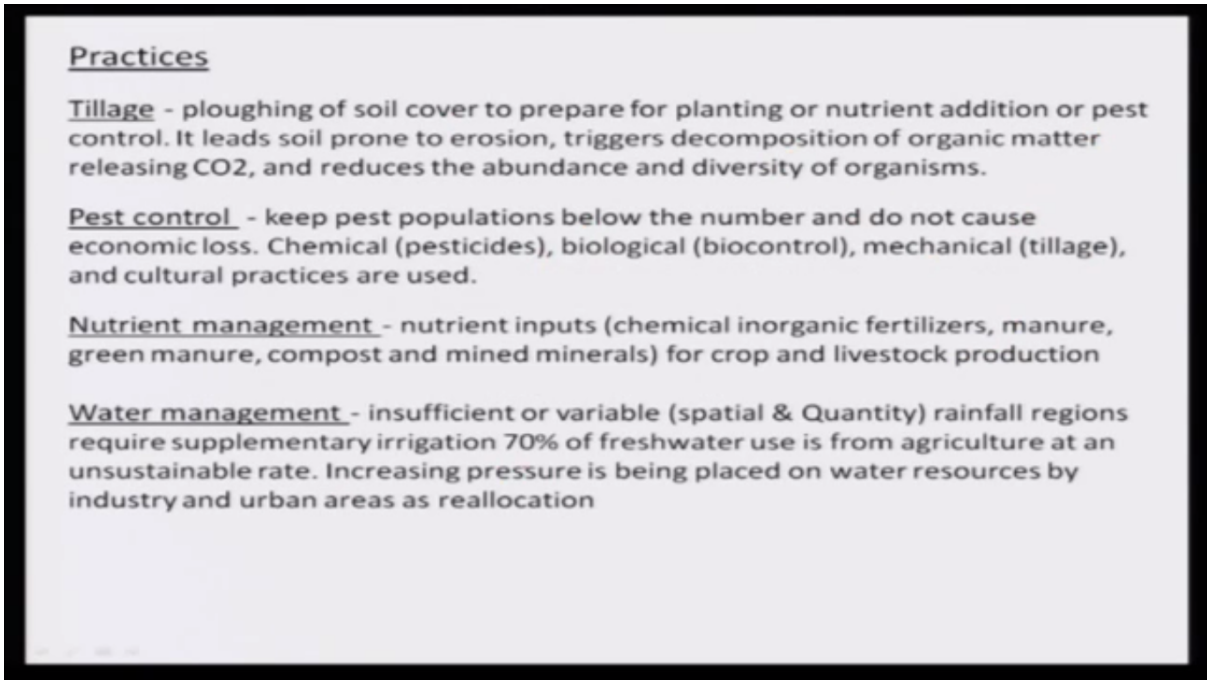

Some of the practices which we have been doing it for the past so many decades are: one is tillages. Tillage is nothing but ploughing the soil cover and then preparing it for planting as well as for nutrient addition or pest control.

The another one, the pest control is to keep the pest population below the number and do not cause any economic loss for the cropping. The type of pesticides which we were using it include chemical, biological, as well as mechanical and cultural practices that are being used.

The another practice which we are using it for crop yield estimation or enhancement are the nutrient management. What are nutrient inputs? They are chemical, inorganic fertilizers. We are adding it so that the crop grows in a better manner. The manure, it could be organic manures or a green manures or composite, and mined minerals from different places and so that crop and livestock production increases.

Another aspect is water management. So availability of water for the crops varies and also at places, they are insufficient. This insufficiency varies in space as well as in quantity. This is about it is said 70 percentage of the fresh water in the world is being used for agriculture at an unsustainable rate.

What is mean by unsustainable rate? Unsustainable rate means when you take out X quantity of water from the groundwater, similarly, same amount, X amount should be recharged in the coming years or on the same year. Then only the input as well as output has got a zero balance. If you extract more water and then next year, there will be a reduction. There will be a deficit of water in the groundwater aquifers so that next year's crop will be suffering. That is what we mean by unsustainable rate.

Now there is a question with the advent of different pumping technology, people are withdrawing more water than what it could get recharged. Now another problem is the land transformation. If you look at what this transformation is land transformation is conversion of a land cover to another use by the human being.

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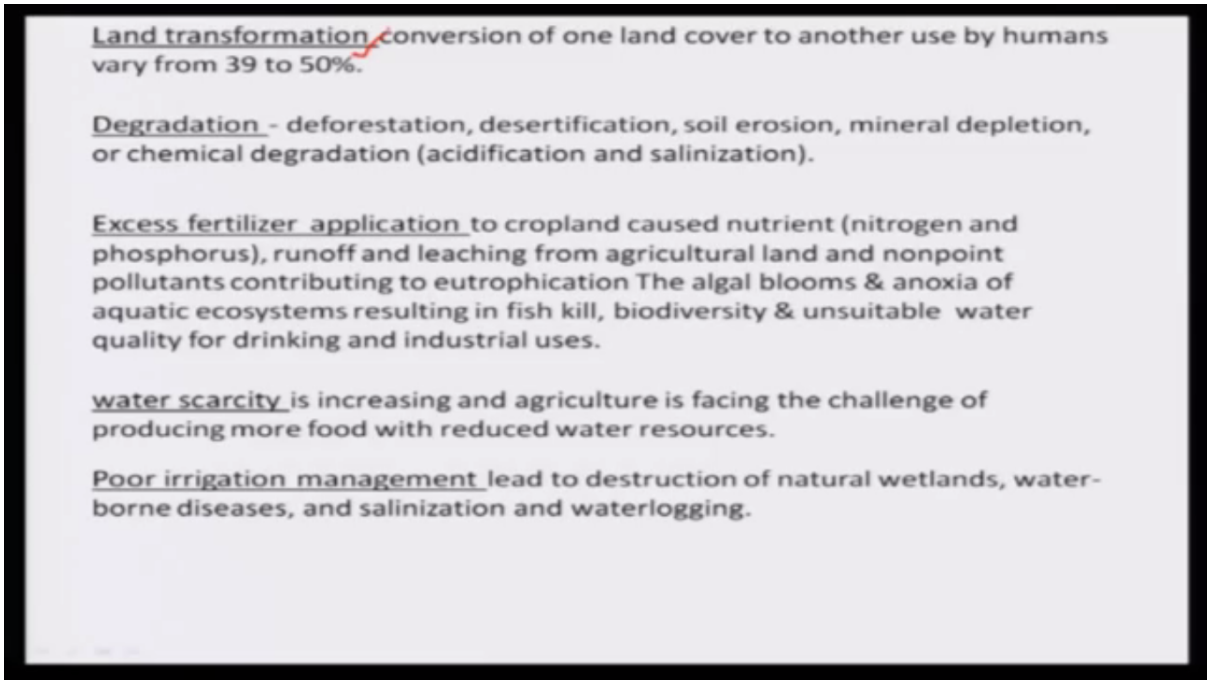

It is estimated 90 -- 39 to 50 percentage of the changes are taken place in the world for the past four to five decades. This type of conversion of land cover into other uses, mainly for the agriculture, has led to degradation of land.

What is mean by degradation from what? Deforestation. Deforestation is nothing but clearing of the trees and making the land for the cultivation, which has led to desertification. What is a desertification? What is a desert is nothing but a condition where no plant could grow in this area. It will be a you have seen Thar deserts, which is a hot desert, and there are cold deserts in that Ladakh area where the seeds cannot grow because the water inside the pore spaces are not there. They are in a frozen conditions.

Same way soil erosion has degraded the land with devoid of soil fertility. The chemical degradation is nothing but pesticides as well as fertilizers, they have reduced the chemical composition led to soil acidification, that means the pH of the soil is less than 7, as well as salinization that is a soil salinity which has gone where the sodium and magnesium salts are more in the soil which does not support any cropping pattern.

Now with the intention of growing more yield what we have tried to do is excess fertilizer we have applied to the plants. That has killed the plants or the kill -- that has degraded the soil as well as during the rainy season, that much amount of excess fertilizer as well as pesticides, they have been leached out or they have been carried out from those areas to the downstream area. This type of activities has created a situation called eutrophication that is the algal bloom, which has been there widespread in many of our thanks. Why this has created? It is a situation where fishes they cannot control, they cannot live in that particular type of quality of water, and so it becomes a unsuitable water for drinking as well as for industrial use.

Another problem is water scarcity. What is water scarcity is I do not get enough water to meet my requirements. For a human being, it is a drinking water. For a plant, it is a plant growth requirements so that it is -- is it -- sometimes some places it is temporary. We call it as a drought. In some places, it is permanent. Then we call it as a desert like situations.

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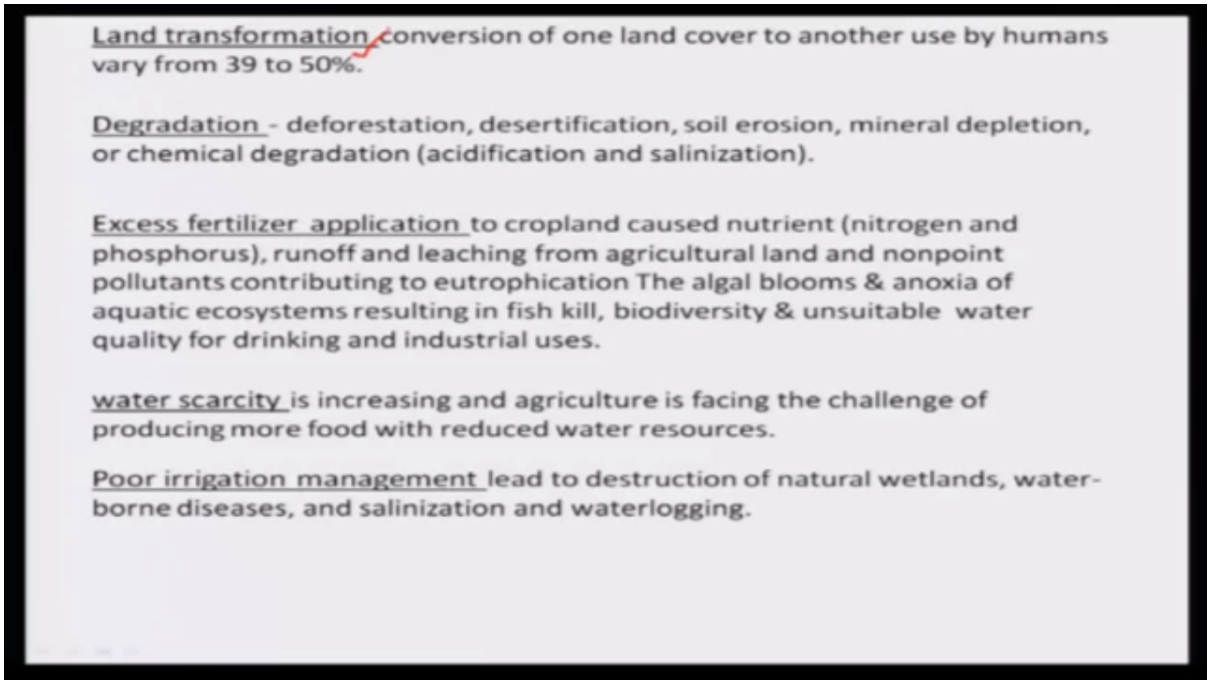

Now the third -- another problem is about the poor irrigation management. What is a irrigation management? I either I pour more water or give more water to the plants or I give less water. This has given it to destruction of natural wetlands which are available in the nearby areas or it has created waterborne diseases. It has been a cause for mosquito and other disease spreading insects, and also similarly salinization as well as water logging.

See water logging and salinization is prevalent in some parts of the country, especially in Haryana as well as Punjab, in some portions of the Maharashtra where the black cotton soil has become -- was saline -- soil salinity has increased and water logging is prevalent.

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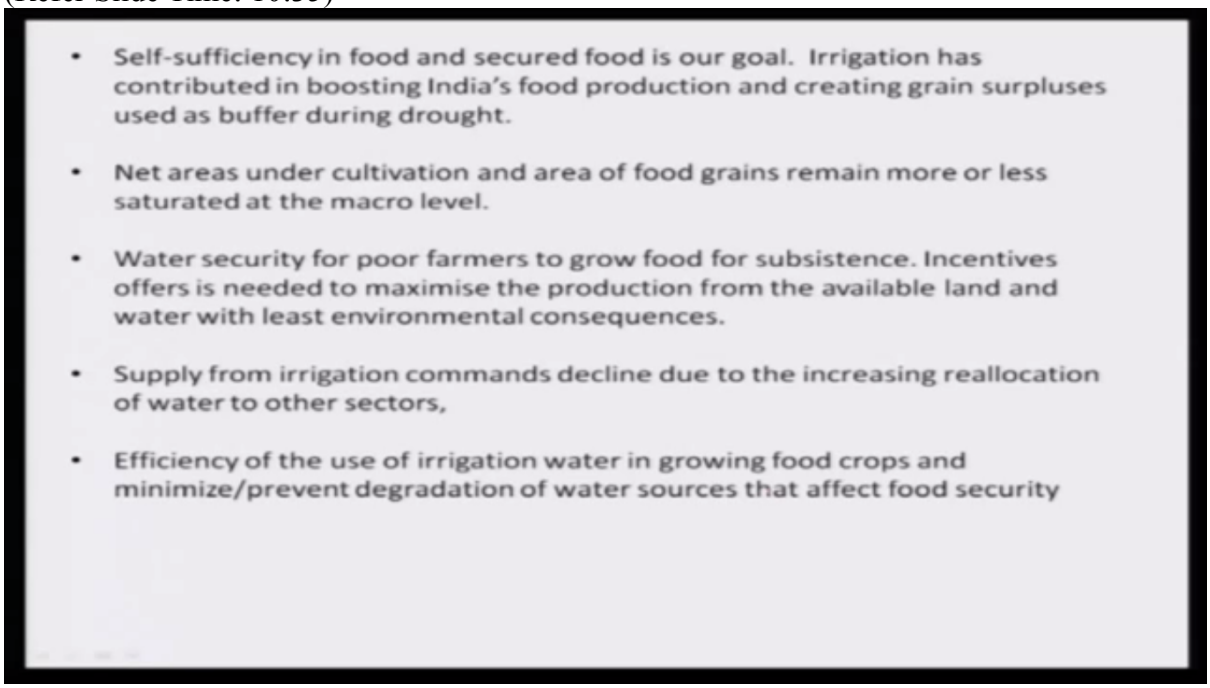

This type of situations prevents us to make the self-sufficiency in food and secured food is our goal. Now irrigation has contributed in boosting our food productions and creating grain surpluses used for as a buffer during the drought period. But the net areas under cultivation is

of food grains has remained more or less saturated at the macro level or a country level or a district level or a state level.

Now water security for poor farmers to grow food for a subsistence. Incentives offered is needed to maximize the production from the available land, with the available water, with the least environmental consequences so that survival is assured.

Further the supply from the irrigation commands, what is a irrigation command is from the stored reservoirs, you convey water through the canals that is whenever there is a water need for the crops and the area under which this type of cropping takes place because of a particular irrigation project, that is what we call it as a command area. This type of water less or water scared conditions, it has happened because of reallocation of water to other sectors.

What do you mean by that reallocation? It is like we need water for a human. We need water for agriculture. We need water for the livestocks. We need water for industries as well as we need water for environmental purpose. So allocating a water which is being given to agriculture, if it is given into industrial areas or taking away water, no water supply to the environmental conditions and giving it to industries, this type of allocation of water or sharing of water from one segment's water to others, that is what is called as reallocation of water. This type of temporary as well as a permanent reallocations, they kills the agriculture activities.

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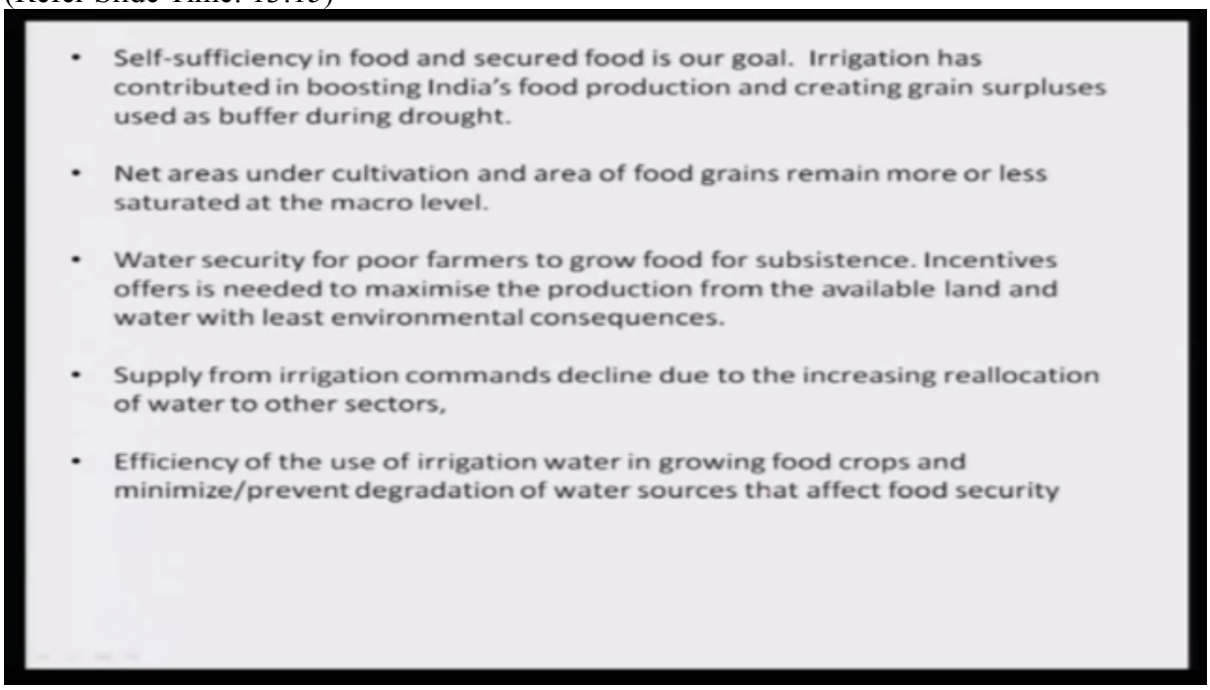

Now what is needed is efficient use of irrigation water to grow for growing food crops and minimize the or prevent the degradation of water sources that affect the food security.

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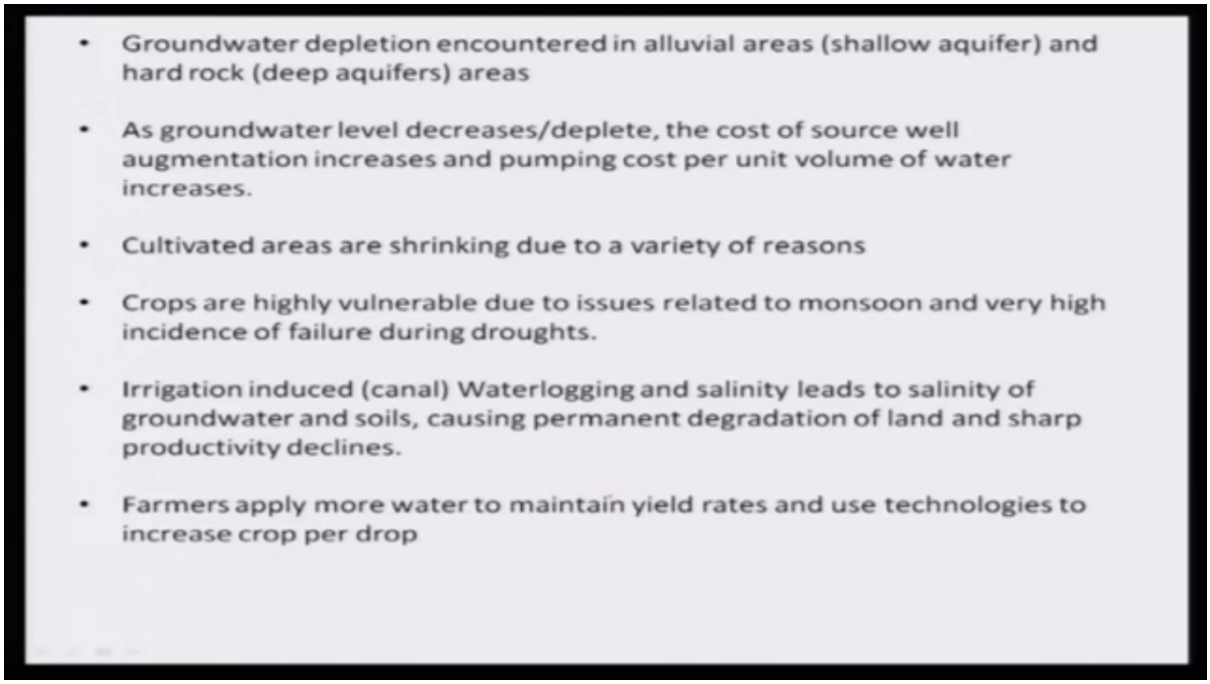

Now groundwater, in this process, groundwater there is a depletion is encounters in many of the places. It is said that shallow aquifer that is available in the alluvial areas alluvial areas, alluvial areas are areas wherein the river sand is deposited or unconsolidated material is there or in the deep aquifers where the hard rock is available. Groundwater depletion has happened in alluvial areas as well as in the hard rock areas. So alluvial areas are nothing but it is a shallow aquifer where we get water from the open dug wells whereas hard rock areas are the deep aquifers where we get water from the deepest portion of the Earth that is more than 50 meters. That is what we call it as a deep aquifers. The reason is deep aquifer depletion of groundwater is very difficult to replace it within a short period whereas shallow aquifer, unless if it rains, unless if you recharge it, these water levels will not be able to come up.

Now what happens to the groundwater because of this level decrease is for pumping it from a deeper layers, we may have to incur lot more money or finance than the present-day conditions. To do that, the pumping cost per unit area goes on increasing. This type of cost escalation in the agriculture will lead on to the profit per unit value of grains which is produced.

Then cultivated actually goes on decreasing it due to so many reasons. The cultivated areas are shrinking due to variety of reasons where the crops that are vulnerable due to issues because of monsoon, and the high incidence of failure during the drought conditions, the irrigation induced, water logging, as well as salinity leads to salinity of groundwater that is the water quality goes down as well as the soil what that salt content in the soil goes on increasing it. This type of regular features lead to permanent degradation of a land as well as sharp productivity in the productivity which decreases.

In order to overcome this, people -- farmers, they follow some shortcuts. So apply more water so that their thinking is that everything will get washed off so that and he can keep the minimum or maintain the yield rates as far as what he is concerned. So they have to use technologies, which will increase the crop productivity per drop.

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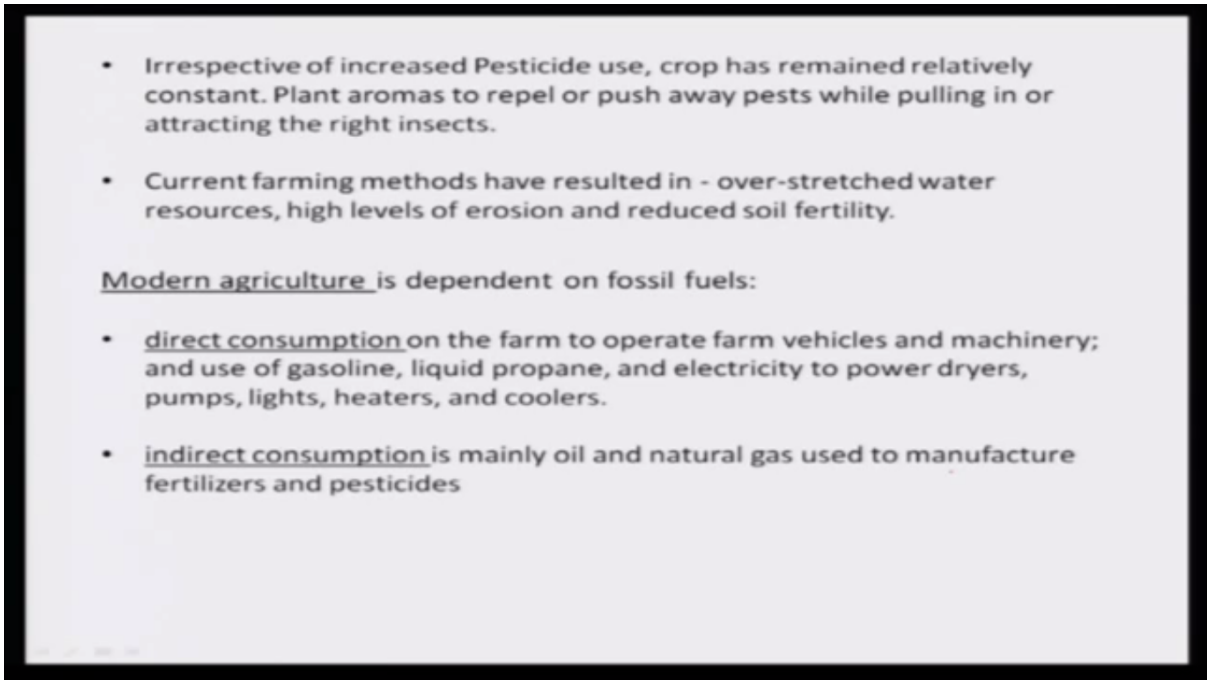

Irrespective of pesticide use, crop has been relatively under threat. There are practices like plant aromas to repel or push away the pests are being used nowadays. The modern agriculture leads uses fossil fuel. What is the impact? The direct consumption is they use it for the farm vehicles as well as machineries, and what do they use is gasoline, liquid propane, and as well electricity. The indirect consumption is the production of manufacture of fertilizers and pesticides. What are the impacts? This impacts on the climate change aspect that means the CO_2 emissions will be on a higher side, which will alter the weather conditions. So we are going for a different way.

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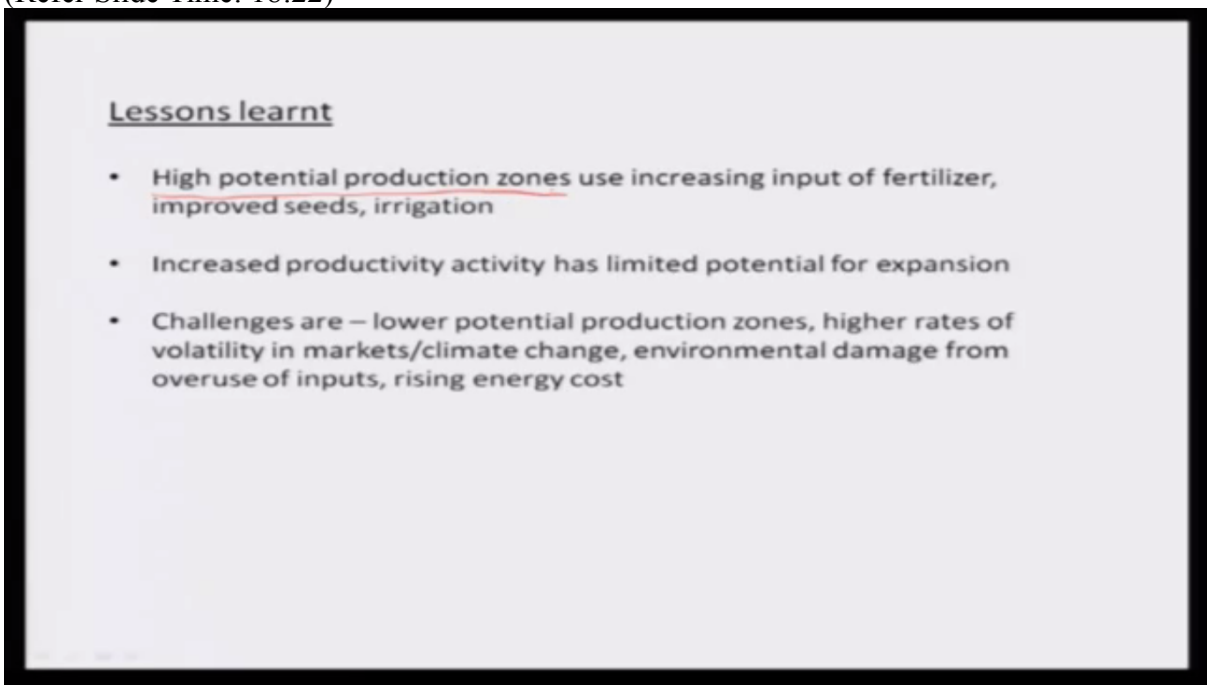

By all this, the past, what we have learnt is we have high potential production zones by way of increasing fertilisers as well as improved seeds and irrigation. We have increased our

productivity with limited potential for expansion. So we cannot expand more of our cultivated land.

Now the challenges are there are more number of areas come under low potential production zones, and there are market -- once you produce it, you may have to sell it in the market. There is a volatility in the market and there are we are created environmental damages from overuse as well as rising the energy cost. This is the lesson to sum up it has happened in the past.

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Now the said practices led to certain unexpected or expected impacts on our resources, as well as on the environment.

And with this, I conclude the first portion of my lecture.