Welcome students. We're going to start with Unit 2. That is environmental problems. The name of the module is bioconcentration and biogeomagnification, and the module number is 9. In this module we are going to see introduction to pollutants, bioconcentration, measurement of bioconcentration biogeomagnification, case study of biogeomagnification.

At the end of this module you will be able to explain the concept of bioconcentration and biogeomagnification. Cite examples of different pollutants and describe the effects of hazardous pollutants such as DDT and Mercury on the living organisms.

Pollution of earth surface is mainly caused by simple biodegradable pollutants. Simple biodegradable pollutants. They are easily biodegradable. Next, complex biodegradable pollutants. These pollutants are resistant to degrade easily. The next pollutants are the nondegradable pollutants. And the last is the physical agents,that is the nuclear energy.

The complex biodegradable pollutants. These are highly complex molecules such as highly branched chain. Increased degree of substitutions.Simple or fused aromatic rings. Cycloparaffins, etc. and that is the reason why these molecules are not easily degradable. Because it requires stepwise removal of substituted groups of atoms. Destruction of ring structures and progressive alteration of constituent units etc. These are degraded slowly slower than the rate of their entry into the environment. Deposits in the environment for long duration of time during which they are taken up in the biosphere, and they are accumulated.

Here comes the term bioaccumulation, bioaccumulation, it is the accumulation of pollutants inside cells and tissues of living organism at a concentration above those of surroundings.

Bioaccumulation takes place in two ways. 1. When an organism eats the contaminated food. And the 2nd way is by absorption directly from water. And when the organism absorbs the pollutant directly from water, it is known as bioconcentration

So bioconcentration is the process by which a chemical concentration in an aquatic organism exceeds that of the water as a result of exposure to water borne chemicals.

The different pollutants which cause bioconcentration are the toxic pesticides like DDT, that is, dichloro diphenyl trichloroethane, aldrine, endrin and PCBS that is polychlorinated biphenyls and many more.

Heavy metals also cause bioconcentration examples of heavy metals such as lead, mercury, copper and many more. Besides, radionuclides also cause bioconcentration, example Strontium-90.

All these are harmful substances. They are carcinogenic, teratogenic and mutagenic.

The concentration of a foreign substance within a biological system. It depends on the rate of uptake, duration of exposure. Rate at which it is being eliminated or reacted upon and solubility in fats.

How this bioconcentration is measured?
Bioconcentration factor. It is the ratio of concentration of a chemical in an organism or biota to the concentration of chemical in the surrounding environment, that is water.

So the formula is BCF is equal to concentration of chemical in an organism upon concentration of chemical in the water.

Now, what is biogeomagnification?
Biogeomagnification is the enhancement in the concentration of pollutants along the food chain. Biogeomagnification, it is also known as bioamplification. Harmful and toxic substances which enter trophic structure at primary producer level get concentrated at each trophic level as they move up upward in the food chain.

Here is an example of Biogeomagnification of DDT in a food chain. So this is our food chain which is made up of two plankton,small fish, large fish which eat the small fish and at the higher trophic level is the fish eating the birds. So when you see this diagram, we can see that the DDT concentration increases as we move up in the food chain. The increase can occur as a result of persistence, where the substance cannot be broken down by environmental processes.

Food chain energetic, where the substances concentration increases progressively as it moves up the food chain. Low or non existent rate of internal degradation of excretion of the substance mainly due to water insolubility.

Effects of DDT.
DDT causes thinning of eggshells and loss of reproductive capacity in birds. It causes the death of fishes. DDT deposited in milk is a potential danger to the infants.

One case study of biogeomagnification. That is the Minamata disease. Minamata disease was first documented in Minamata in Japan in 1957. This disease is caused by the heavy metal that is Mercury. A chemical factory was releasing Mercury into this Minimata Bay between 1932 and 1968. This Mercury bioaccumulated in shellfish and was biomagnified in fishes. The fish is the staple diet of the local people living in this Minamata Bay. So this Mercury got bioaccumulated and it got biomagnified and the population got this disease Minamata disease.

Effects of this minamata disease, or the effect of Mercury, are it causes deformation in the offsprings, notably affecting the nervous system. The children suffer from mental retardation. And it brings about genetic effects.
What is the difference between bioconcentration and Biomagnification?
It happens within an organism.Whereas biogeomagnification It occurs across levels of the foodchain.
These are some of the references.
Thank you.