Wildlife Conservation
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Lecture – 40
Revision – III

[FL]. So, now we have to come to the last lecture of this course which is the third Revision lecture.

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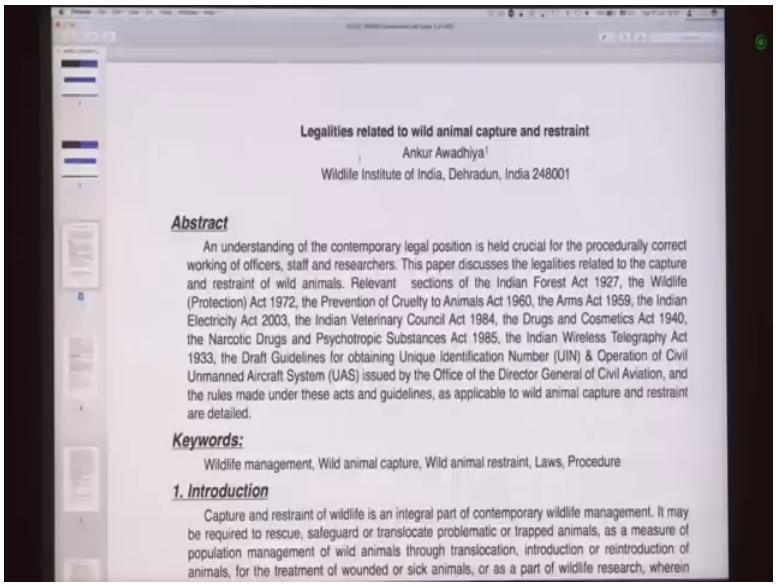

So, here we looked at so we are going to begin with legal aspects of capture and restraint. So, we had a look at the Indian Forest Act of 1927.

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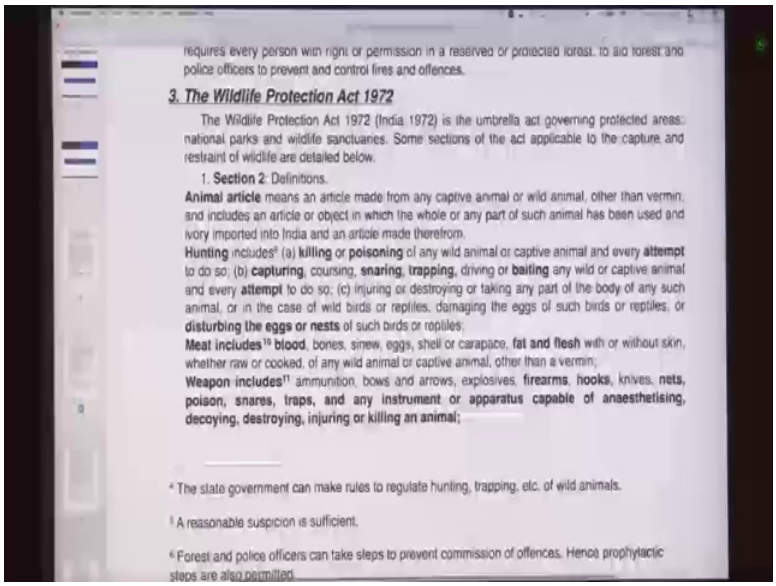

The most important act for us is the Wildlife Protection Act. Now in this case section 2 is the most important one which defines animal article hunting. So, hunting includes killing or poisoning, capturing, snaring, trapping, baiting every attempt to do all of these.

So, essentially when you are setting up a trap that is hunting under the Wildlife Protection Act. Then it defines meat, so meat includes blood fat flesh and so on. Weapon includes firearms, hooks, nets, poisons, snares, traps, and any other equipment, or apparatus that is capable of anaesthetizing, decoying, destroying, injuring, or killing of an animal.

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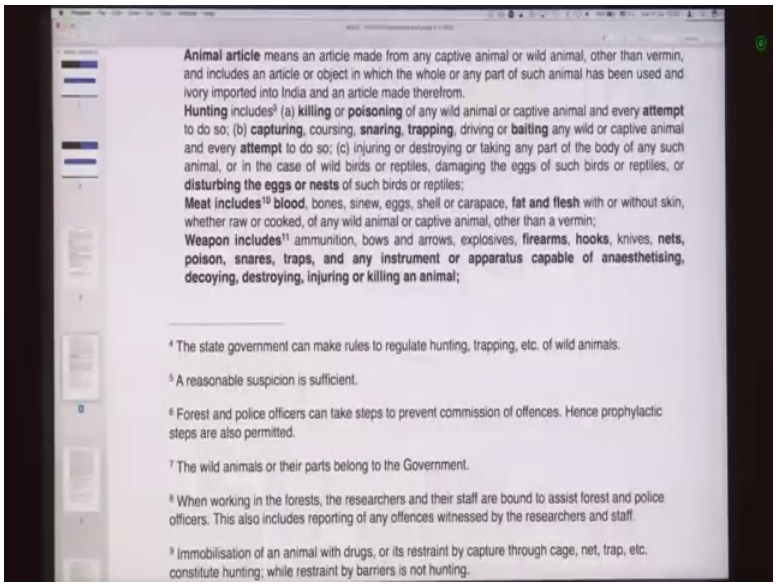

Animal article means an article made from any captive animal or wild animal, other than vermin, and includes an article or object in which the whole or any part of such animal has been used and ivory imported into India and an article made therefrom.

Hunting includes[9] (a) **killing** or **poisoning** of any wild animal or captive animal and every **attempt** to do so; (b) **capturing**, coursing, **snaring**, **trapping**, driving or **baiting** any wild or captive animal and every **attempt** to do so; (c) injuring or destroying or taking any part of the body of any such animal, or in the case of wild birds or reptiles, damaging the eggs of such birds or reptiles, or **disturbing the eggs or nests** of such birds or reptiles;

Meat includes[10] **blood**, bones, sinew, eggs, shell or carapace, **fat and flesh** with or without skin, whether raw or cooked, of any wild animal or captive animal, other than a vermin;

Weapon includes[11] ammunition, bows and arrows, explosives, **firearms**, **hooks**, knives, **nets, poison, snares, traps, and any instrument or apparatus capable of anaesthetising, decoying, destroying, injuring or killing an animal;**

[4] The state government can make rules to regulate hunting, trapping, etc. of wild animals.

[5] A reasonable suspicion is sufficient.

[6] Forest and police officers can take steps to prevent commission of offences. Hence prophylactic steps are also permitted.

[7] The wild animals or their parts belong to the Government.

[8] When working in the forests, the researchers and their staff are bound to assist forest and police officers. This also includes reporting of any offences witnessed by the researchers and staff.

[9] Immobilisation of an animal with drugs, or its restraint by capture through cage, net, trap, etc. constitute hunting; while restraint by barriers is not hunting.

So, essentially when we look at these definitions we can understand that most of the things that we are doing in the name of captioning of animals are prohibited, and they are regulated unless explicitly permitted.

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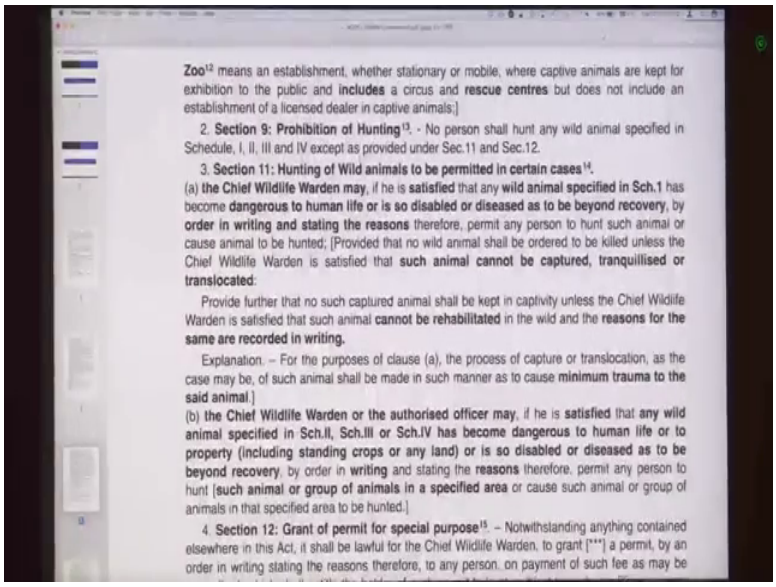

Zoo[12] means an establishment, whether stationary or mobile, where captive animals are kept for exhibition to the public and **includes** a circus and **rescue centres** but does not include an establishment of a licensed dealer in captive animals;]

2. **Section 9: Prohibition of Hunting**[13]. - No person shall hunt any wild animal specified in Schedule, I, II, III and IV except as provided under Sec.11 and Sec.12.

3. **Section 11: Hunting of Wild animals to be permitted in certain cases**[14].

(a) **the Chief Wildlife Warden may**, if he is **satisfied** that any **wild animal specified in Sch.1** has become **dangerous to human life or is so disabled or diseased as to be beyond recovery**, by **order in writing and stating the reasons** therefore, permit any person to hunt such animal or cause animal to be hunted; [Provided that no wild animal shall be ordered to be killed unless the Chief Wildlife Warden is satisfied that **such animal cannot be captured, tranquillised or translocated**:

Provide further that no such captured animal shall be kept in captivity unless the Chief Wildlife Warden is satisfied that such animal **cannot be rehabilitated** in the wild and the **reasons for the same are recorded in writing.**

Explanation. – For the purposes of clause (a), the process of capture or translocation, as the case may be, of such animal shall be made in such manner as to cause **minimum trauma to the said animal**.]

(b) **the Chief Wildlife Warden or the authorised officer may**, if he is **satisfied** that **any wild animal specified in Sch.II, Sch.III or Sch.IV has become dangerous to human life or to property (including standing crops or any land) or is so disabled or diseased as to be beyond recovery**, by order in **writing** and stating the **reasons** therefore, permit any person to hunt [**such animal or group of animals in a specified area** or cause such animal or group of animals in that specified area to be hunted.]

4. **Section 12: Grant of permit for special purpose**[15]. – Notwithstanding anything contained elsewhere in this Act, it shall be lawful for the Chief Wildlife Warden, to grant [***] a permit, by an order in writing stating the reasons therefore, to any person, on payment of such fee as may be

And then hunting is prohibited and then permission of hunting can be had through section 11. And in the case of section 12, so this talks about who grants the permits and then there are different situations for which permits can be granted.

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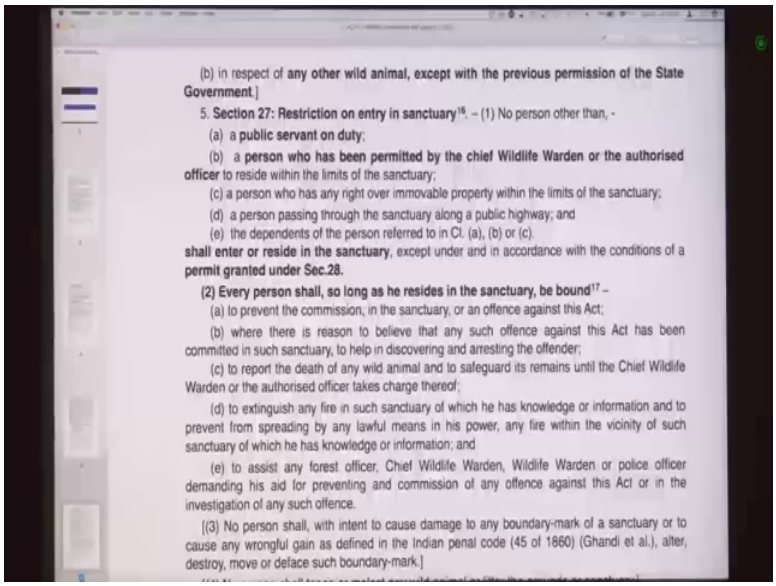

Schedule 1 animals and schedule 2 animals are given more preference. So, schedule 1 and part 2 of schedule 2 and other animals I given a less preference. Then you have restriction on entries destruction etcetera is prohibited and so on. Declaration of national parks wild life etcetera, are government property.

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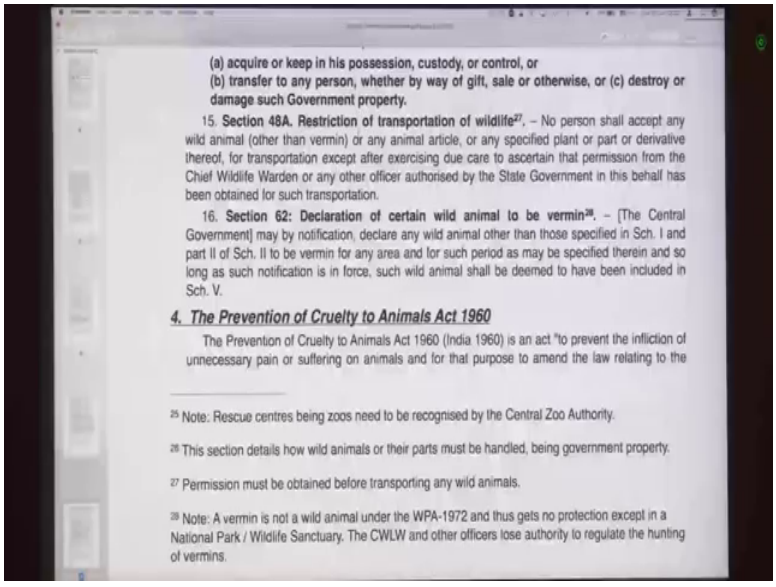

And then section 62 is a very important section it talks about the declaration of certain wild animals to be vermin's. And here also animals it says declare any wild animal other than those specified and schedule 1 and part 2 of schedule 2. Now, the next important act

is the Prevention of Cruelty to Animals Act of 1960. Now in this case treating animals cruelly is defined very clearly.

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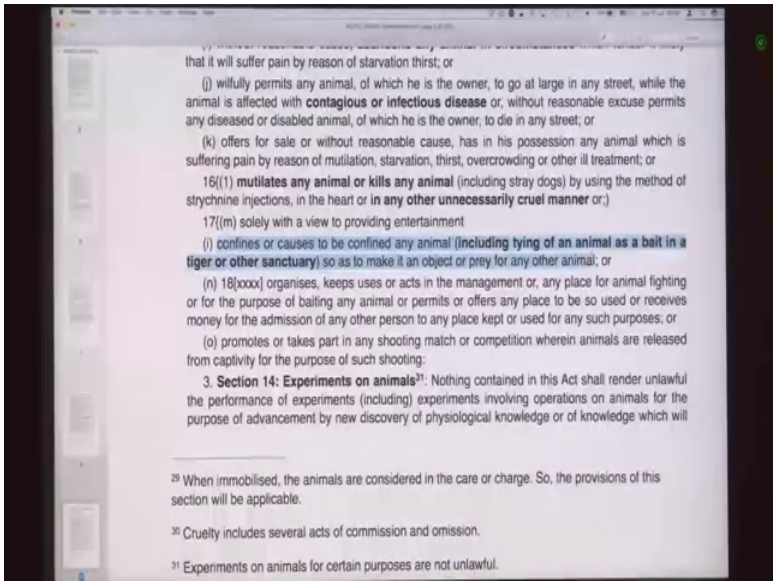

Now in the case of our situations so it is says 17 m is solely with the view of providing to providing entertainment confines, or causes any animal to be confined. Including tying of an animal as a bait or in the in tiger or other sanctuary.

Now, the point here to note is that if you are using an animal as a bait that is not explicitly prohibited, but only when you are using it as a bait for the purpose of entertainment and entertainment alone. Then it also regulates experimentation of animals, there is a committee; the duties are defined and so on.

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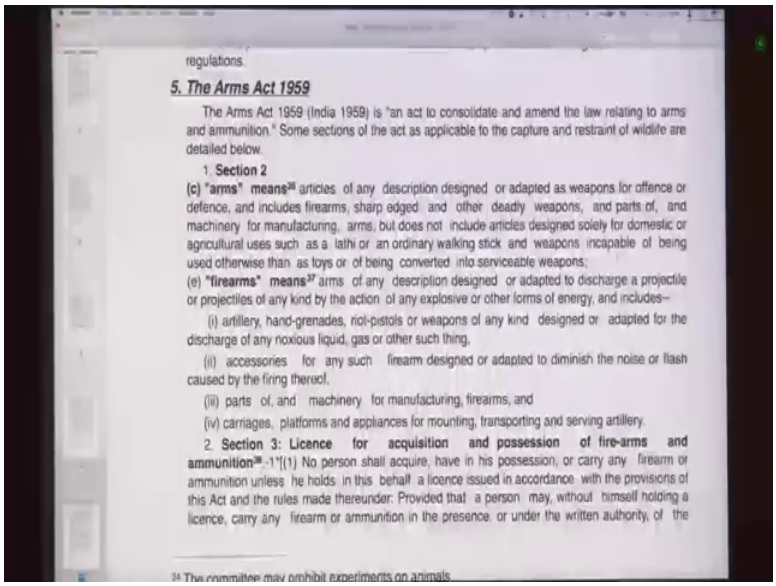
regulations.

5. The Arms Act 1959

The Arms Act 1959 (India 1959) is "an act to consolidate and amend the law relating to arms and ammunition." Some sections of the act as applicable to the capture and restraint of wildlife are detailed below.

1. **Section 2**

(c) "arms" means[36] articles of any description designed or adapted as weapons for offence or defence, and includes firearms, sharp edged and other deadly weapons, and parts of, and machinery for manufacturing, arms, but does not include articles designed solely for domestic or agricultural uses such as a lathi or an ordinary walking stick and weapons incapable of being used otherwise than as toys or of being converted into serviceable weapons;

(e) **"firearms" means**[37] arms of any description designed or adapted to discharge a projectile or projectiles of any kind by the action of any explosive or other forms of energy, and includes--

(i) artillery, hand-grenades, riot-pistols or weapons of any kind designed or adapted for the discharge of any noxious liquid, gas or other such thing,

(ii) accessories for any such firearm designed or adapted to diminish the noise or flash caused by the firing thereof,

(iii) parts of, and machinery for manufacturing, firearms, and

(iv) carriages, platforms and appliances for mounting, transporting and serving artillery.

2. **Section 3: Licence for acquisition and possession of fire-arms and ammunition**[38].-1*[(1) No person shall acquire, have in his possession, or carry any firearm or ammunition unless he holds in this behalf a licence issued in accordance with the provisions of this Act and the rules made thereunder: Provided that a person may, without himself holding a licence, carry any firearm or ammunition in the presence or under the written authority, of the

[34] The committee may prohibit experiments on animals.

The next important act is the Arms Act of 1959. So, here it defines arms and firearms.

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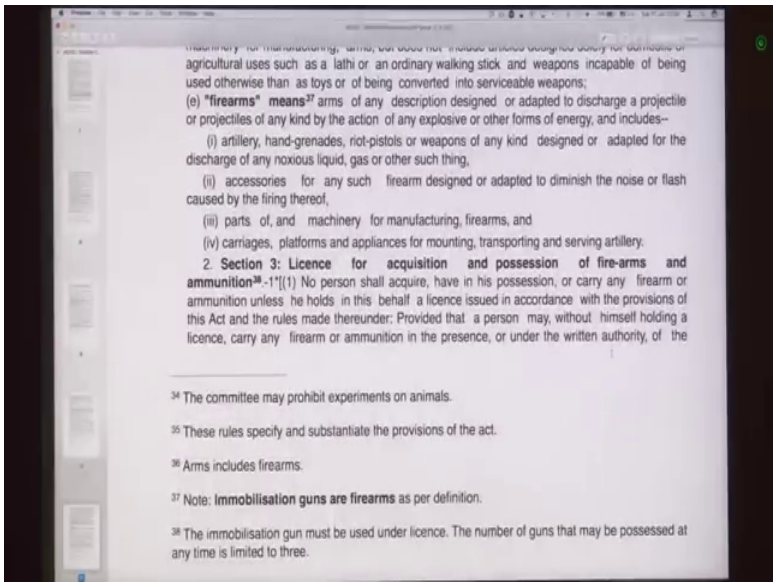
agricultural uses such as a lathi or an ordinary walking stick and weapons incapable of being used otherwise than as toys or of being converted into serviceable weapons;

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[34] The committee may prohibit experiments on animals.

[35] These rules specify and substantiate the provisions of the act.

[36] Arms includes firearms.

[37] Note: **Immobilisation guns are firearms** as per definition.

[38] The immobilisation gun must be used under licence. The number of guns that may be possessed at any time is limited to three.

Now, in this case these two points are important. Immobilization, guns are firearms as per the definition, and arms also includes firearms. So, basically the immobilization guns are firearms and as well as they are arms.

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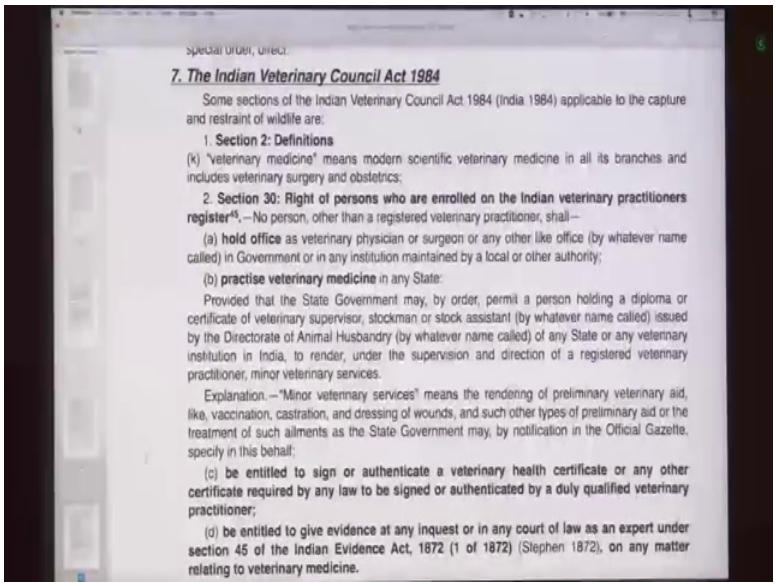

7. The Indian Veterinary Council Act 1984

Some sections of the Indian Veterinary Council Act 1984 (India 1984) applicable to the capture and restraint of wildlife are:

1. **Section 2: Definitions**

(k) "veterinary medicine" means modern scientific veterinary medicine in all its branches and includes veterinary surgery and obstetrics;

2. **Section 30: Right of persons who are enrolled on the Indian veterinary practitioners register**[45].—No person, other than a registered veterinary practitioner, shall—

(a) **hold office** as veterinary physician or surgeon or any other like office (by whatever name called) in Government or in any institution maintained by a local or other authority;

(b) **practise veterinary medicine** in any State:

Provided that the State Government may, by order, permit a person holding a diploma or certificate of veterinary supervisor, stockman or stock assistant (by whatever name called) issued by the Directorate of Animal Husbandry (by whatever name called) of any State or any veterinary institution in India, to render, under the supervision and direction of a registered veterinary practitioner, minor veterinary services.

Explanation.—"Minor veterinary services" means the rendering of preliminary veterinary aid, like, vaccination, castration, and dressing of wounds, and such other types of preliminary aid or the treatment of such ailments as the State Government may, by notification in the Official Gazette, specify in this behalf;

(c) **be entitled to sign or authenticate a veterinary health certificate or any other certificate required by any law to be signed or authenticated by a duly qualified veterinary practitioner;**

(d) **be entitled to give evidence at any inquest or in any court of law as an expert under section 45 of the Indian Evidence Act, 1872 (1 of 1872)** (Stephen 1872), **on any matter relating to veterinary medicine.**

Next is the Indian Electricity Act, the Indian Veterinary Council Act. Now Indian Veterinary Council Act very clearly mentions that if you are giving any drug to and to a wild animal. You need to have a registration with the veterinary council, and which also means that you need to have a degree in veterinary science and medicine.

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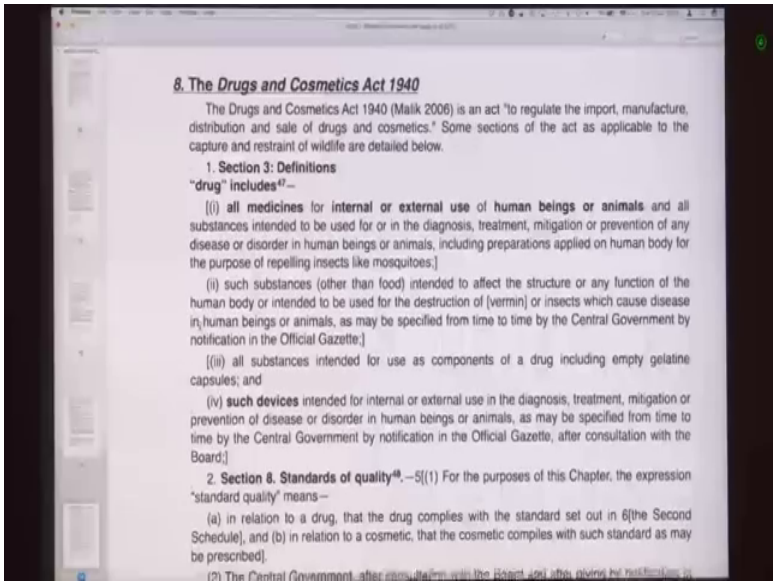

8. The Drugs and Cosmetics Act 1940

The Drugs and Cosmetics Act 1940 (Malik 2006) is an act "to regulate the import, manufacture, distribution and sale of drugs and cosmetics." Some sections of the act as applicable to the capture and restraint of wildlife are detailed below.

1. **Section 3: Definitions**

"drug" includes[47]—

[(i) **all medicines** for **internal or external use** of **human beings or animals** and all substances intended to be used for or in the diagnosis, treatment, mitigation or prevention of any disease or disorder in human beings or animals, including preparations applied on human body for the purpose of repelling insects like mosquitoes;]

(ii) such substances (other than food) intended to affect the structure or any function of the human body or intended to be used for the destruction of [vermin] or insects which cause disease in human beings or animals, as may be specified from time to time by the Central Government by notification in the Official Gazette;]

[(iii) all substances intended for use as components of a drug including empty gelatine capsules; and

(iv) **such devices** intended for internal or external use in the diagnosis, treatment, mitigation or prevention of disease or disorder in human beings or animals, as may be specified from time to time by the Central Government by notification in the Official Gazette, after consultation with the Board;]

2. **Section 8. Standards of quality**[48].—5[(1) For the purposes of this Chapter, the expression "standard quality" means—

(a) in relation to a drug, that the drug complies with the standard set out in 6[the Second Schedule], and (b) in relation to a cosmetic, that the cosmetic compiles with such standard as may be prescribed].

(2) The Central Government, after [illegible]

Then you have the Drugs and Cosmetics Act, so whenever we are importing, or manufacturing, or transporting any of our drugs mostly our. So, they are regulated under this act and also under the Narcotics and the Psychotropic Substances Act.

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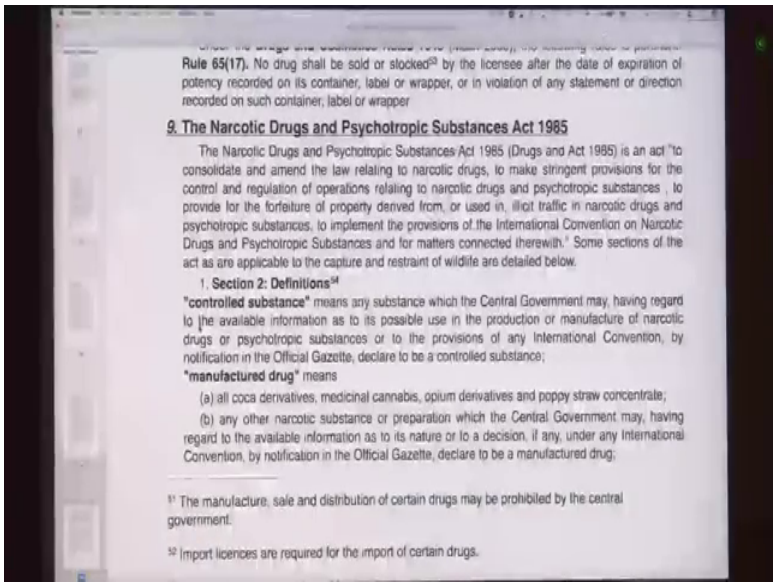

So, especially when we are talking about immobilizing drugs a number of them are narcotics. So, the provisions of this act also applied to them. So, the important sections are already highlighted.

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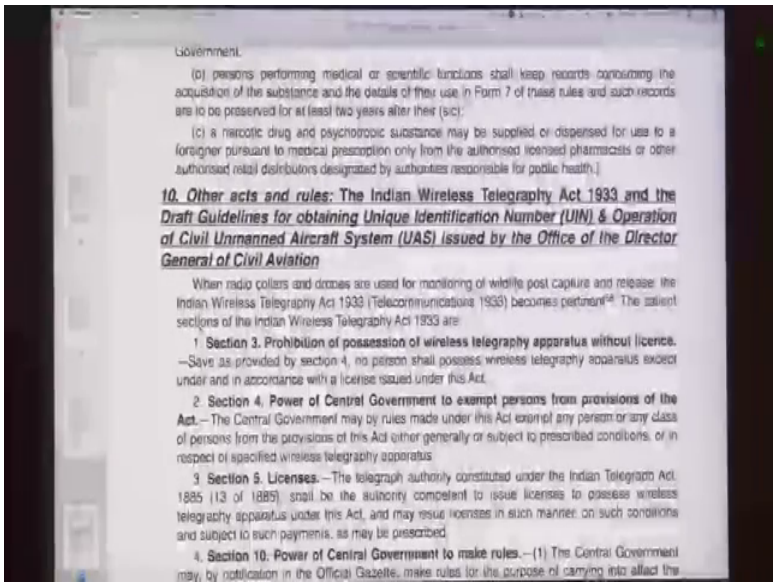

And next is the Indian Wireless Telegraphy Act the draft guidelines for the use of drones. So, these are the important acts and regulations that are required here. So, next we looked at other topics in capture and restraint.

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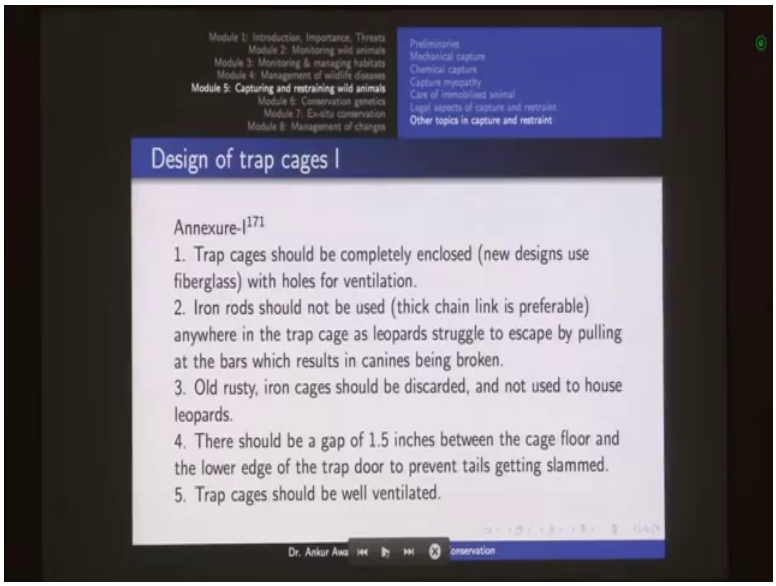

So, when we are designing trap cages; how should they be designed. Then transport of captive animals and all of these are governed by the CZA guidelines.

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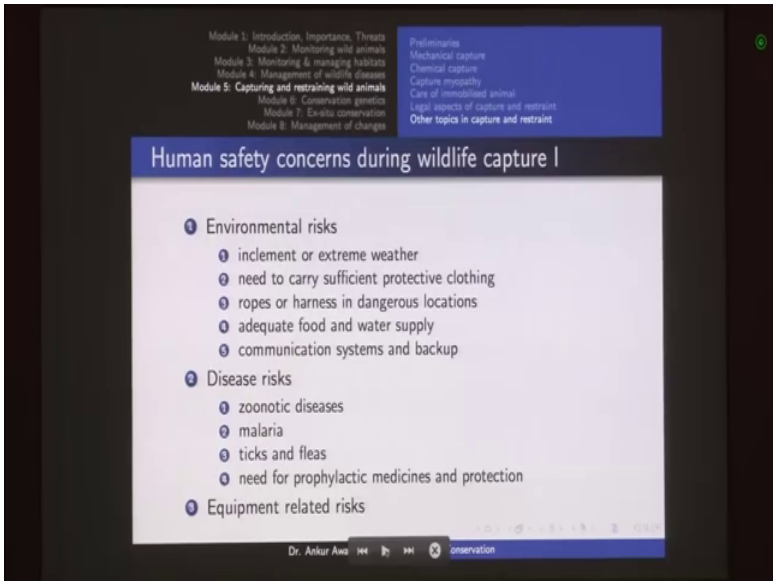

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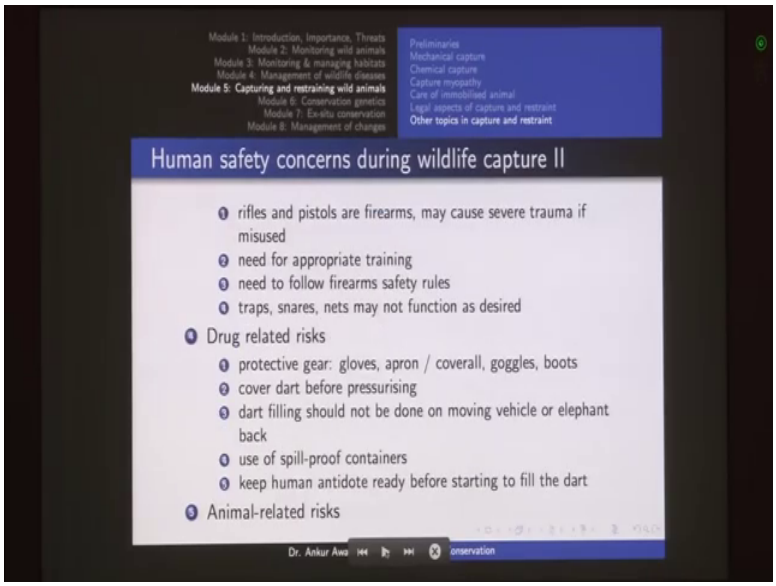

And next we have the human safety concerns. So, whenever you are capturing a wild animal, or whenever you are immobilizing a wild animal or whether you are working with a wild animal you need to take care of environmental risk, disease risk, equipment related risk. Drug related risk, animal related risk, and evacuation protocols.

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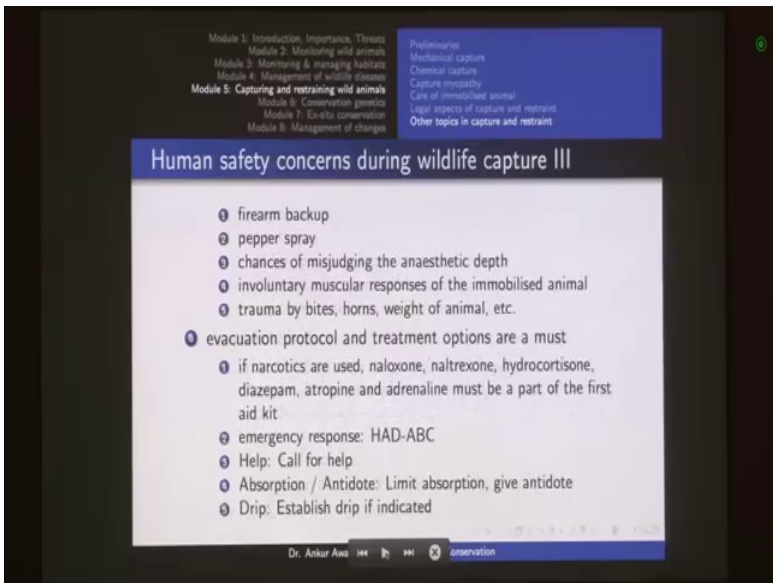

So, the next module was Conservation Genetics.

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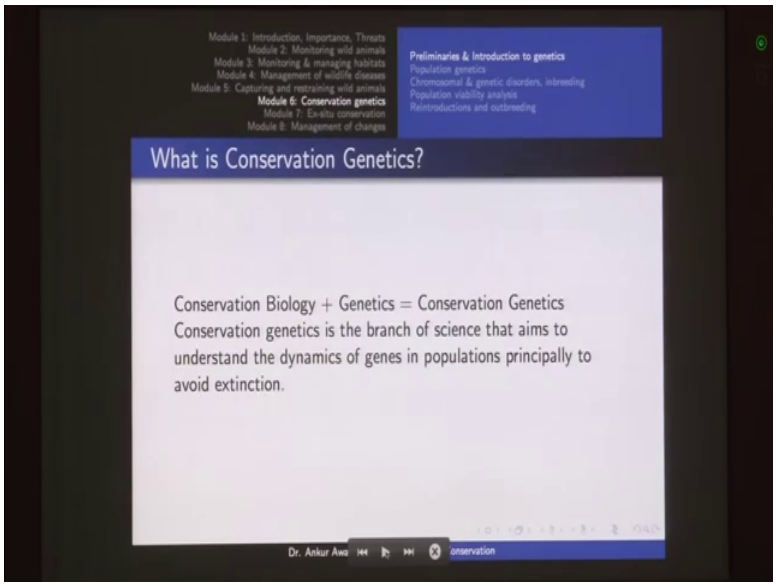

So, we began with what is conservation genetics? What is conservation biology plus genetics or a branch of science that aims to understand the dynamics of genes in populations principally to avoid extinction.

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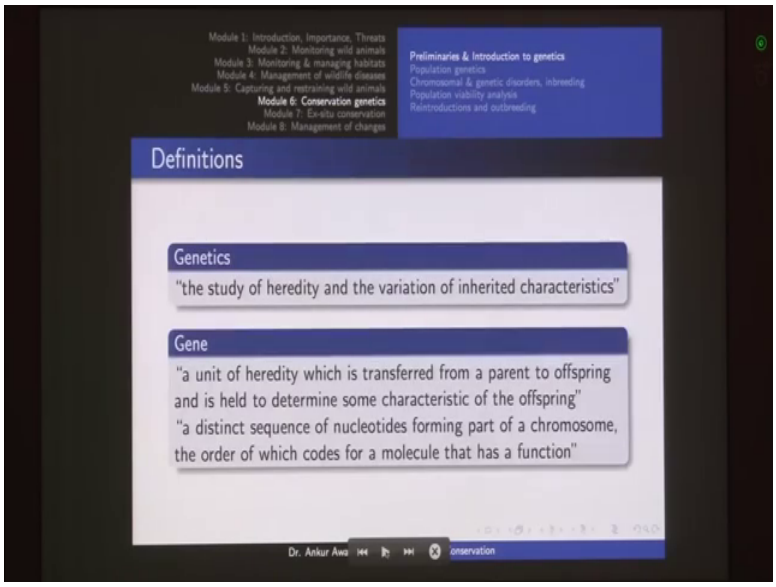

Then we looked at what is genetics? What is a gene?

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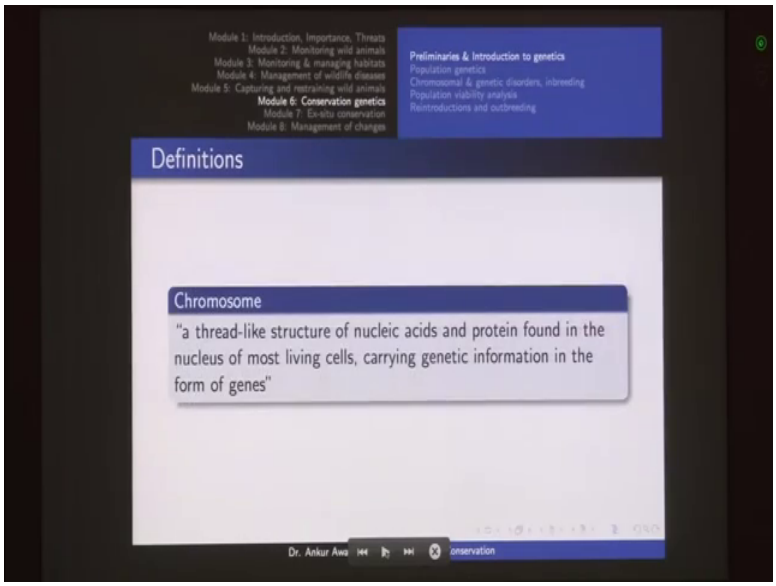

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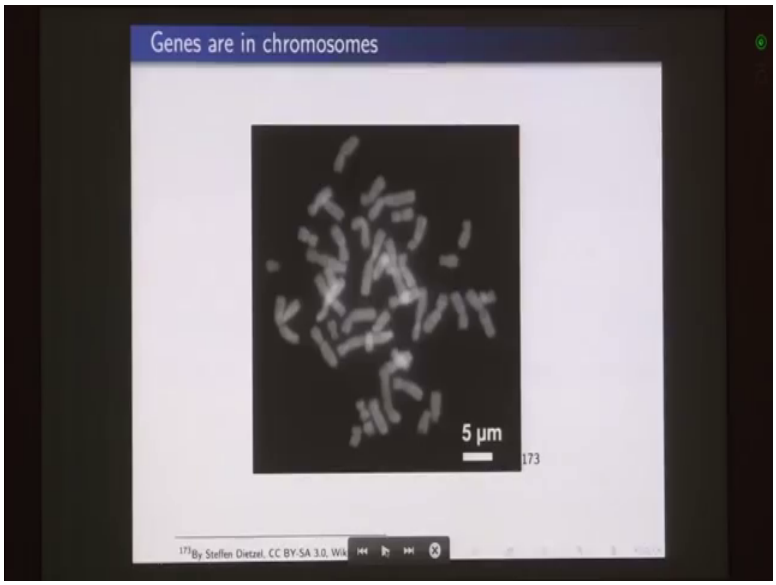

What is a chromosome?

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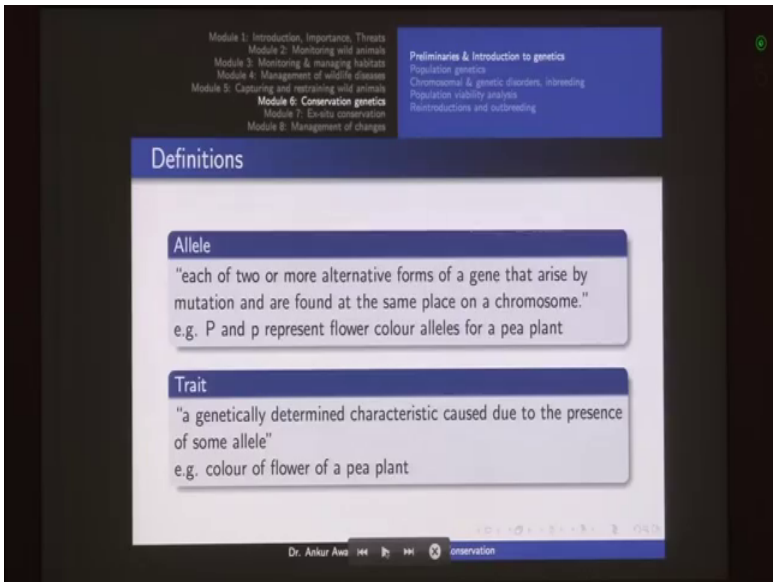

What is allele? What is a trait?

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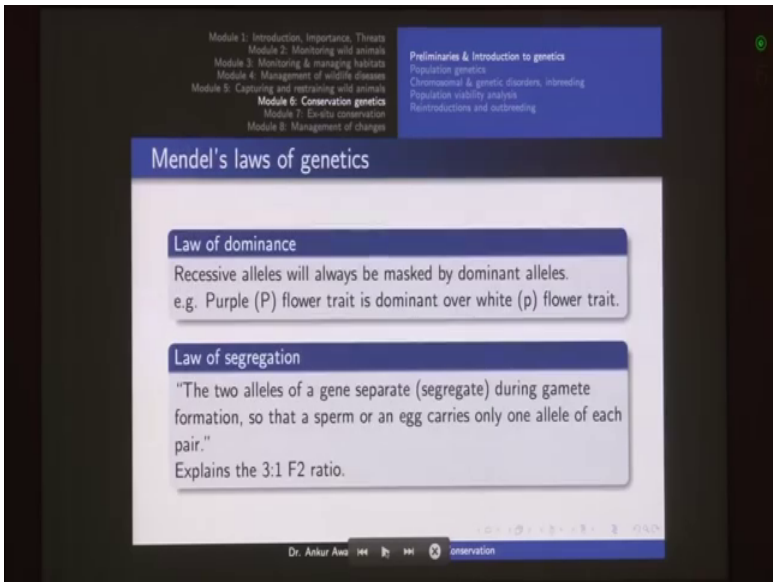

What is genotype? What is phenotype? Then we had the law of a I mean genetics, law of dominance, law of segregation, law of independent assortment.

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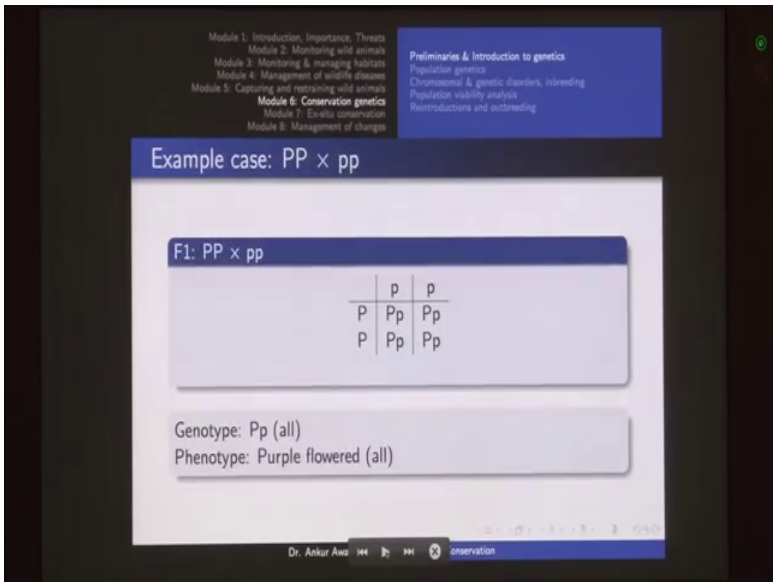

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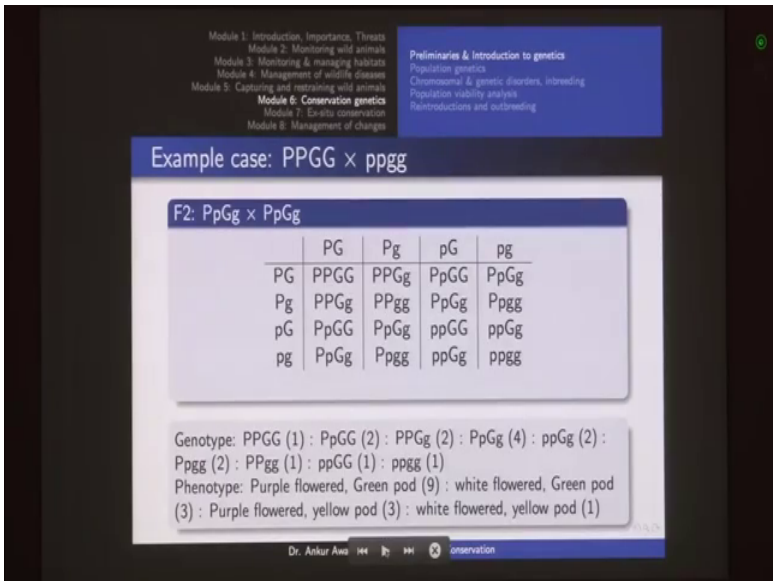

Then we looked at all different finite squares.

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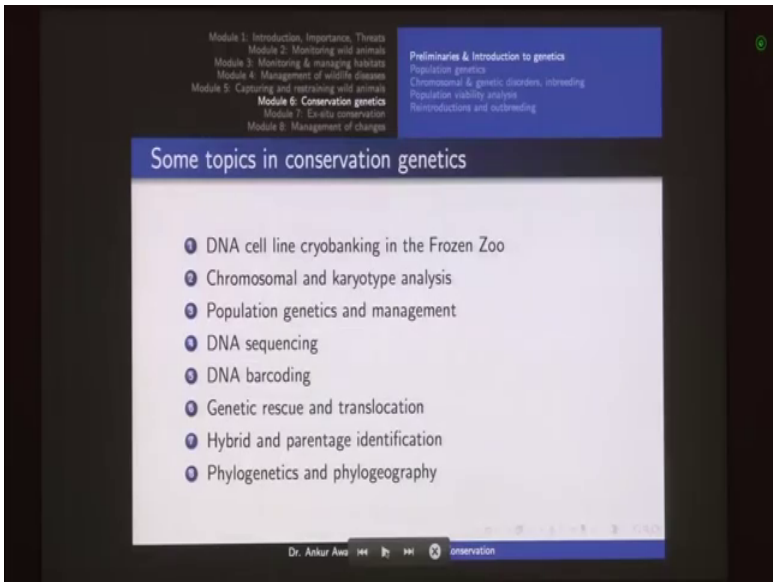

Then we looked at co dominance and incomplete dominance and then some topics in conservation genetics. So, conservation in genetics is important because we are doing things such as DNA cell line, cryobanking, then chromosomal analysis, karyotype analysis, population genetics, DNA sequencing, bar-coding and so on. Next we had a look at population genetics.

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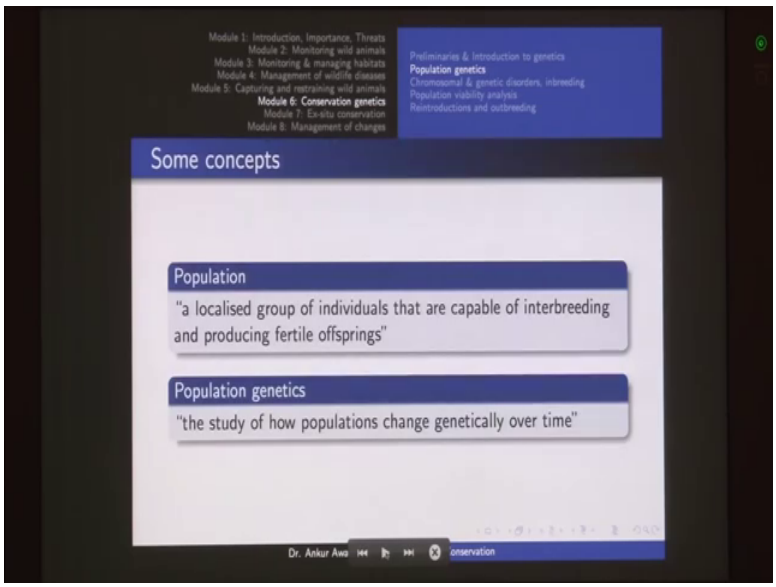

So, what is a population? A population is a localized group of individuals that are capable of interbreeding and producing fertile offspring. So, we looked at different

populations giving the examples of tigers from Madhya Pradesh and tigers from Sundarbans or say tigers from Mudumalai. So, all of these are different populations of tigers and population genetics ask the question how populations are changing genetically over time.

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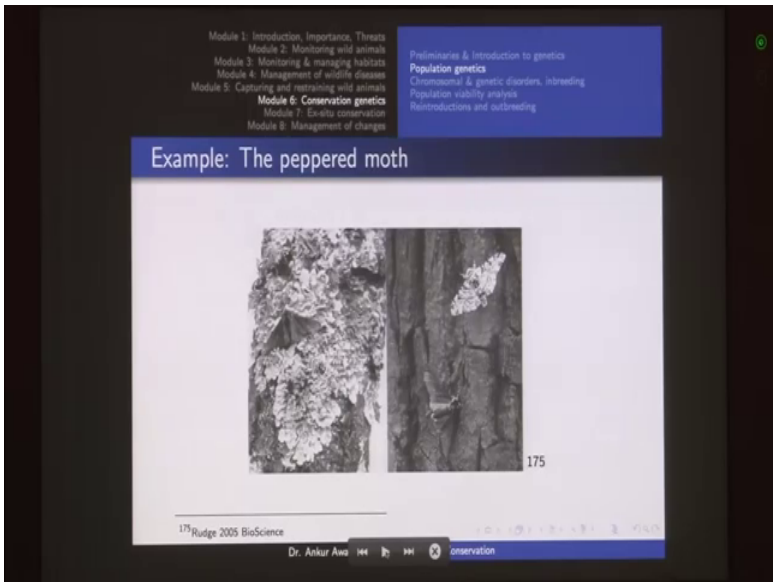

So, we looked at this example of the peppered moth. So, in this example earlier when there was less amount of population so, the barks of the trees were light in color. And so out of these two varieties peppered moth, the melanistic variety was very clearly visible, but the whitish variety, or the lighter colored variety it became very easily camouflage. So, both of these traits were present both of these phenotypes were present in the population, but then this one was more dominant.

Now, later on when the area became more populated and soot covered all of these tree barks. So, the lighter variety became more conspicuous and the darker variety became less conspicuous. So, this is how population genetics works in response to the environment. Then it is related with evaluation.

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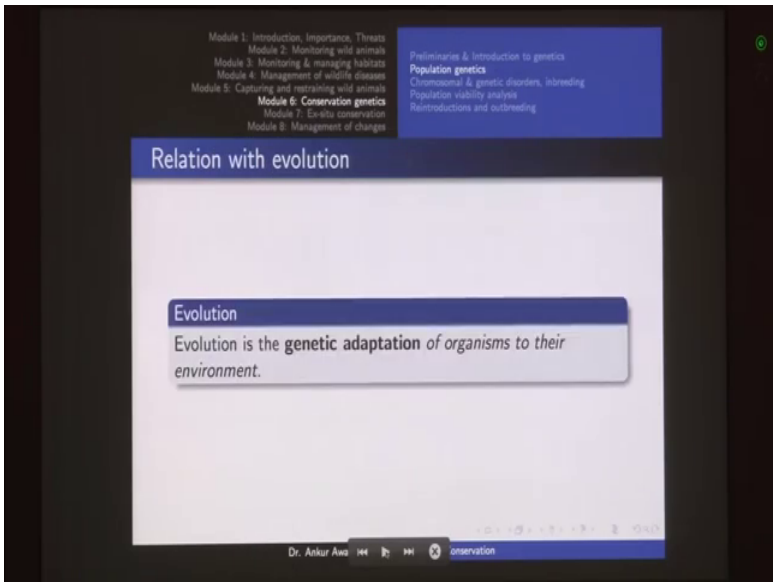

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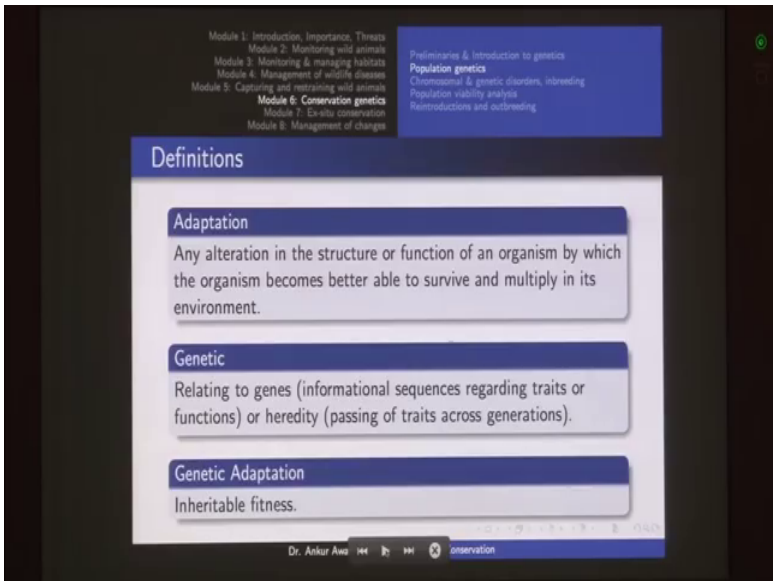

Then we looked at adaptation, and genetic adaptation. So, genetic adaptation is an inheritable fitness.

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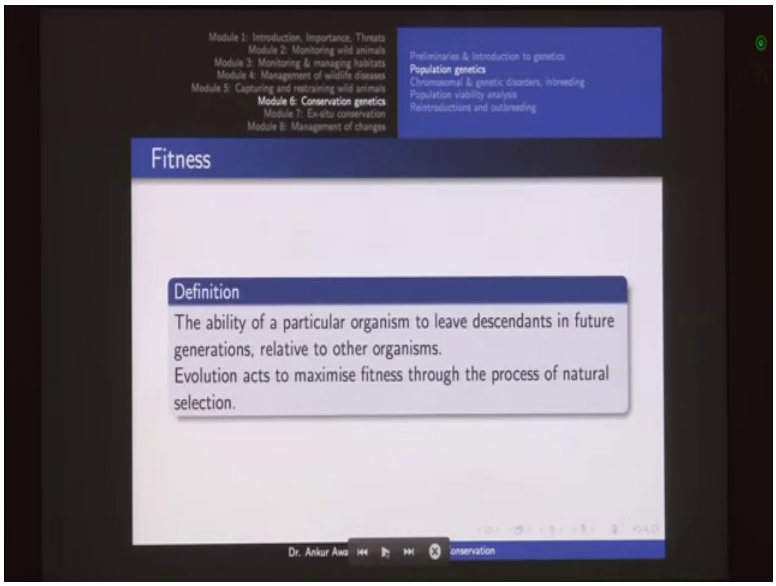

Then we defined fitness as the ability of a particular organism to leave descendants in future generations, relative to other organisms. So, evolution tends to maximize the fitness.

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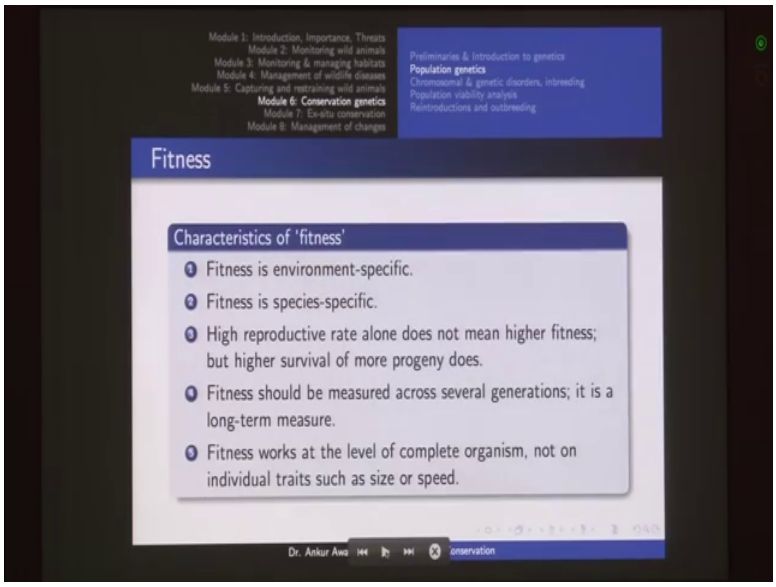

So, fitness we looked at different characteristics of fitness. And then we defined natural selection.

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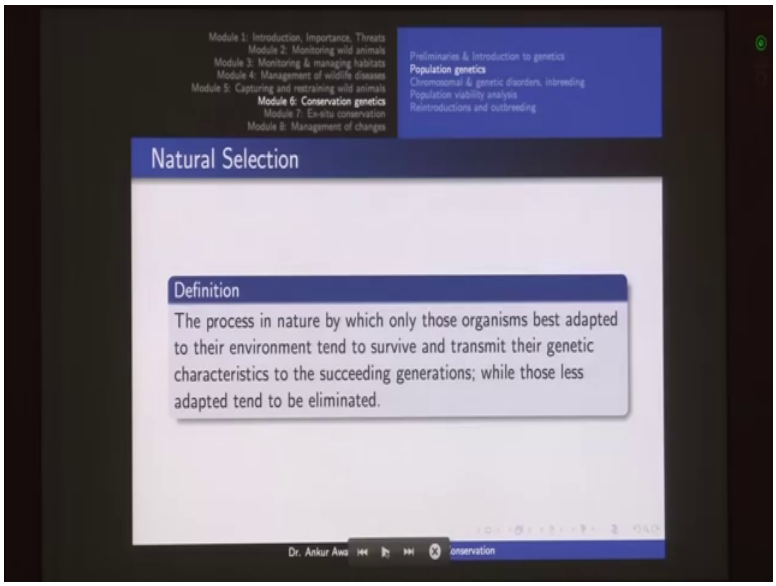

The process in nature by which only those organisms best adapted to the environment tend to survive and transmit their genetic characteristics to the succeeding generations; while those less adapted tend to be eliminated.

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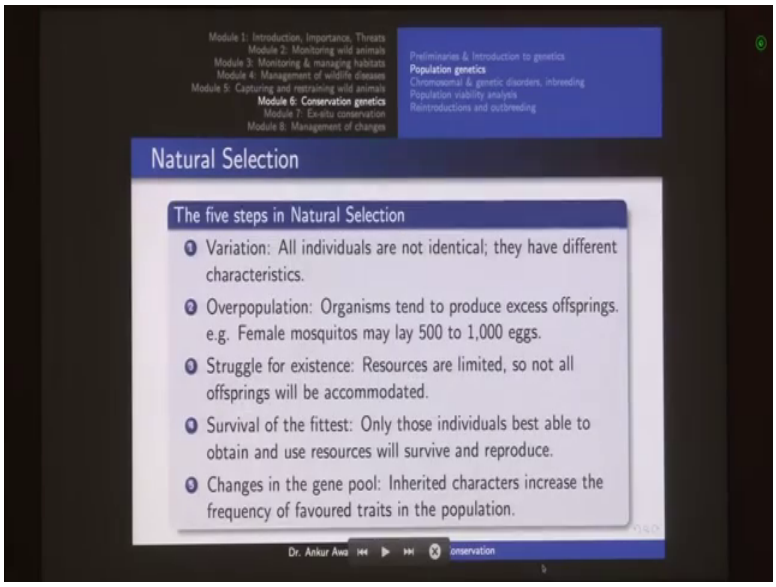

So, this is natural selection and it occurs in five steps; one is variation. So, all the individuals are not identical they have different characteristics. So for instance the dark variety of peppered moth and the light variety of peppered moth, then we had over population.

So, organisms tend to produce excess number of offspring's. And then there is a struggle for existence because the resources are limited, but then we have excess number of offspring's that need to be accommodated. So, then because of this is struggle only a few organism are able to survive.

So, it says survival of the fitness, and then because of this survival of the fittest these organisms are able to pass on their genes to the next generations. So, there is a change in the gene pool. And so this is how the natural selection occurs.

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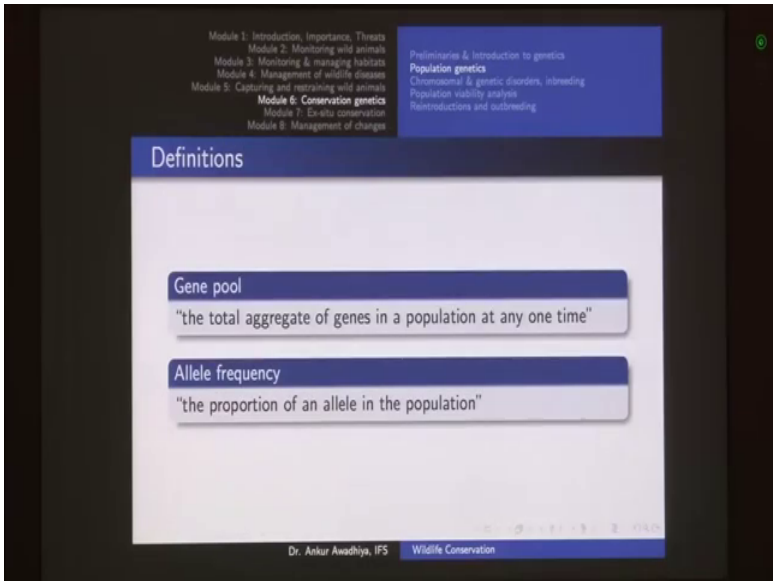

Next we defined gene pool as the total aggregate of genes in a population at any one time; and allele frequency as the proportion of an allele in the population.

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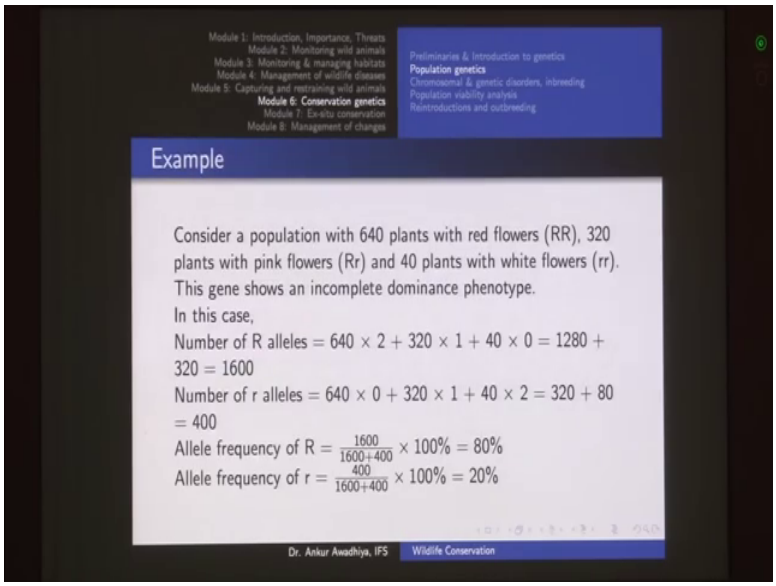

So, we looked at how allele frequencies are calculated.

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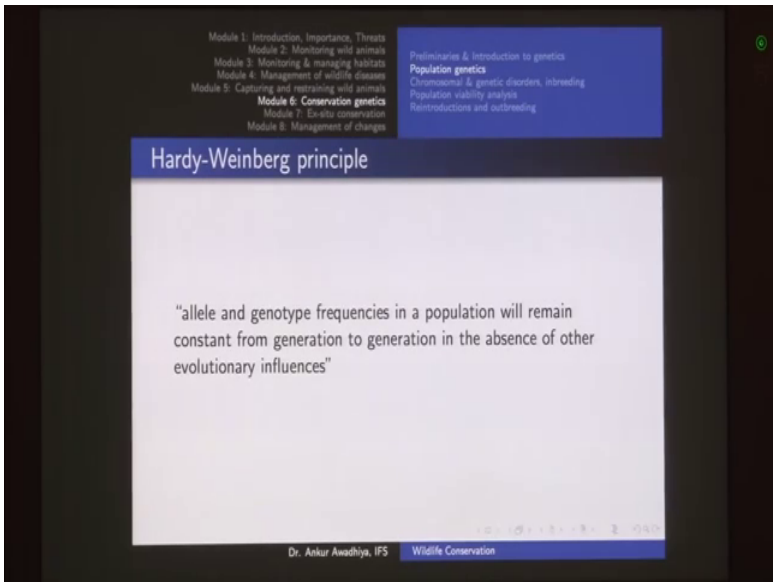

Hardy-Weinberg principle is a very important principle. It says "allele and genotypic frequencies in a population will remain constant from generation to generation in the absence of other evolutionary influences". So, basically if evolution has not taking place then allele frequencies and genotype frequencies will remain constant for every generation.

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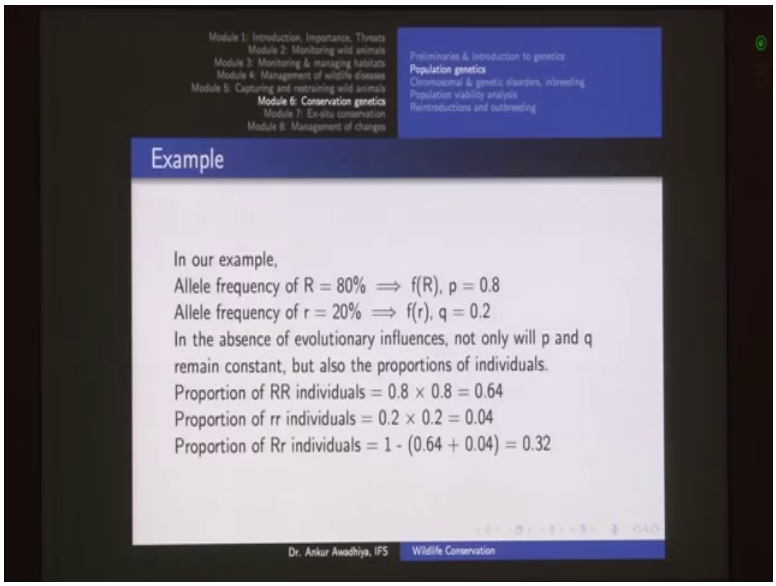

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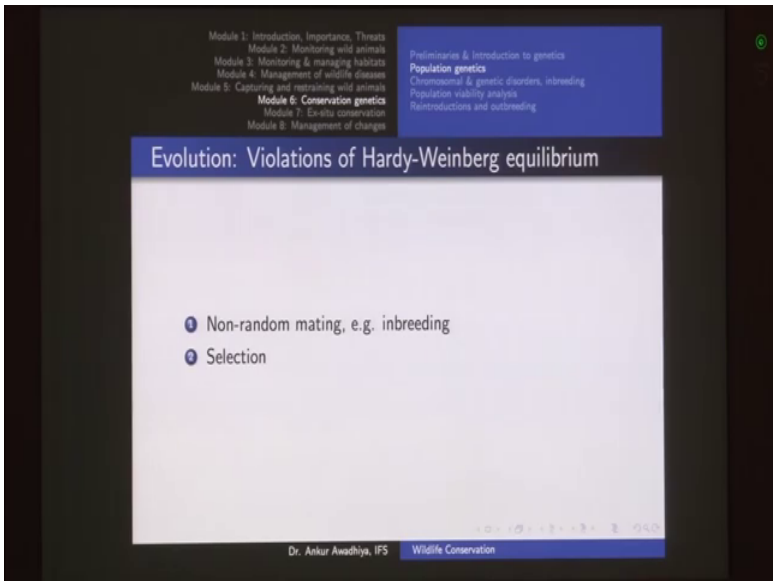

Then we looked at how evolution occurs. So, evolution occurs if there is a nonrandom mating, if there is a selection of mates, if there is mutation, if there is selection of individuals.

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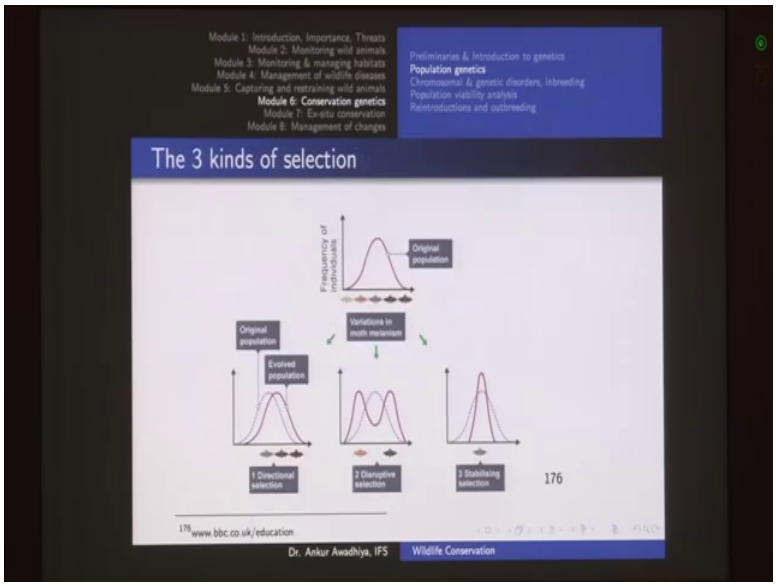

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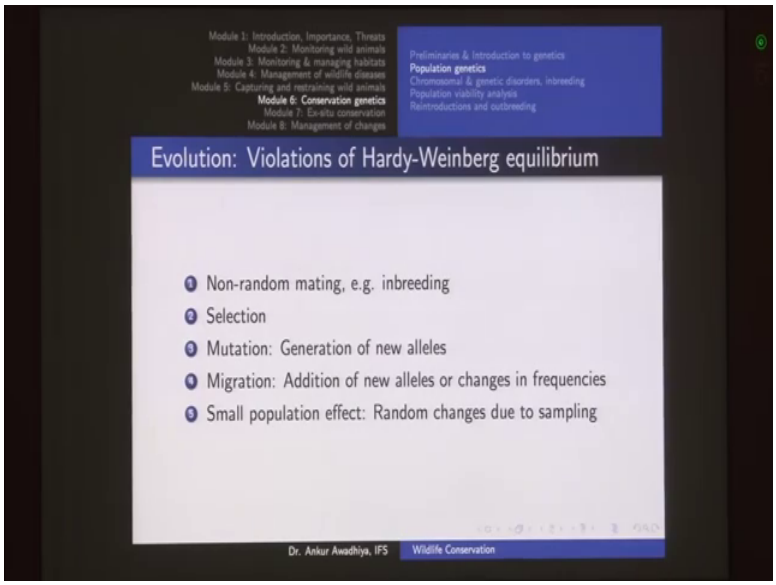

If there is a mutation, if there is migration, and if there is a small effect.

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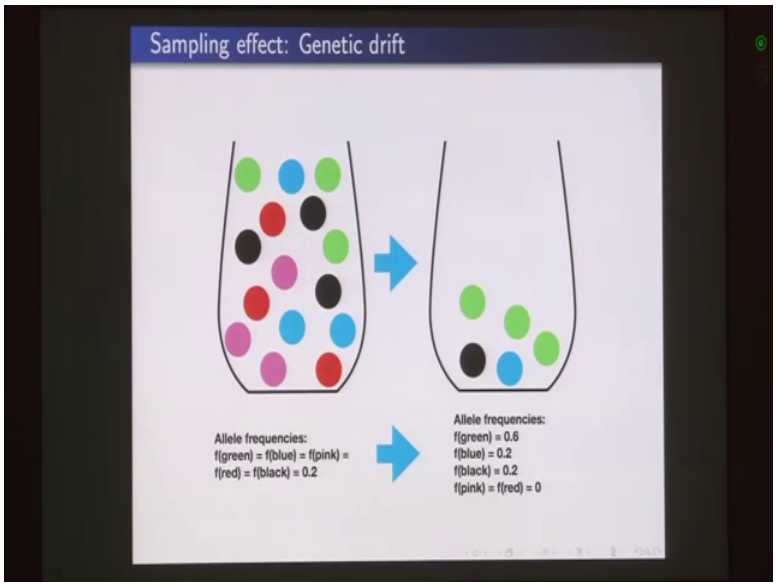

So, we just shown here in the in the example of genetic drift; so, here you have all these different varieties that are available in your gene pool, but then if you take only these ones for the next generation. So, the allelic frequency changes in the gene pool. So, this is an example of genetic drift.

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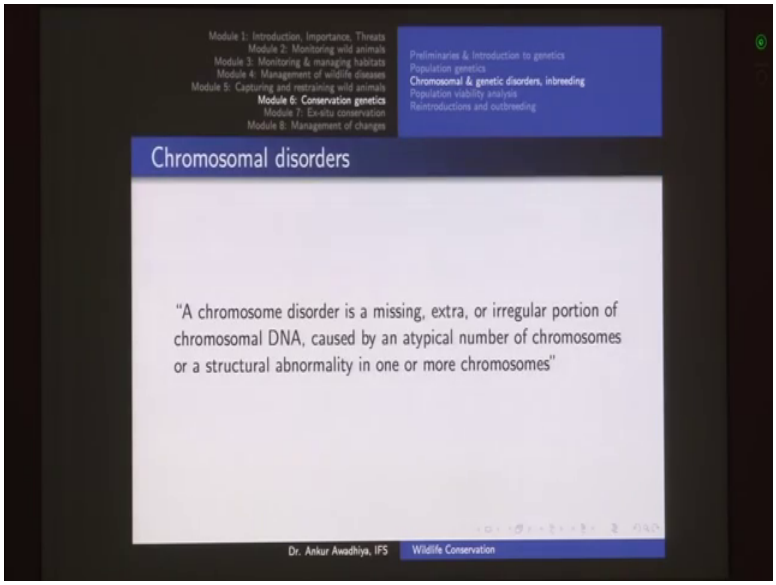

Next we looked at chromosomal and genetic disorders in inbreeding. So, we had defined chromosome in the last lecture here we looked chromosomal disorders.

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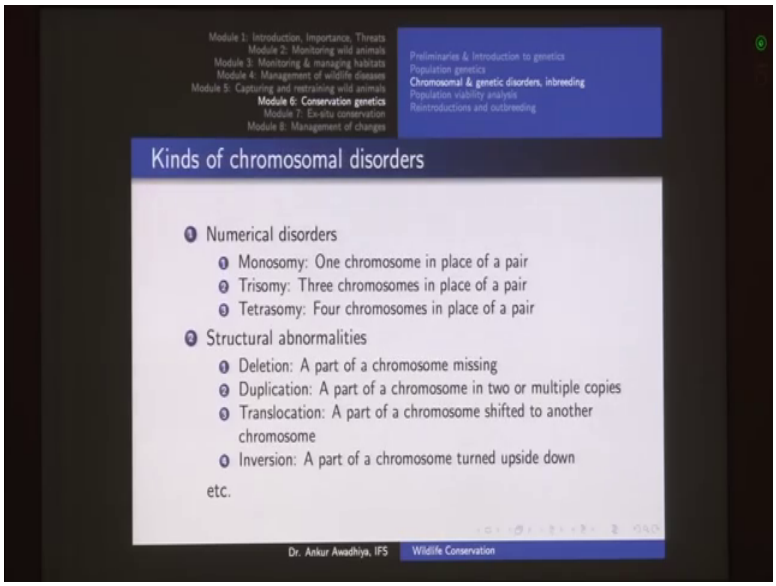

So, we have numerical disorders and structural abnormalities. So, these are the varieties.

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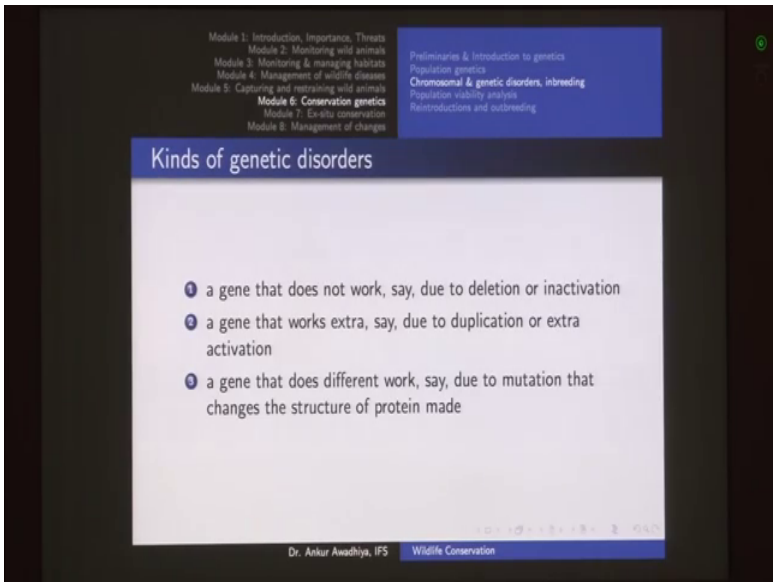

Then genetic disorders you have a gene that does not work, a gene that does a extra work, or a gene that does a different work.

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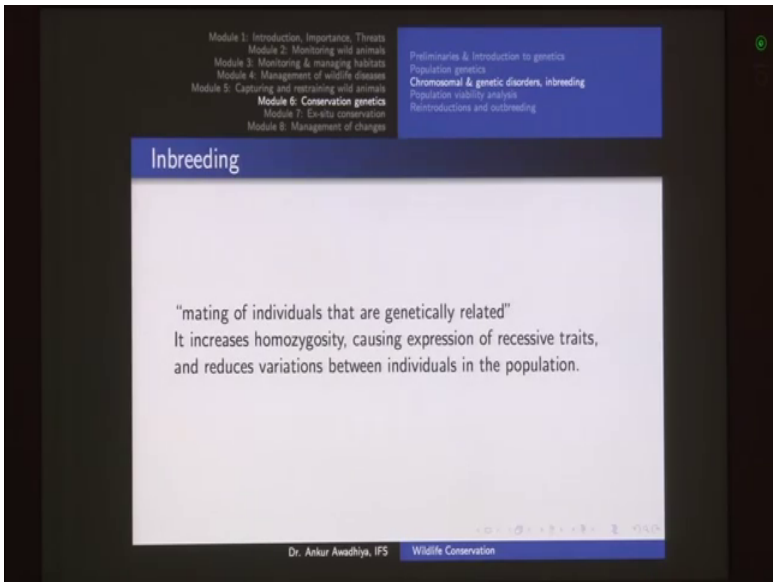

Now, inbreeding is mating of individual that are genetically related. Now, this becomes very important in the case of smaller populations where most of the individuals are already related.

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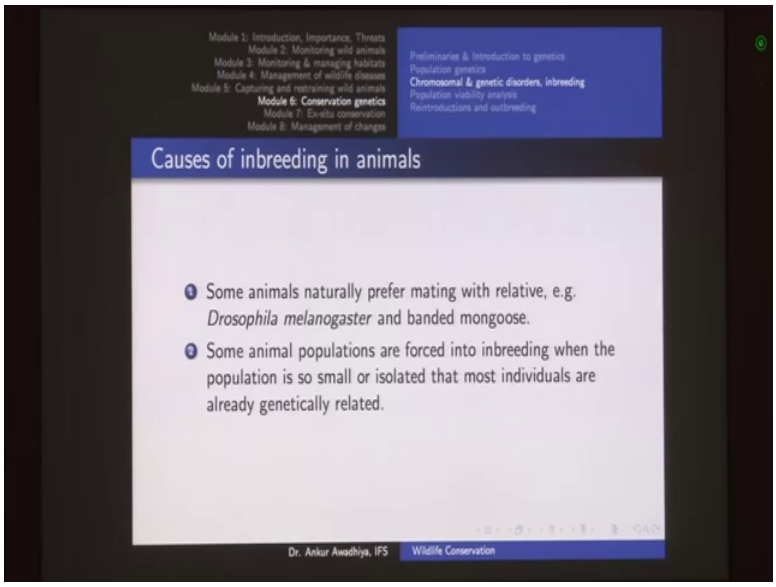

So, some organisms prefer mating with their relatives, and some are force into in breeding.

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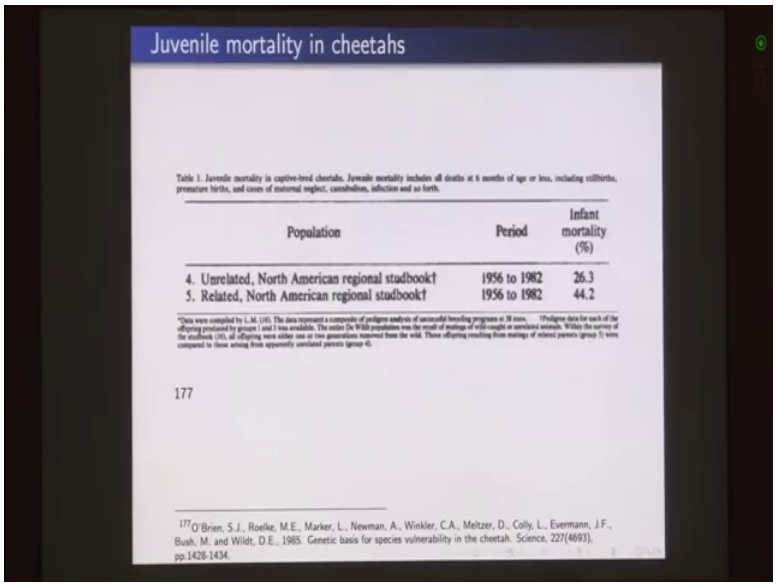

Now, what are the impacts of in inbreeding? So, this paper showed us that in the case of cheetahs if you have unrelated individuals then there is 26 percent infant mortality. For the related organisms there is 44 percent infant mortality. So, infant mortality goes up.

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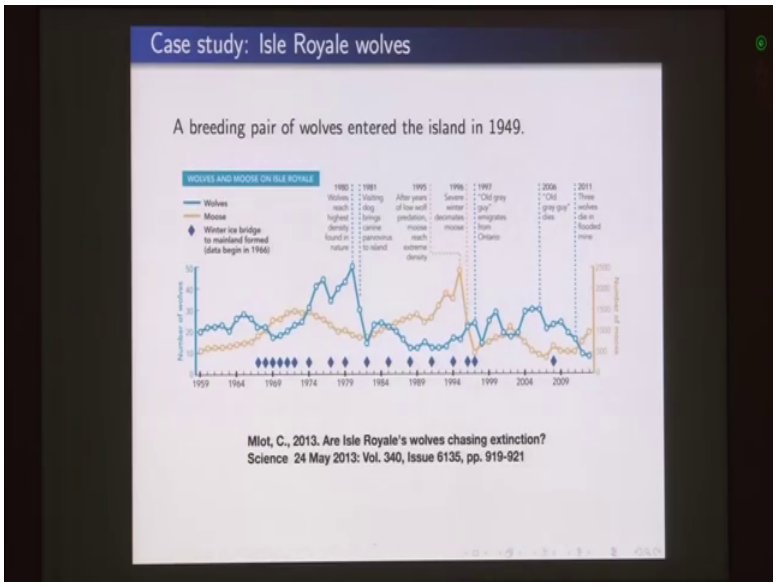

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Next we had this case study of Isle Royale wolves which because of their smaller population and inbreeding; and now seeing a number of abnormalities such as still births, or abortions.

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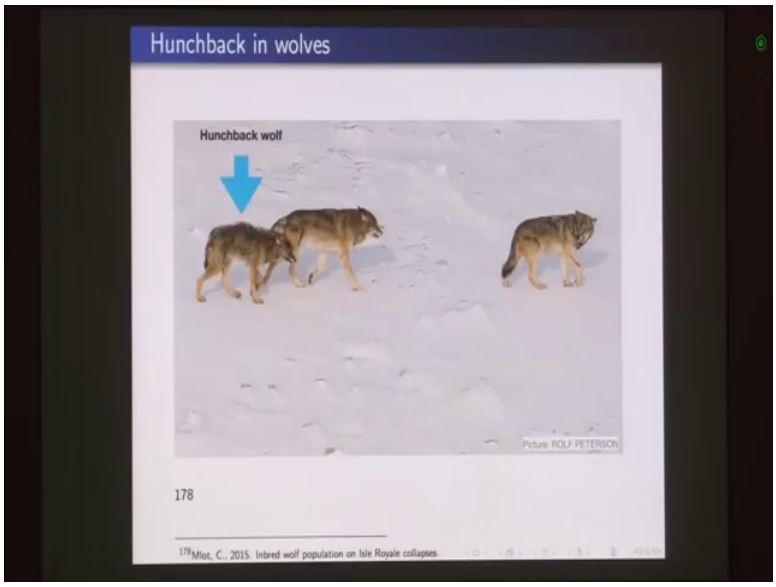

Opaque eyes, hunchback because: of which they are not able to hunt properly.

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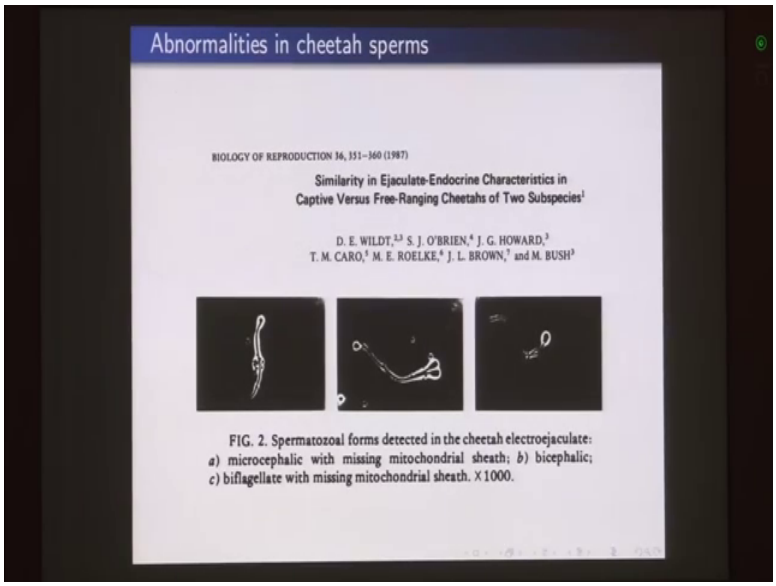

In the case of other small population such as cheetahs, so we are observing things such as micro cephalic sperms, bi cephalic sperms, biflagellate sperms.

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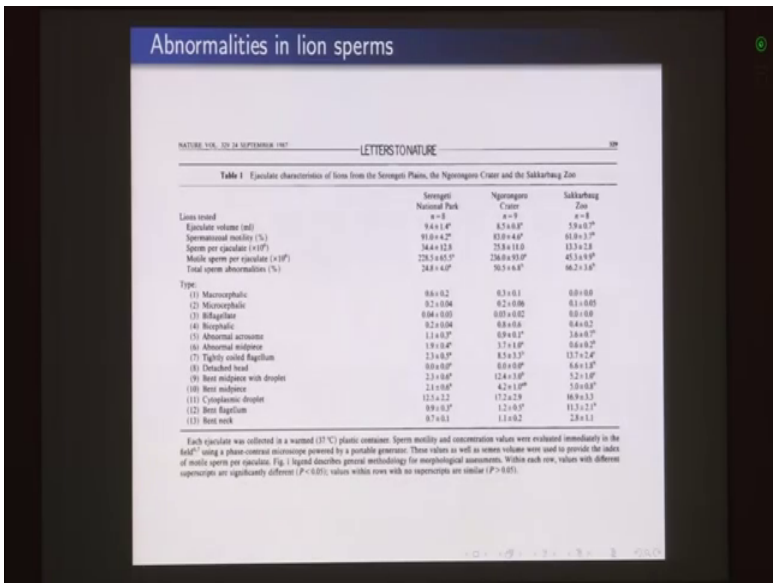

And even in the case of lions we are observing very similar things. So, there are a number of abnormalities seen in this sperms.

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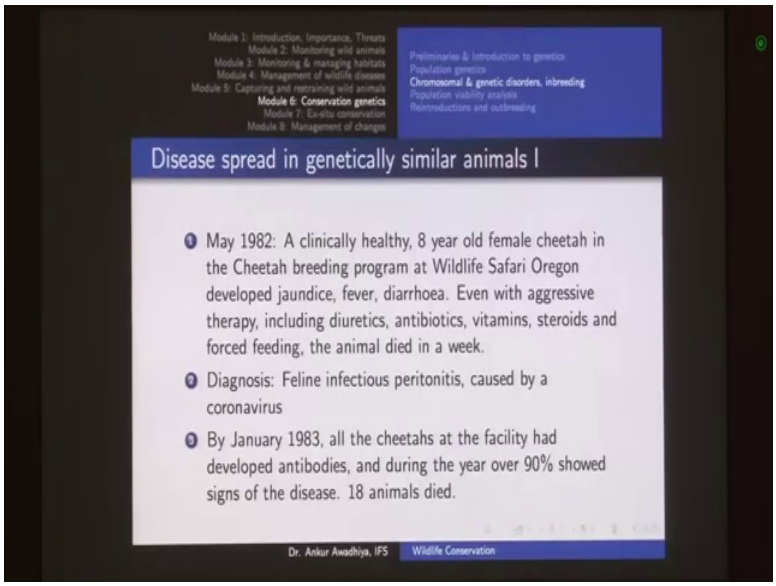

And then we looked at this case study in which diseases spread very quickly in the case genetically similar animals because, there is hardly any difference in the immune response. Next we had a look at the population viability analysis.

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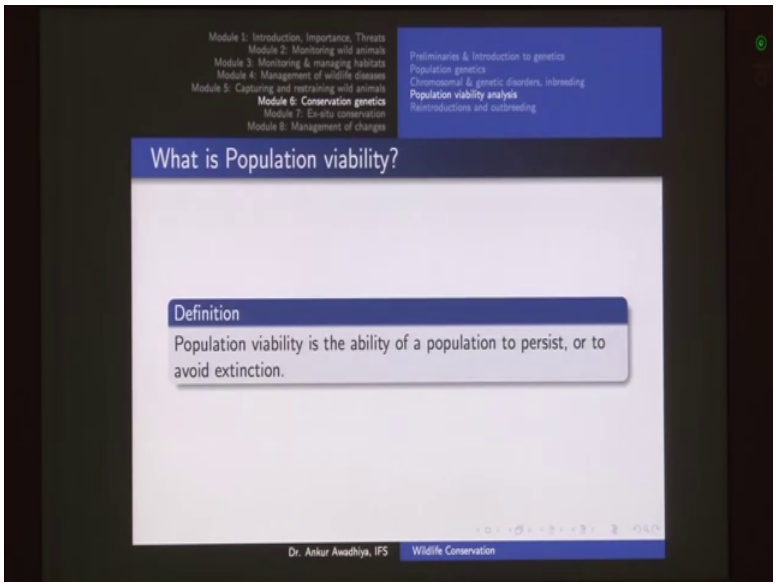

So, we defined population viability as the ability of a population to persist, or to avoid extinction.

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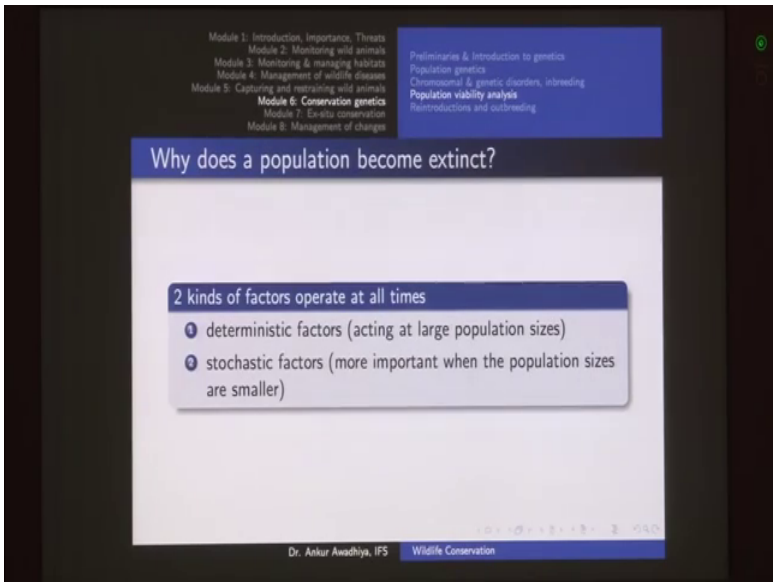

So, we looked at population viability analysis, so two kinds of factors deterministic factors, and stochastic factors we have discussed this before.

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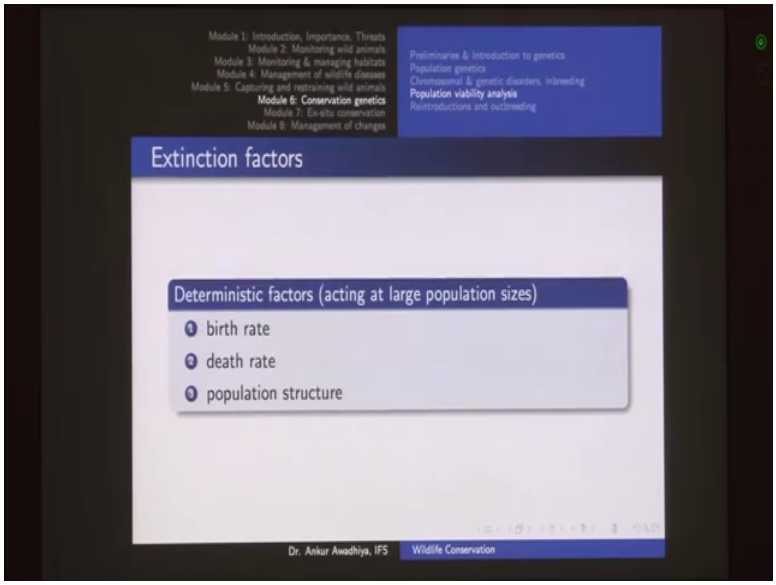

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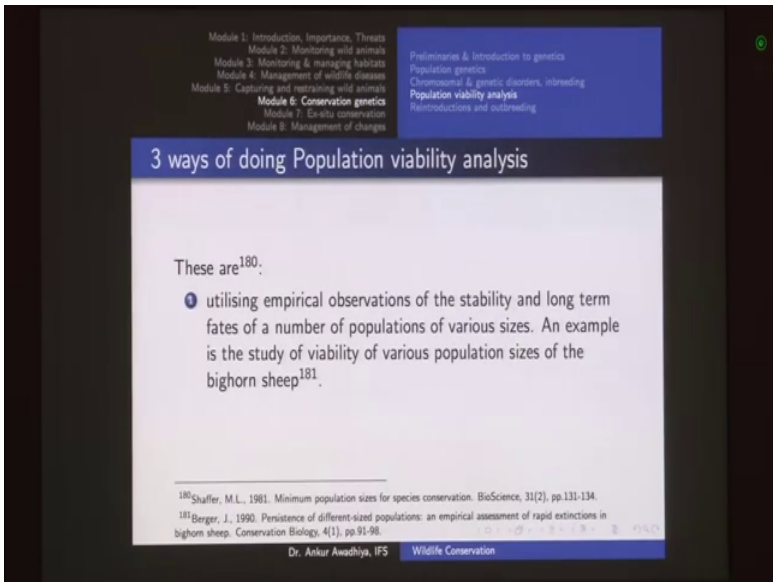

And next in the case of population viability analysis you will use any methodology to determine a minimum viable population, or the size at which the population has a 99 percent probability of persistence for 1000 years. And then these are different terms and there are 3 ways; one is using the field data, or empirical observations of what happens at different population sizes.

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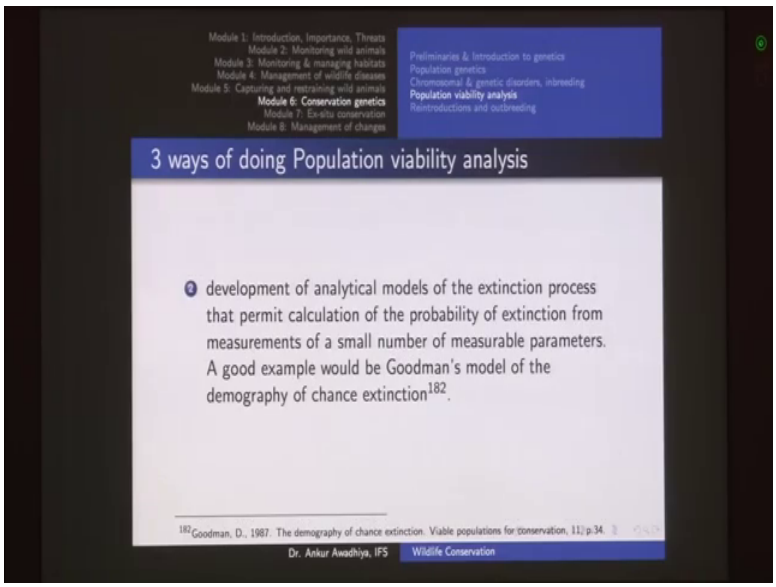

Second is using mathematical modules.

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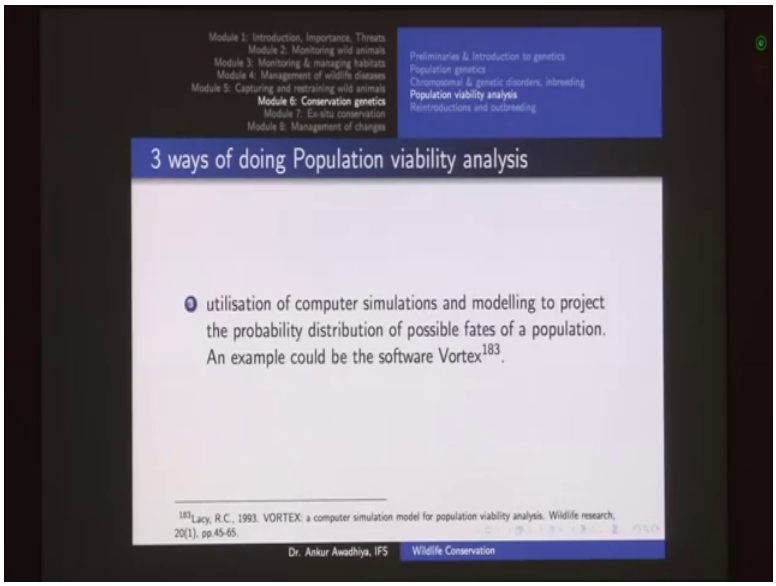

And third is using computer simulations.

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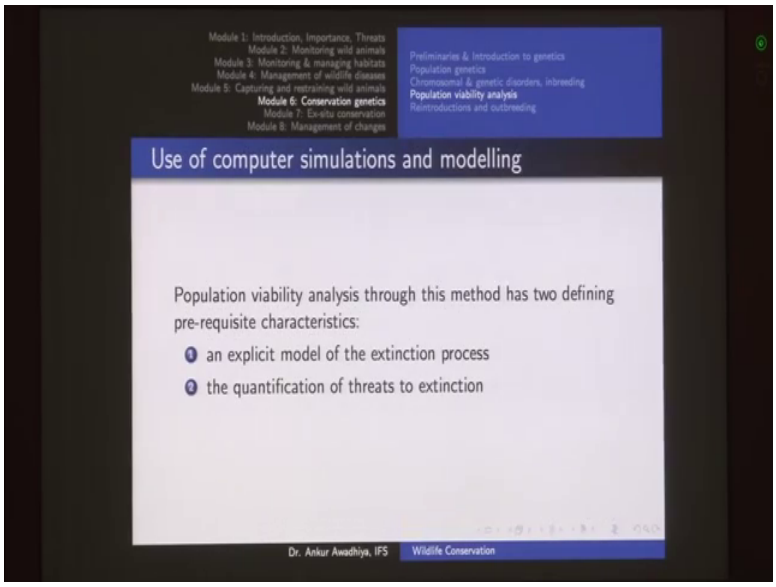

Now, in the case of computer simulation, so you also recover a mathematical model to work in the background and you also require a quantification of the threats to extinction. So, we have looked at the software called vortex and also it is another version called eddy that can be used for population viability analysis.

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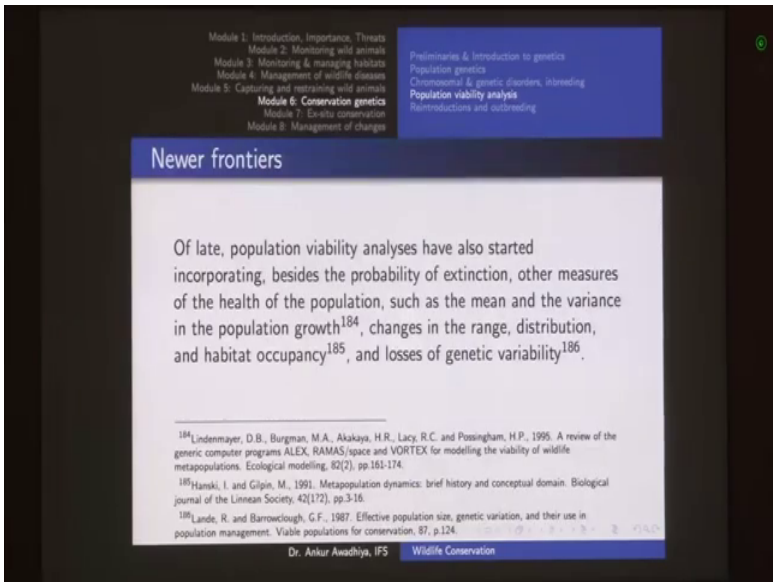

And now this is being used for a number of other studies as well. Next we looked at reintroductions and out breeding.

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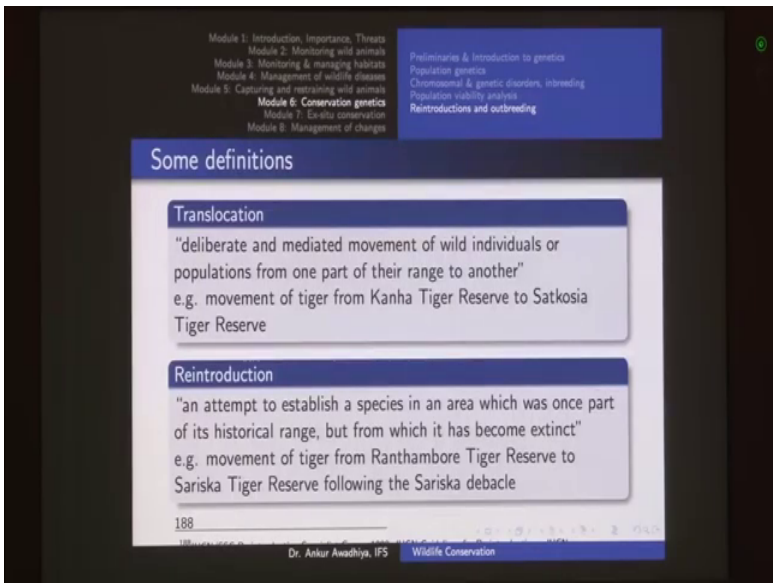

So, translocation is the movement of animals from one place to another. Reintroduction is reestablishment of a species into an area that where it was earlier present, but is now not present.

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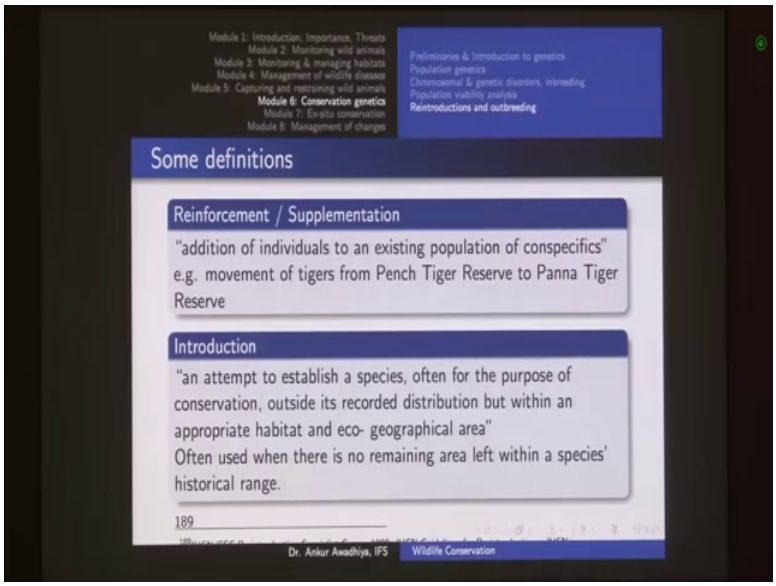

Reinforcement is when you are trying to increase the number of animals in a certain area. Introduction is when you are trying introducing a species into an area where it was never found before.

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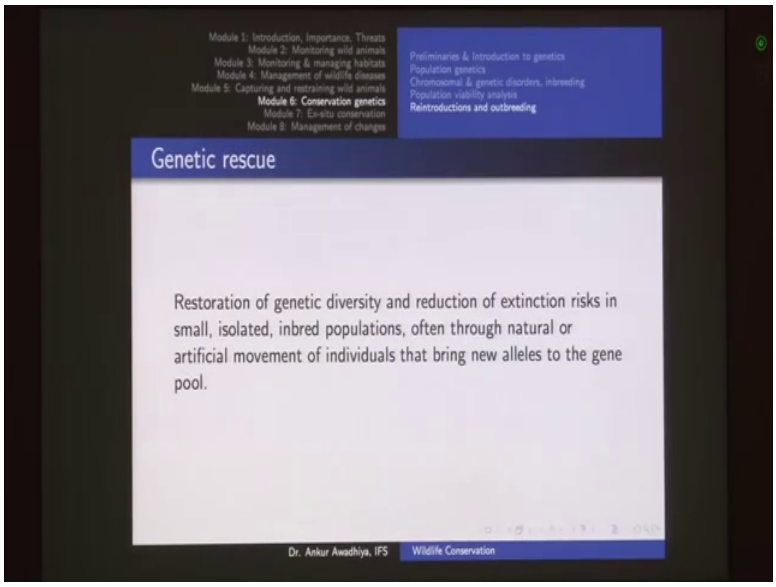

So, next we talked about genetic rescue.

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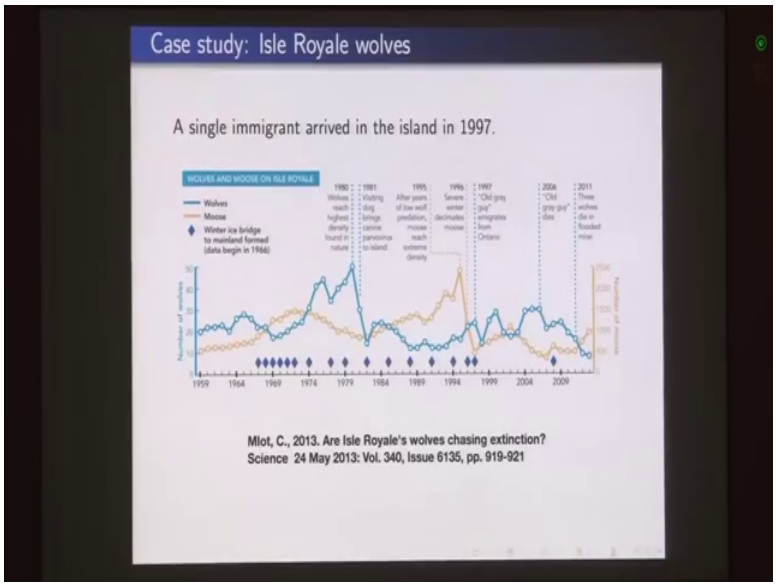

So, this was the example from the Isle Royale wolves when a single individual came in into this very inbreed population. So, there was some amount of genetics bigger that was observed.

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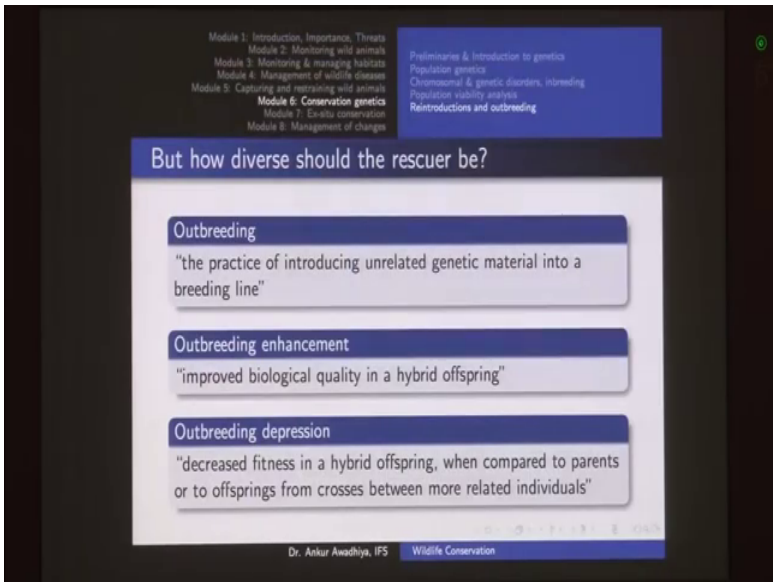

Now, next we asked this question how diverse should a rescuer be. So, in the case of out breeding, so we are bringing in individuals that are having unrelated genetic material. So, you can have out breeding enhancement, or out breeding depreciation. So, we are always looking for out breeding enhancement, but out-breeding dispersion needs to be reduced.

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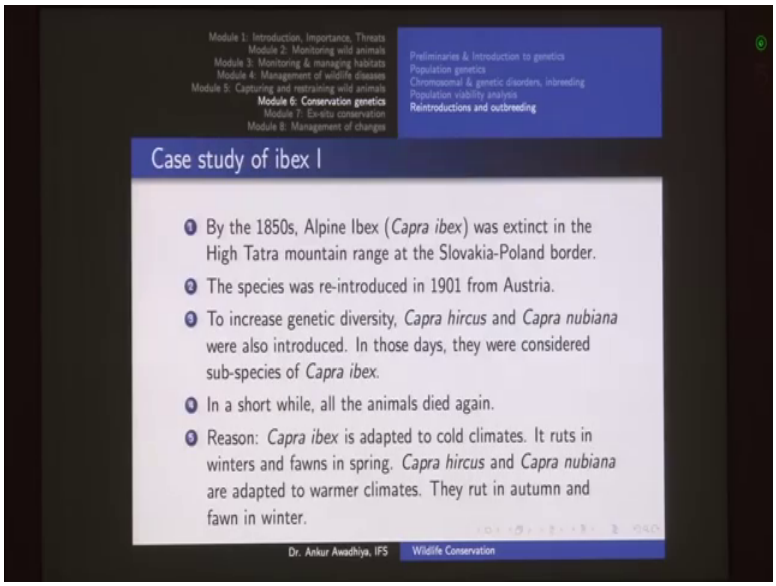

Now, we looked at two examples through which we can have out-breeding depression. So, in the case of Ibex it is a goat. And we looked at this goat that was living in very cold areas and when it was outbreed with other goats that were coming from warmer areas. So, it gave birth in very cold seasons because of which the offspring's died.

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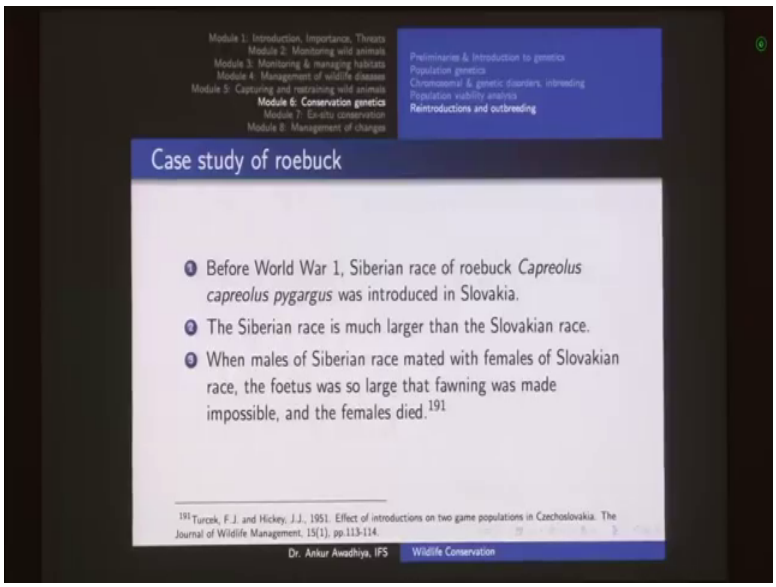

And in the case of roebuck we had a case in which the Siberian race was introduced. The Siberian race was much bigger, so when the females got impregnated the fetuses were so

large that they that they were not able to come out. And so the fetus died and the mother also died.

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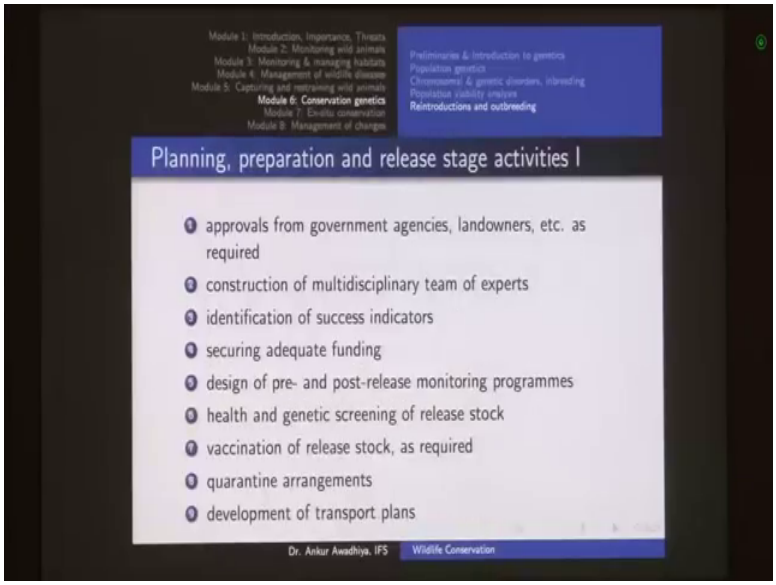

So, these are two examples of out breeding. Then we looked at different planning preparation and release stage activities, post release activities.

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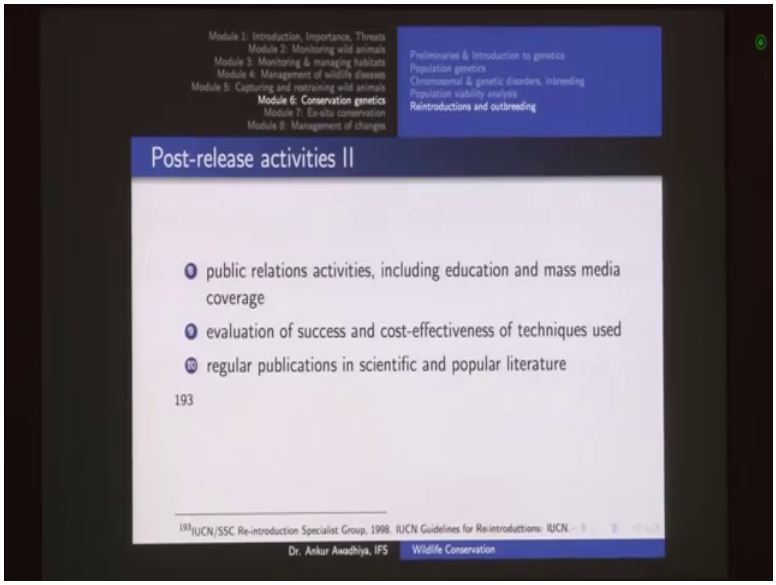

The next module was ex-situ conservation.

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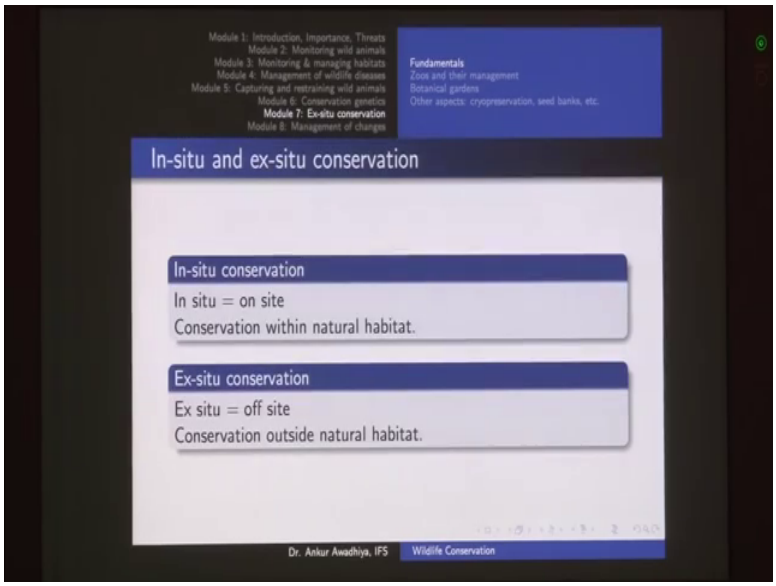

So, we defined what is in situ conservation. In situ is on the site ex situ is off the site. So, conservation within a national habitat is in situ conservation, outside the national habitat is ex situ.

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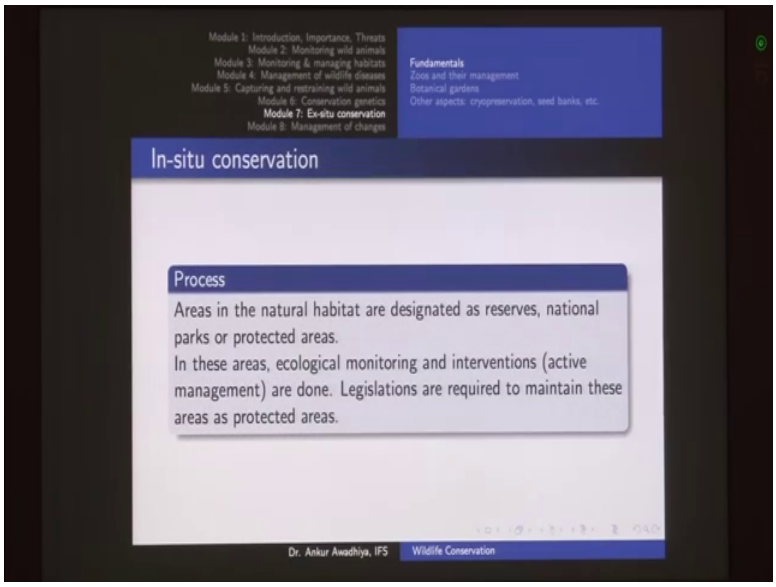

Now, in the process of in situ conservation we have things like reserves, national parks, so protected areas.

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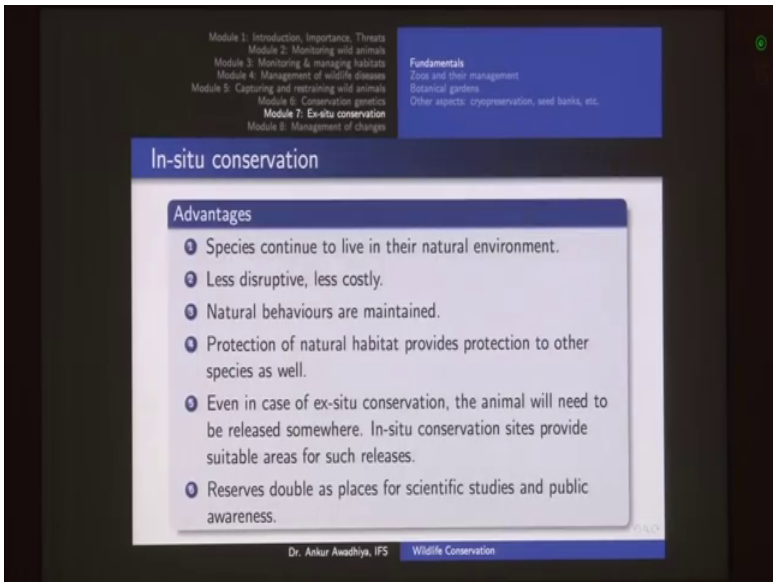

Then we looked at their advantages and disadvantages.

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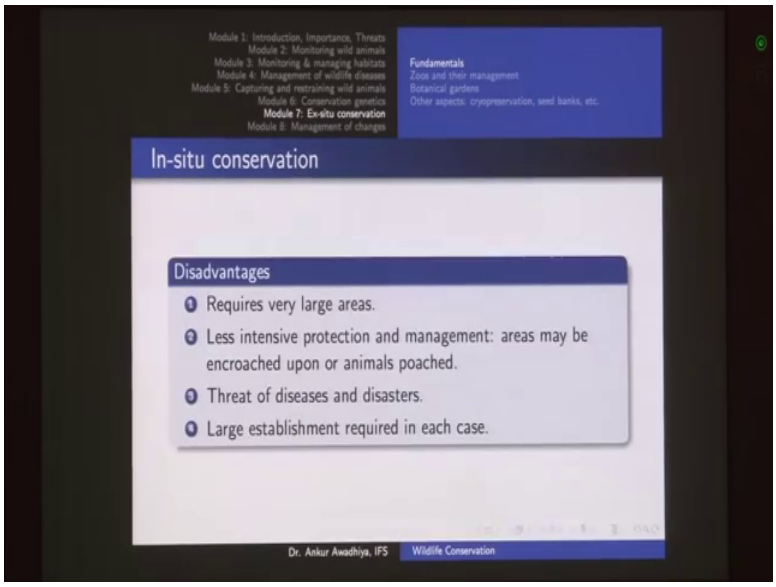

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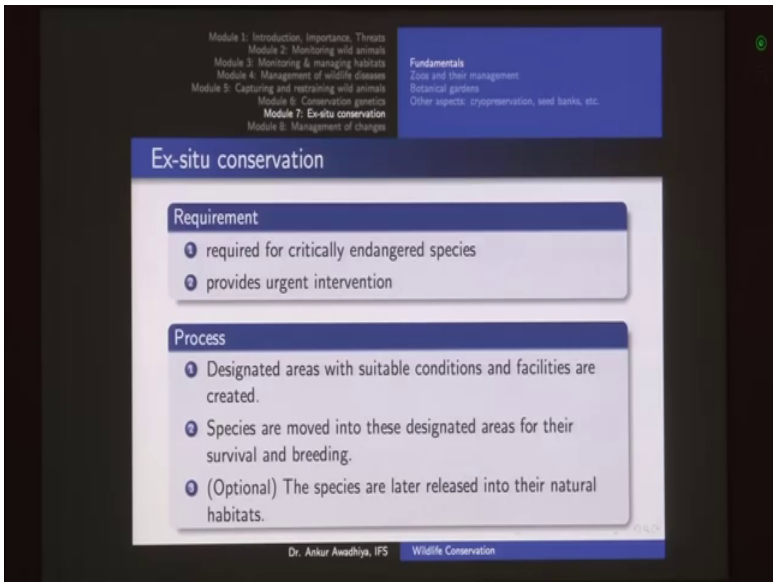

In the case of ex situ conservation they are required when you have very few number of individuals. So, they are critically endangered and you need to provide an urgent intervention and a very focused an intensive intervention. Then we create the ex situ observation facilities. So, it allows a better control of variables, there are also a number of disadvantages.

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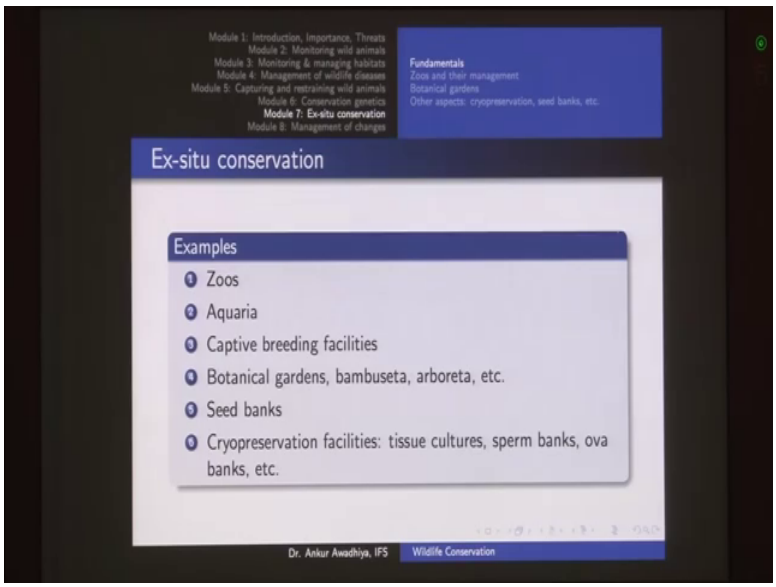

So these are the examples of ex situ conservation, zoo, aquaria, captive breeding facilities, botanical gardens, bambuseta which are which are places where bamboos are

grown, arboreta where trees are grown together, seed banks cryo preservation facilities tissue cultures sperm bank ova bank so on.

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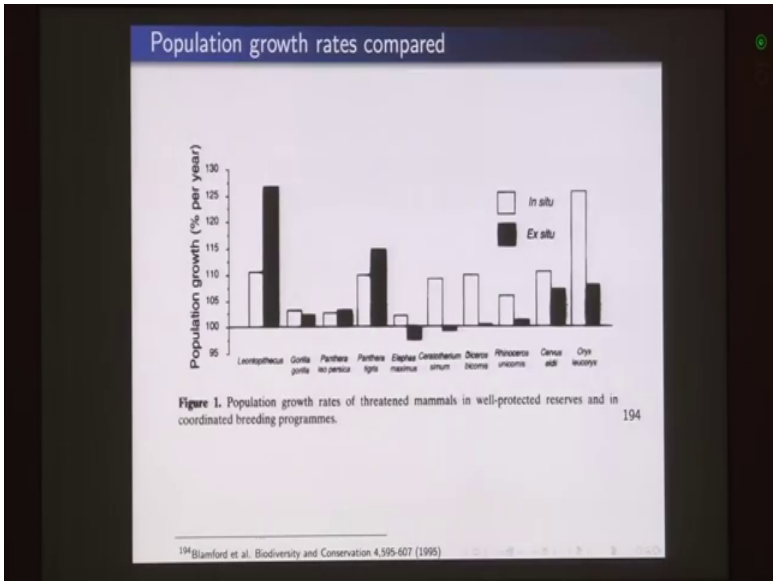

Now, the population growth rate tells us that in certain situations in situ is better, in certain situations a ex situ is better, and in certain situations ex situ just does not work.

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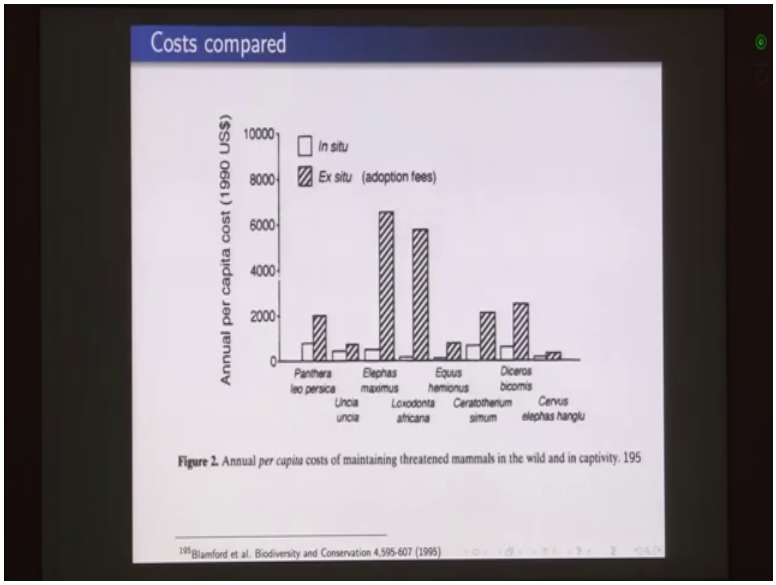

Next we looked at the cost. So, ex situ is in most cases much more costlier.

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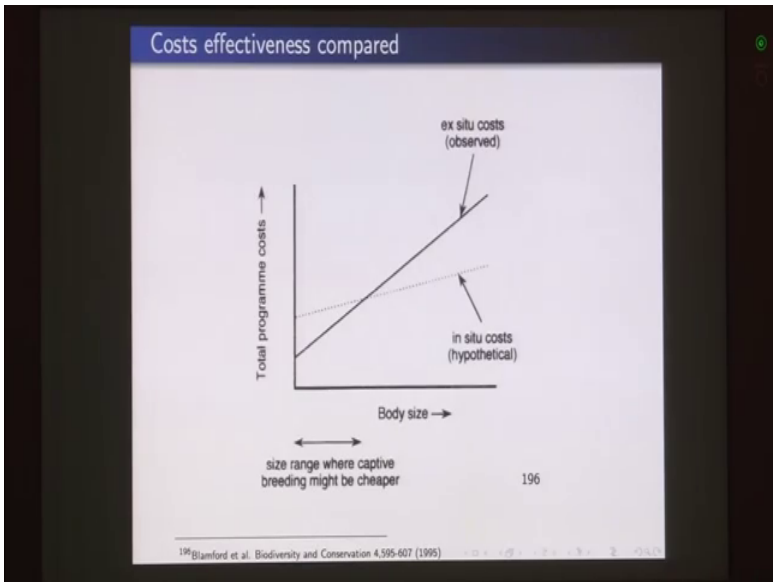

But in certain organisms that are having a smaller body size, then your ex situ cost may be the lesser than the in situ cost. So, this gives us a cost benefit analysis of what to prefer in which situation.

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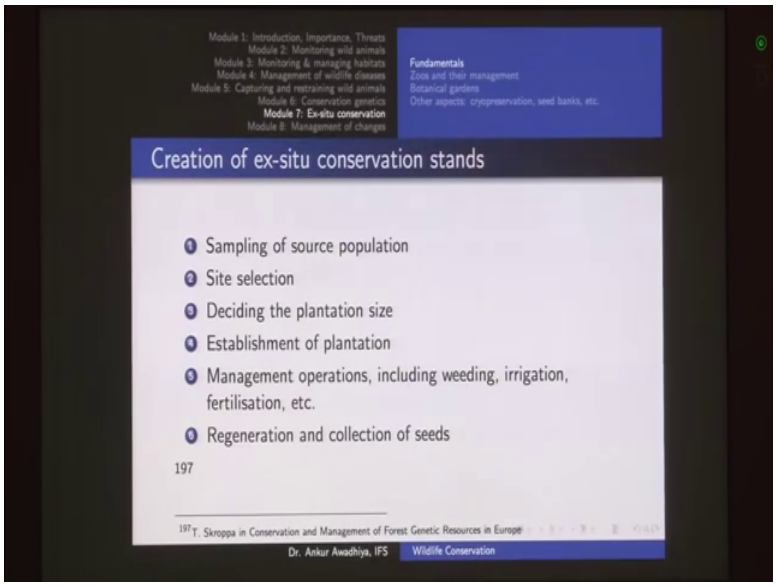

Now, we looked at creation of ex situ conservation stands, and the genetic implications.

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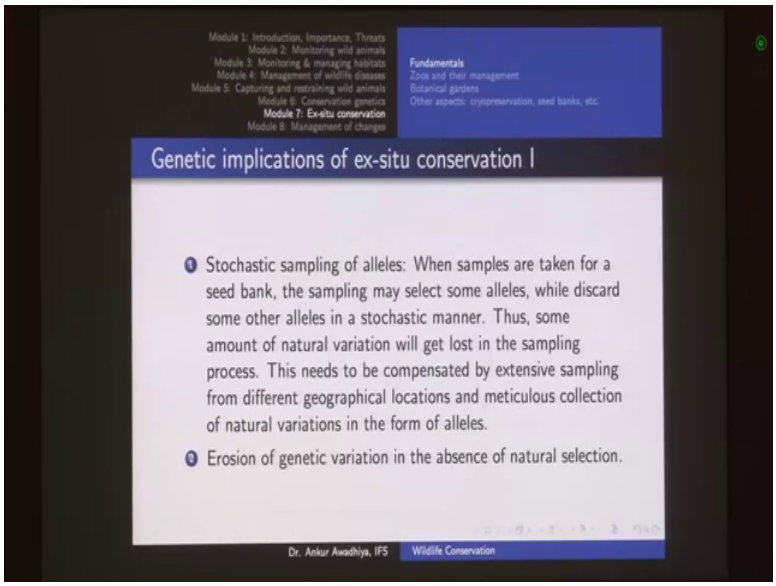

So, genetic implications are stochastic sampling of allele. So, you are just keeping a small subset of the population. So, a number of alleles might be lost, a number of variations may be lost. Next there is erosion of genetic variation in the absence of natural selection in your ex situ facility.

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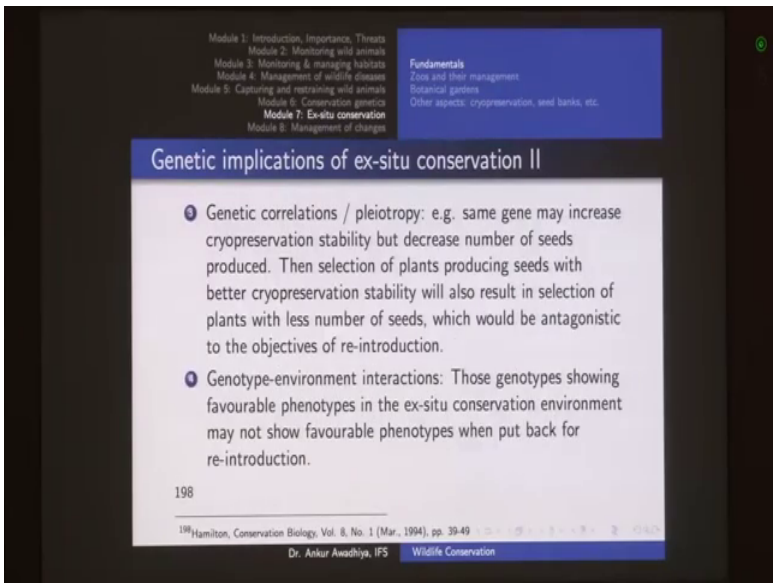

Next is genetic correlations and pleiotropy. So, when you are selecting for a certain characteristic then some other characteristic may also get selected at the same time which may or may not be useful for you, and forces the genotype environment interactions. So,

the organisms that are able to survive best in the ex situ conservation environment may not be able to survive that will when they are reintroduced back in to the natural environment.

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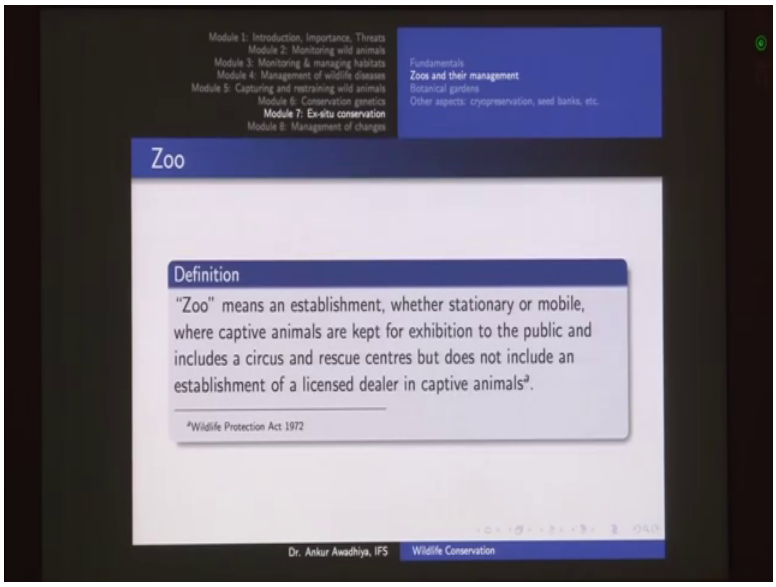

Next we looked at zoos and their management. So, the definition of zoo it is an establishment, where is whether stationary, or mobile, where captive animals are kept for exhibition to the public. And it also includes circus and rescue centers, but it does not include an establishment of a licensed dealer in captive animals. So, this comes from our Wild Life Protection Act 1972.

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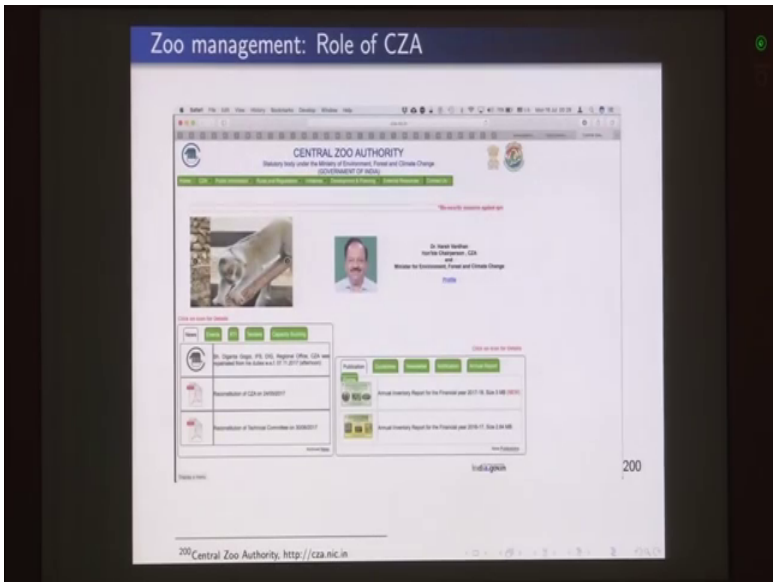

We looked at different kinds of zoos, central zoo authority maintenance an administrative control, regulatory control.

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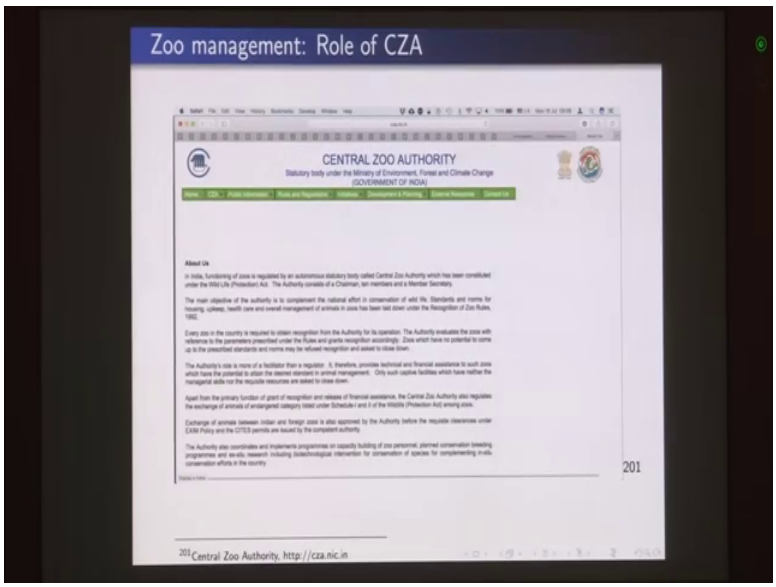

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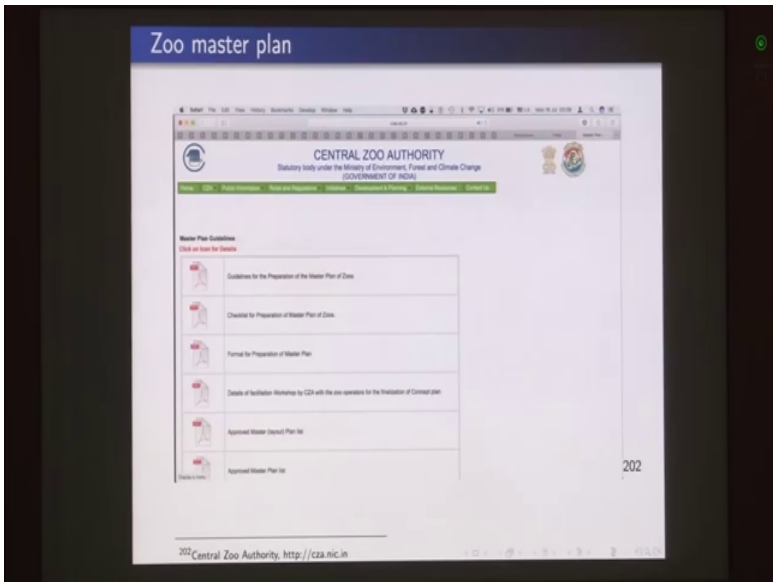

And also a role of a facilitator of these different zoos comes up with guidelines.

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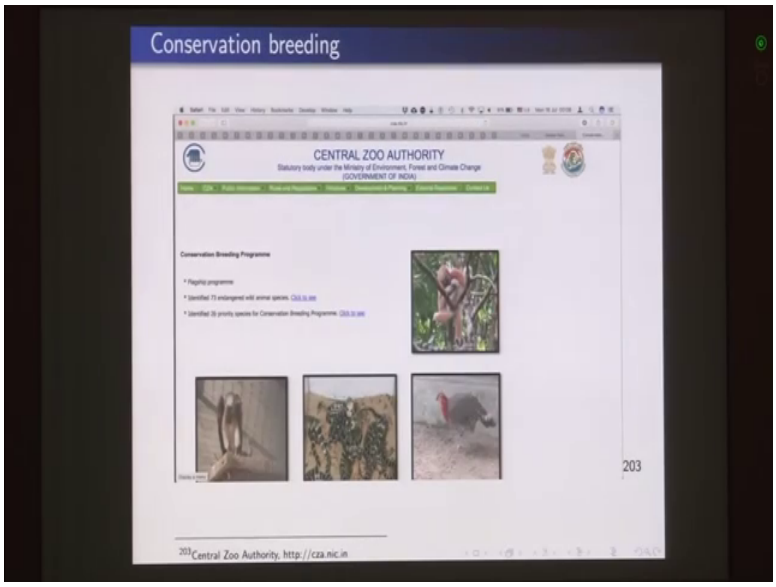

And then these are master plan guidelines.

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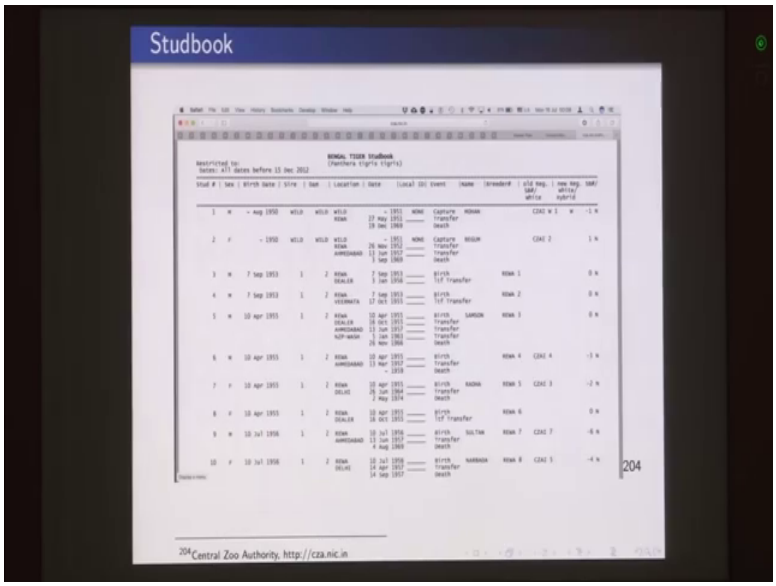

It also facilitates conservation breeding.

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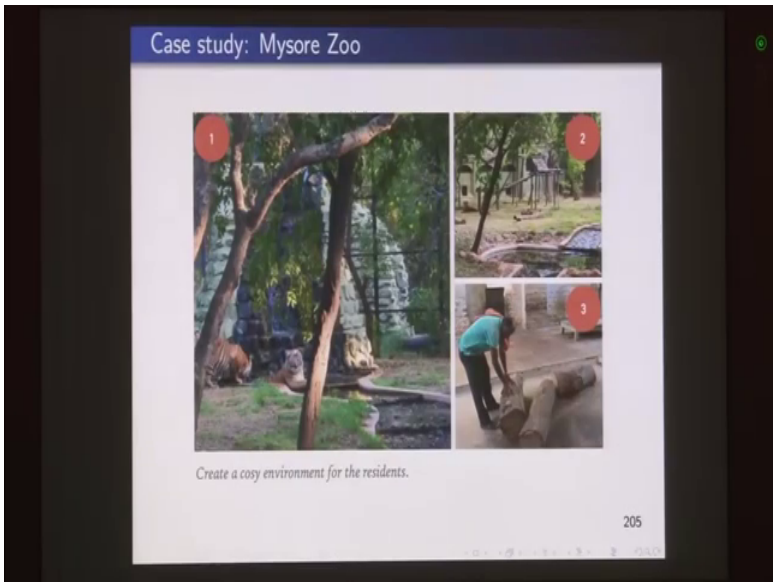

It helps in the maintenance of studbook for various animals. And then we looked at the case study of Mysore zoo to look at what goes on in a zoo.

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So, there is a cozy environment provided for the animals, feeding, then timing of feeding exotic animals if you are keeping them.

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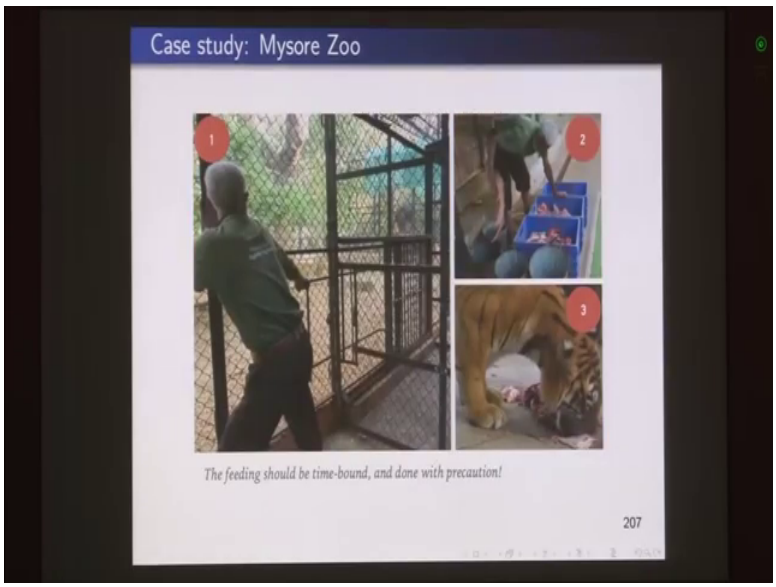

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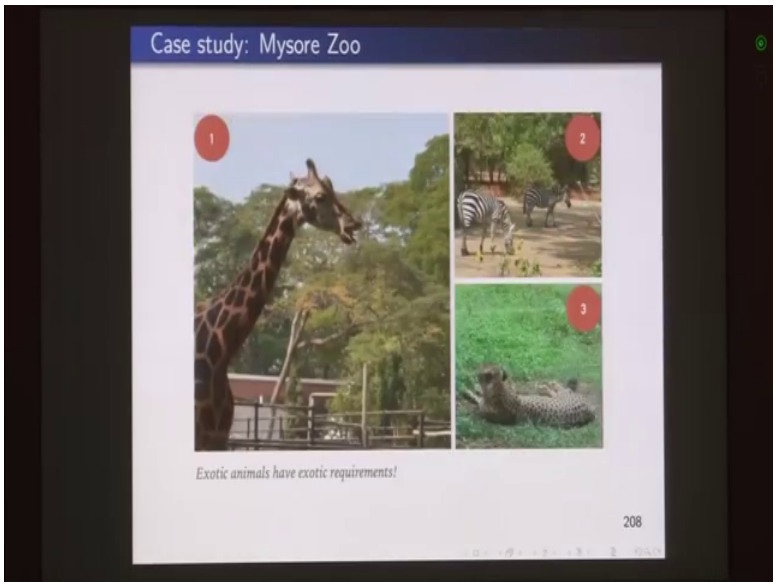

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Then they have exotic requirements, that needs to be full filled.

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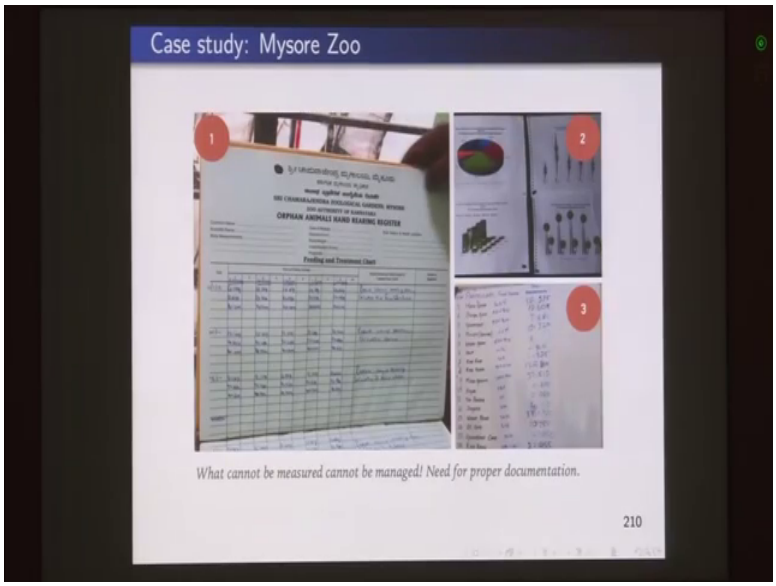

Landscape needs to be planned properly.

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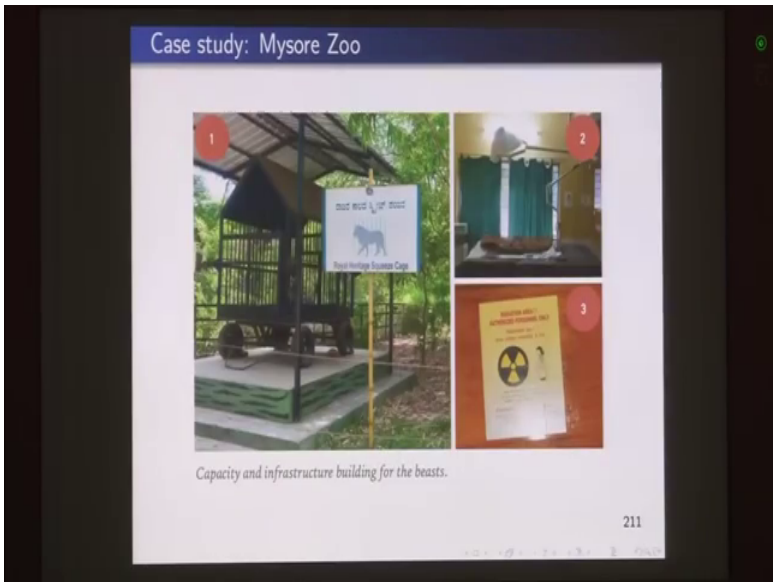

You need proper documentation; capacity, and infrastructure building including vetenary facilities; research and enrich activities, eco friendly activities.

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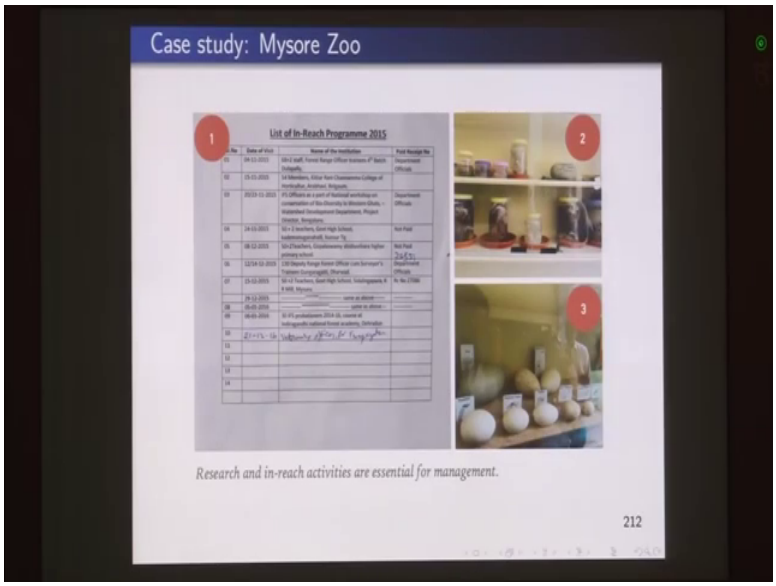

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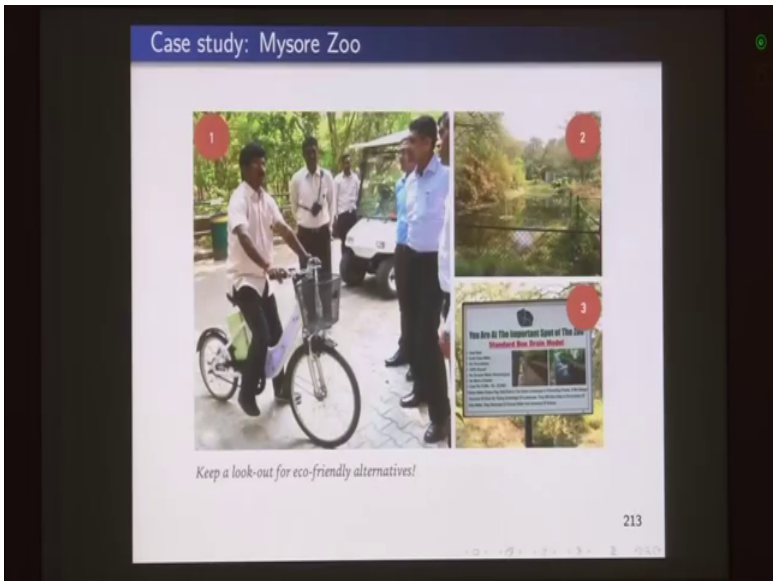

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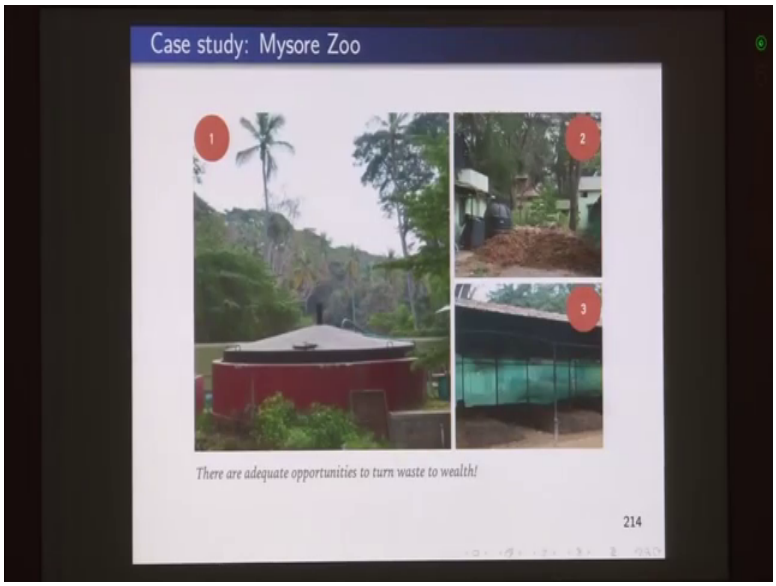

Then waste management what to do with the waste?

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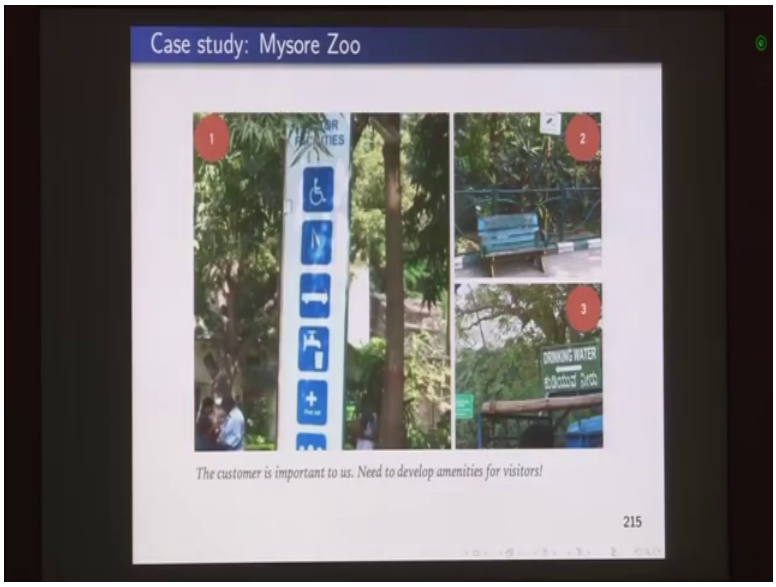

What to do with the dung? Then management of tourist.

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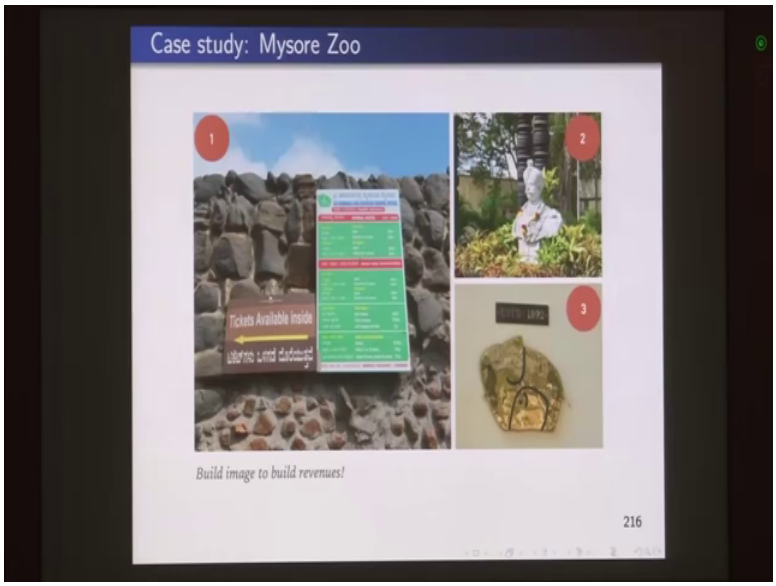

Then building of images.

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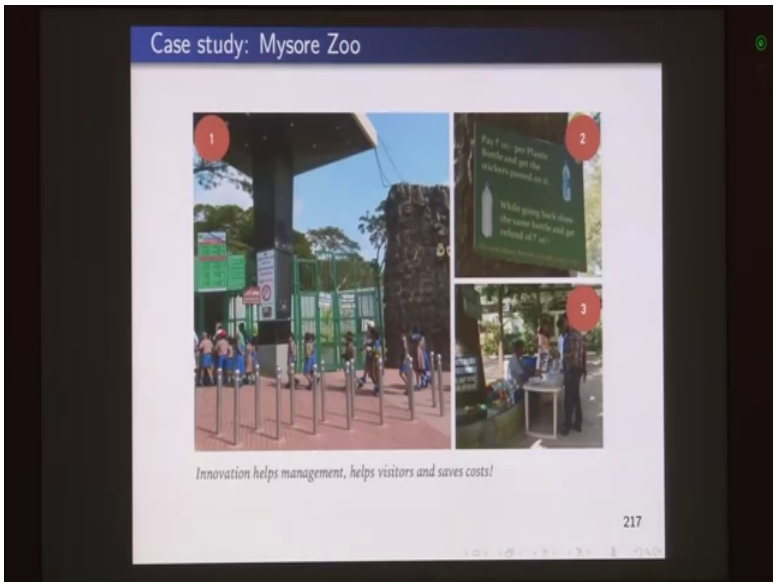

Creating a very nice ecosystem, for the visitors to roam around.

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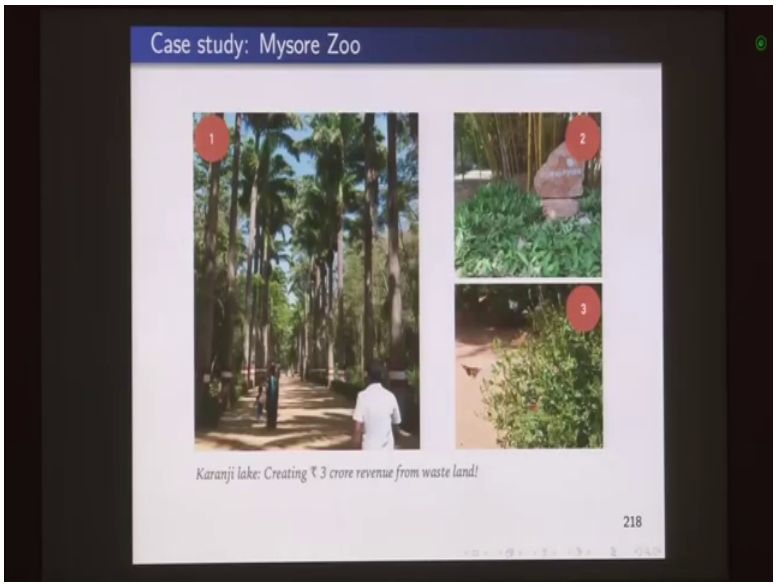

Then puts of innovation, and then also display of plants. Butterflies, orchids, birds and so on.

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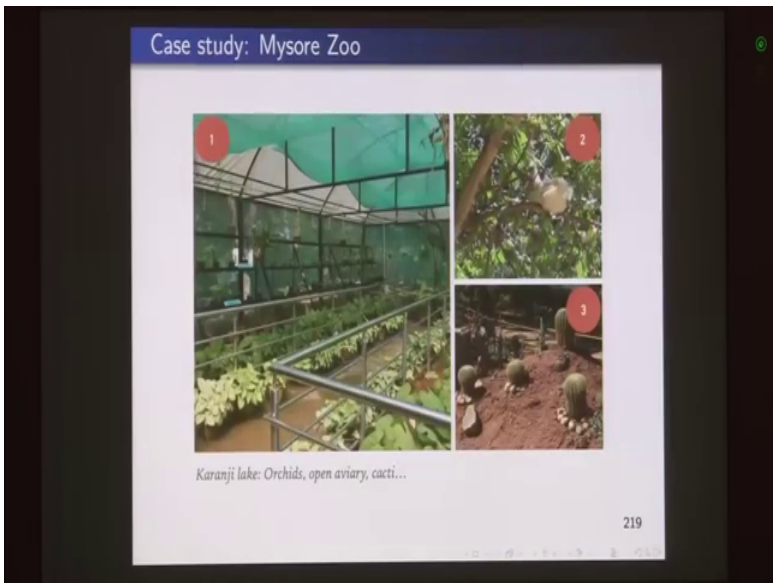

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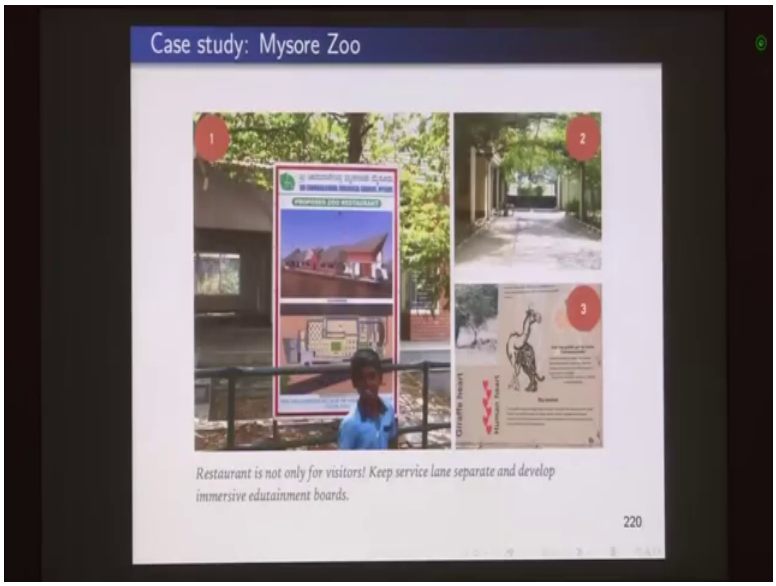

And we also had a look at the Bear rescue facility in Agra.

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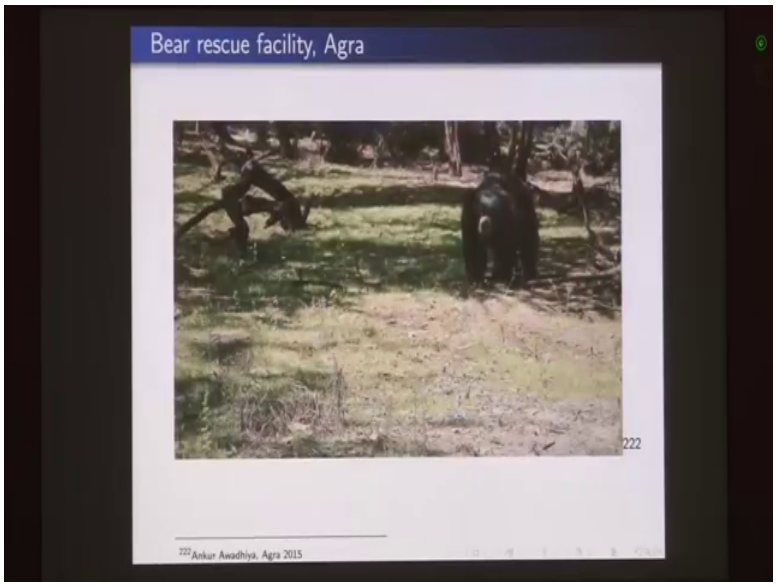

Lion rescue facility, Bhopal.

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Turtle rescue facility in which case the turtle eggs are brought and then raised in an enclosure. So, that dogs are not able to feed on them. Then we also looked at the need to prevent stereotype.

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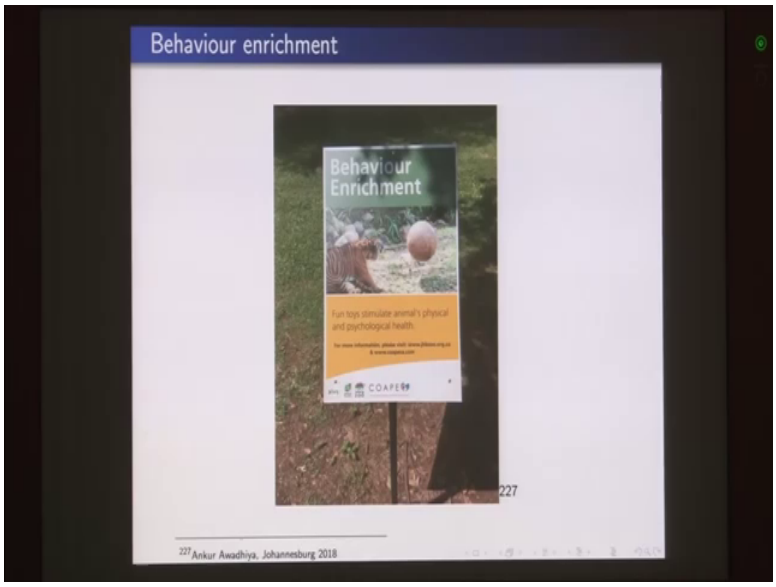

So, there is stereotype behavior that is present if there is no environment enrichment or behavioral enrichment in the zoos. So, the animals get bored and then they show behaviors that are extreme repetitive. So, for instance they may just go on moving like

this and this or they may just pace around in their small enclosures. So, these are examples of stereotypes and these needs to be prevented.

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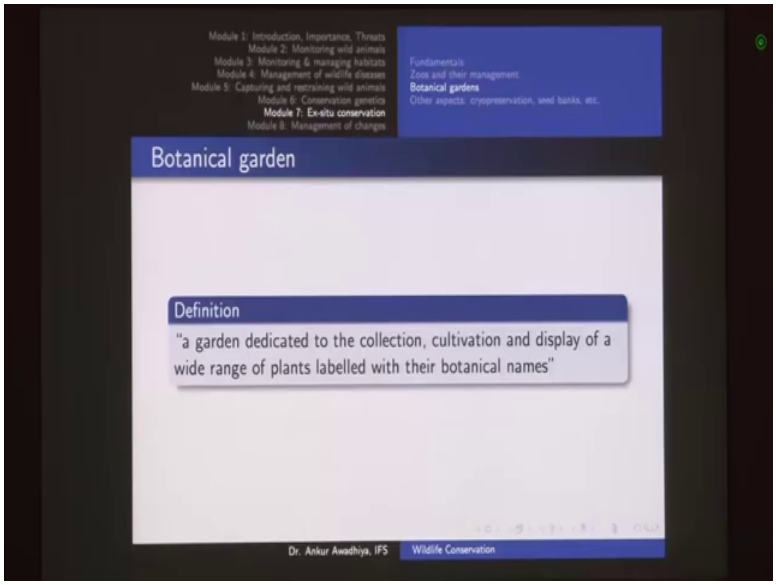

Next we had a look at the botanical gardens. So, botanical gardens are similar to our normal gardens, but then in this case we have a lot of scientific information that is also put in.

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So, we looked at hanging gardens of Babylon, Nishat gardens of Srinagar which are examples of normal gardens. And then we had a look at Kirstenbosch botanical garden in Cape Town as a case study. What will things are done in this kirstenbosch gardens?

So, we had different plants and then different kinds of experiences, different kinds of learning's that are provided to people. So, that they become more tune to the cause of conservation. Next we will looked at seed banks and cryoperseveration.

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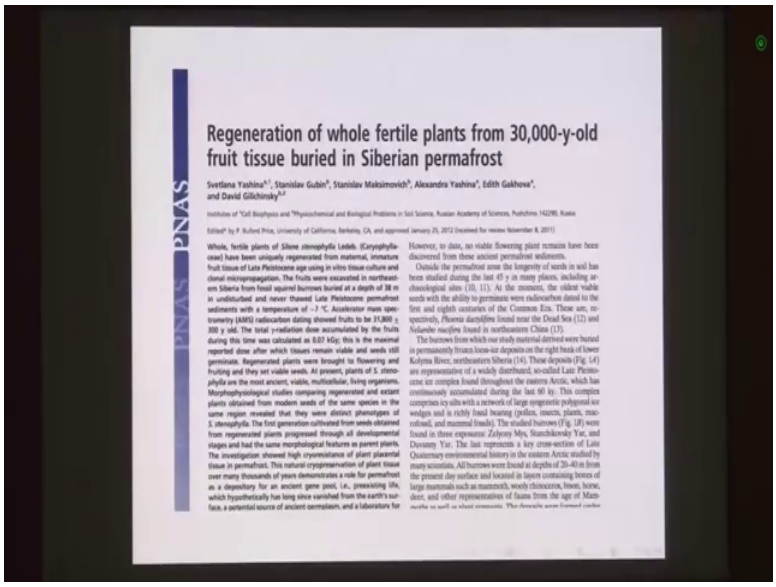

So, we started with these two cases in which a plant was raised back after 30000 years, when it was there in the Siberian permafrost.

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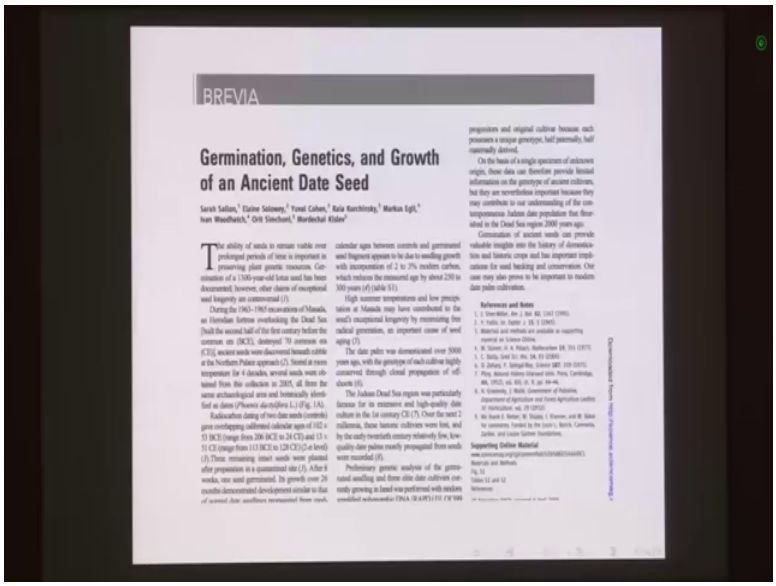
BREVIA

Germination, Genetics, and Growth of an Ancient Date Seed

Sarah Sallon,[1] Elaine Solowey,[2] Yuval Cohen,[3] Rafa Korchinsky,[1] Markus Egli,[4] Ivan Woodhatch,[4] Orit Simchoni,[5] Mordechai Kislev[3]

The ability of seeds to remain viable over prolonged periods of time is important in preserving plant genetic resources. Germination of a 1300-year-old lotus seed has been documented; however, other claims of exceptional seed longevity are controversial (1).

During the 1963–1965 excavations of Masada, an Herodian fortress overlooking the Dead Sea [built the second half of the first century before the common era (BCE), destroyed 70 common era (CE)], ancient seeds were discovered beneath rubble at the Northern Palace approach (2). Stored at room temperature for 4 decades, several seeds were obtained from this collection in 2005, all from the same archaeological area and botanically identified as dates (*Phoenix dactylifera* L.) (Fig. 1A).

Radiocarbon dating of two date seeds (controls) gave overlapping calibrated calendar ages of 102 ± 53 BCE (range from 206 BCE to 24 CE) and 13 ± 51 CE (range from 113 BCE to 128 CE) (2-σ level) (3). Three remaining intact seeds were planted after preparation in a quasiaxial slot (3). After 9 weeks, one seed germinated. Its growth over 29 months demonstrated development similar to that of normal date seedlings germinated from stock, progenitors and original cultivar because each possesses a unique genotype, half paternally, half maternally derived.

On the basis of a single specimen of unknown origin, these data can therefore provide limited information on the genotype of ancient cultivars, but they are nevertheless important because they may contribute to our understanding of the contemporaneous Judean date population that flourished in the Dead Sea region 2000 years ago.

Germination of ancient seeds can provide valuable insights into the history of domesticators and historic crops and has important implications for seed banking and conservation. Our case may also prove to be important to modern date palm cultivation.

References and Notes

Supporting Online Material

calendar ages between controls and germinated seed fragment appears to be due to seedling growth with incorporation of 2 to 3% modern carbon, which reduces the measured age by about 250 to 300 years (*4*) (table S1).

High summer temperatures and low precipitation at Masada may have contributed to the seed's exceptional longevity by minimizing free radical generation, an important cause of seed aging (*5*).

The date palm was domesticated over 5000 years ago, with the genotype of each cultivar highly conserved through clonal propagation of offshoots (*6*).

The Judean Dead Sea region was particularly famous for its extensive and high-quality date culture in the 1st century CE (*7*). Over the next 2 millennia, these historic cultivars were lost, and by the early twentieth century relatively few, low-quality date palms nearly propagated from seeds were recorded (*8*).

Preliminary genetic analysis of the germinated seedling and three elite date cultivars currently growing in Israel was performed with modern amplified polymorphic DNA (RAPD) (*9*, *10*)

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Fig. 1. (A) Ancient date seeds from Masada. (B) Germinated seedling age 3 months: normal development of simple juvenile leaves. Height = 15 cm. (C) Age 7.5 months: some leaves showing white patches. Height = 31 cm. (D) Age 26 months: normal seedling development with compound leaves. Height = 121 cm. [Photo credit: G. Elsner]

After a span of 2000 years when it was kept in a dry condition; so, keeping things in cool conditions and keeping things in a dry condition both are things that are used to preserve.

So, we began with what is a seed? What is the structure of a seed? What is the characteristic of a good seed? When do you collect seed? Which trees you collect seeds from?

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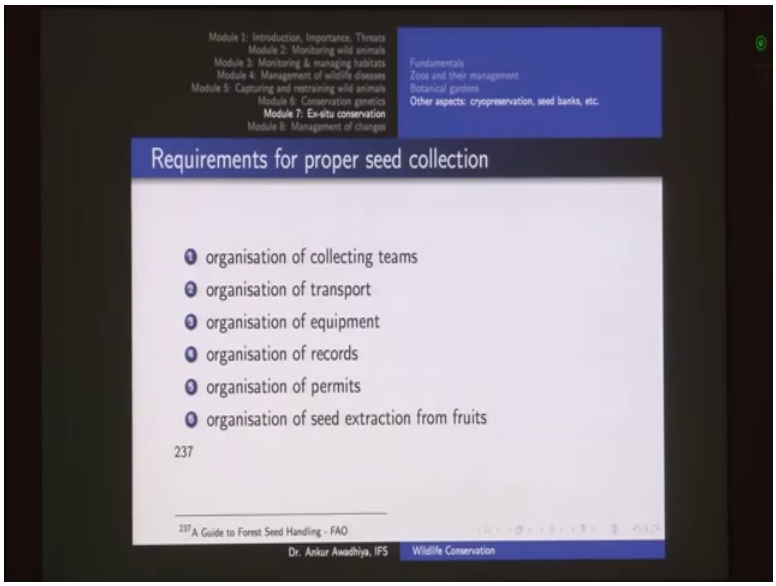

Then how do you collect specifically for conversation? What are the requirements for proper seed collection? What are the ways of collecting seeds? And then what are the other operations that are done?

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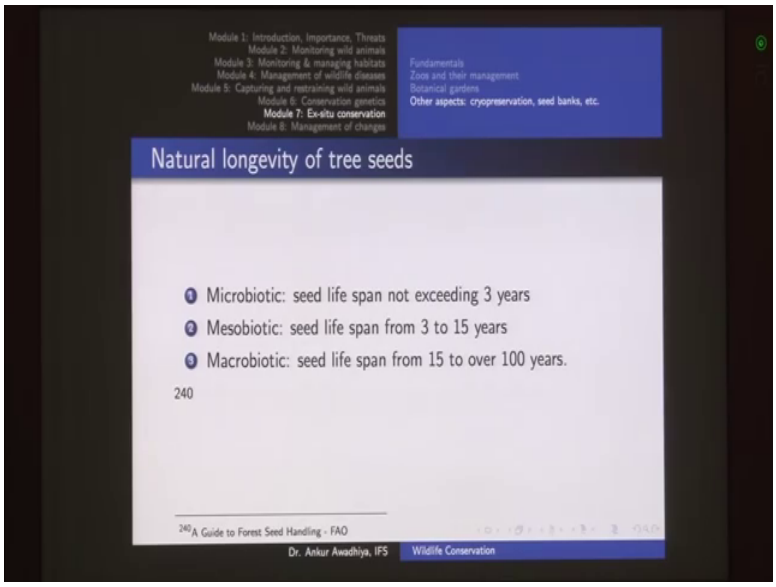

Next we looked at longevity of various seeds. So, these are divided into 3 categories micro biotic; so this is small life, mesobiotic middle life, macro biotic is large life.

So, microbiotic is less than 3 years, mesobiotic is 3 to 15 years. And macrobiotic is 15 to 100 years, or more than 1000 years. So, these are 3 longevity classifications.

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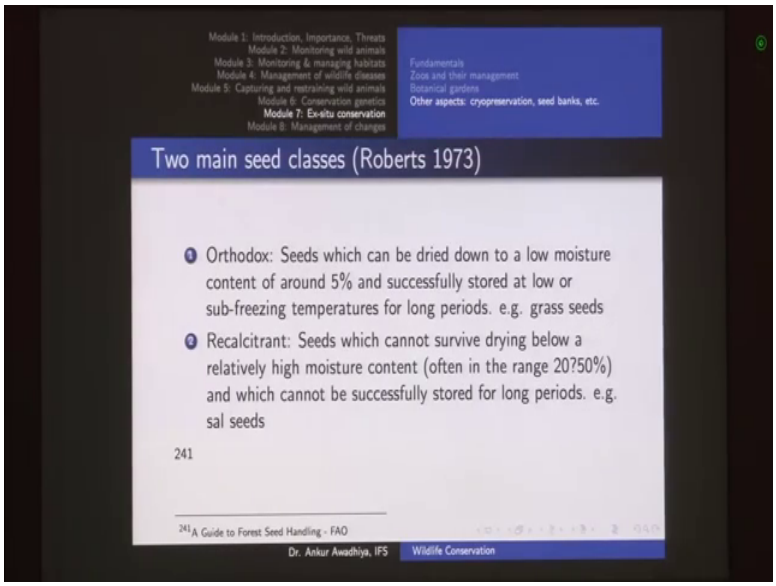

And then there are two kinds of seeds that are defined they are orthodox seeds, and recalcitrant seeds. Orthodox seeds are those seeds that do not have a very large amount of oil in them, they are able to tolerate very low moisture content.

So, they can be dried to a moisture content of less than 5 percent, and then they can be also stored at low, or sub freezing temperatures for very long periods. So, example includes are grass seeds, or grain seeds, or bamboo seeds, and so on.

Now, in the case of recalcitrant seeds these are seeds that cannot survive drying below a relatively high moisture content; often in the range of 20 to 50 percent and which cannot be successfully stored for long periods. Specially because they have a high concentration of oils in them example includes sal seeds.

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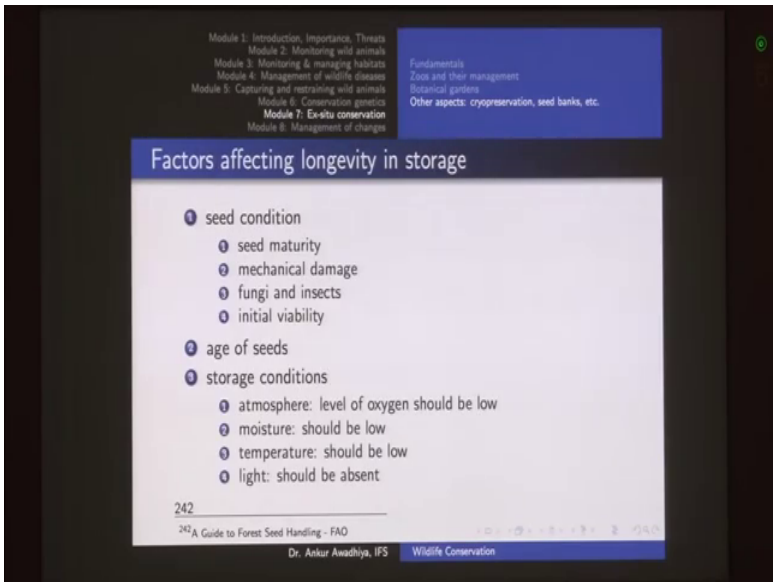

Now, these were the natural variations, but longevity also depends on the seed condition, the age of seeds and the storage conditions. So, these are things that we play with when we are creating a seed bank.

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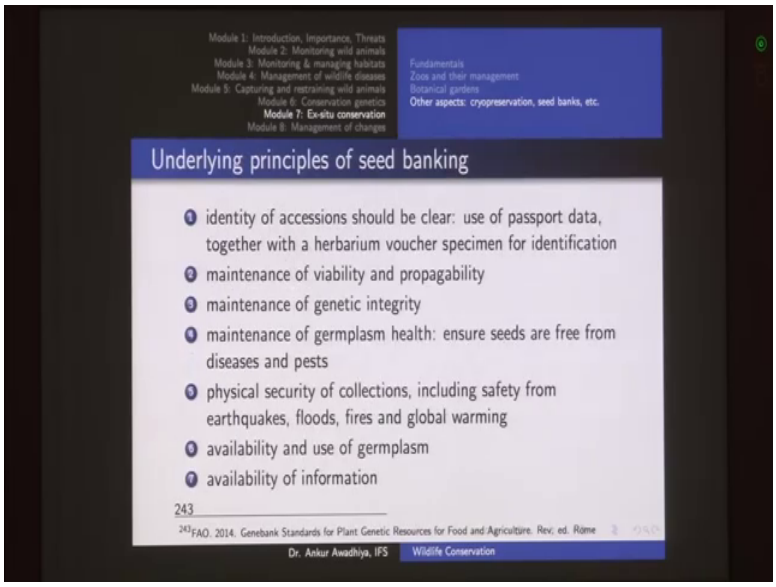

Next we looked at various principles of seed banking ah. So, it should be everything should be identifiable, maintenance of viability and propagability, genetic integrity, germplasm health, physical security. So, this includes safety from a earthquakes, floods,

fires, global warming, terrorism and so on; then availability and use of germplasm for others and availability of information.

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So, we looked at Svalbard global seed vault in Norway that is a good example of one such seed bank.

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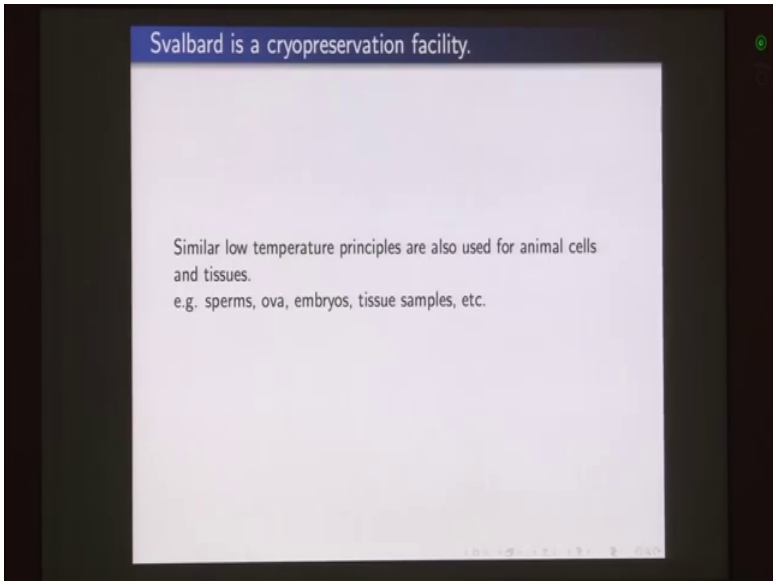

And then such cryopreservation, so cryo is low temperature preservation.

So, preservation at low temperature this can also be done for animal samples such as sperm, ova, embryos, and tissues.

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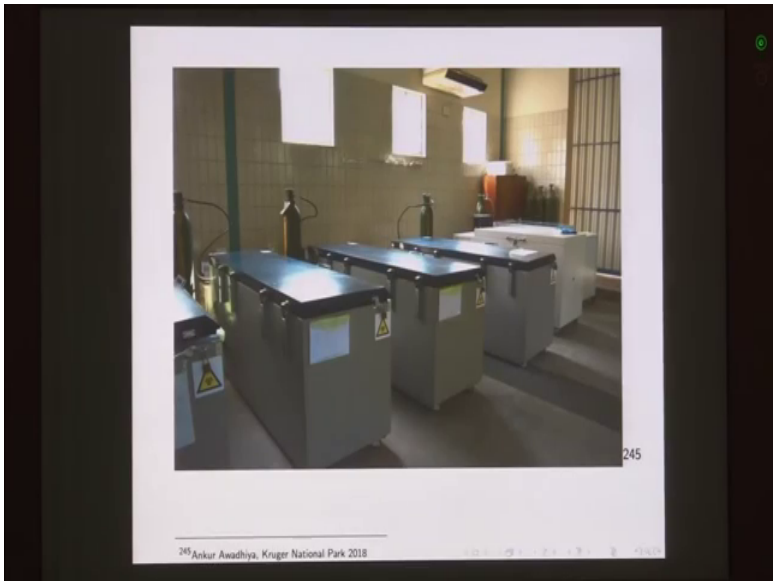

So, we looked at this example from Kruger national park in which we have these chest freezers in which various samples are kept. And this can be used later on.

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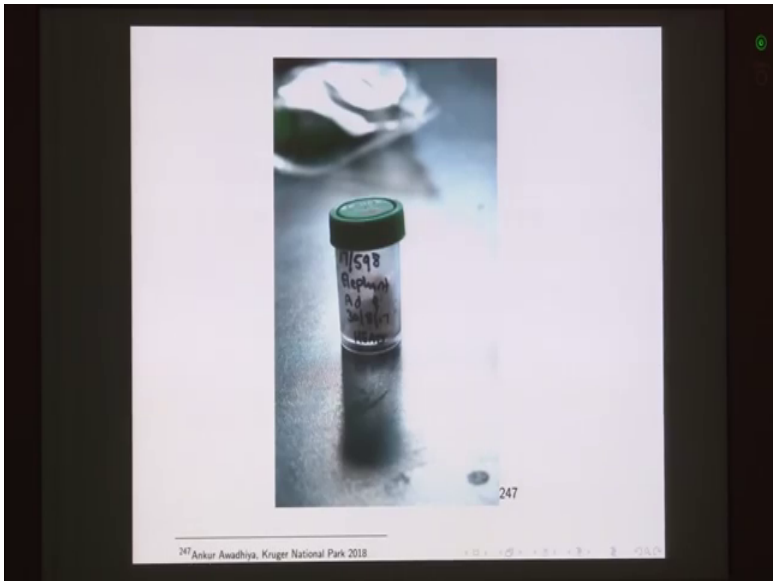

Now, in the last module we had a look at the management of changes. So, we looked at four different things we looked at climate change, plastics, oil spills. And then we had a

Sariska of case study of what of how crisis manifest itself and then how this crisis is overcome in the field situations.

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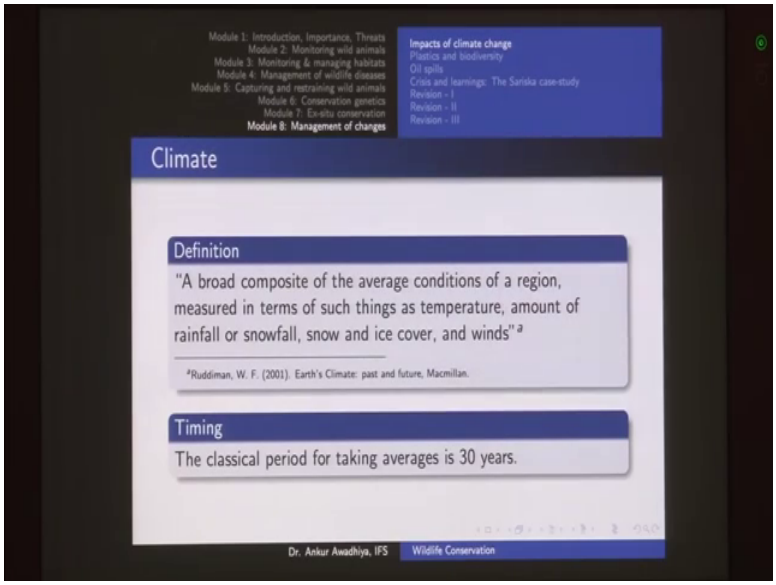

So, in the case of climate change we looked at what is the climate? Then classical period of taking average is just 30 years. So, we differentiate between climate and weather; whether is at this particular time point or at any particular time point and climate is an averaged out value over multiple years typically 30 years.

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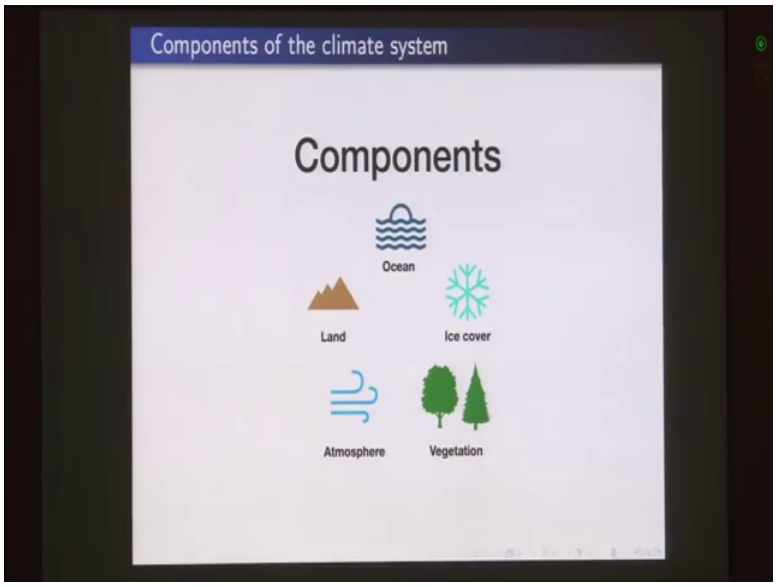

So, there are 5 components of climate land, ocean, ice cover, vegetation, and atmosphere. These interact with each other to form the climatic system.

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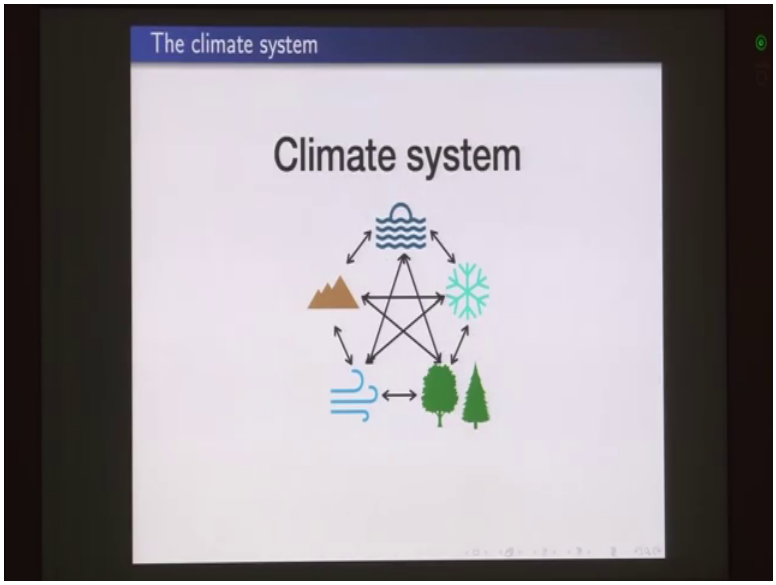

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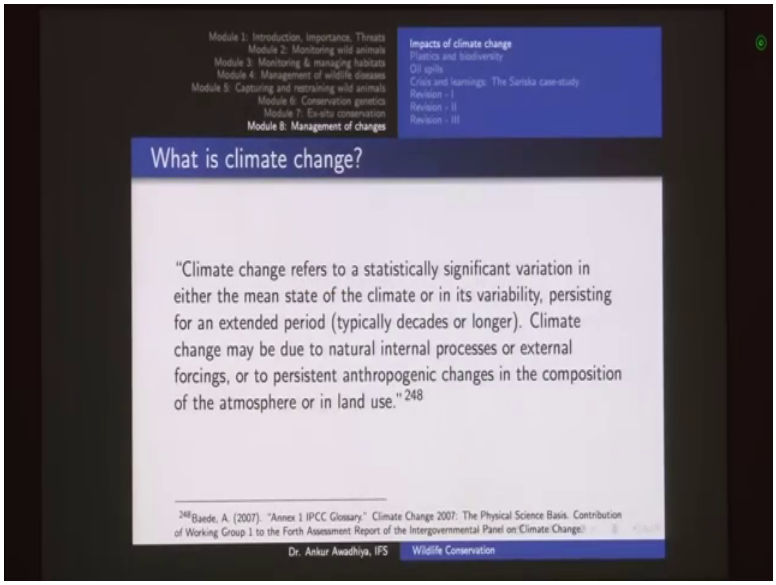

And then climate change is statistically significant variation in the mean state, or the variability persisting for an extended period.

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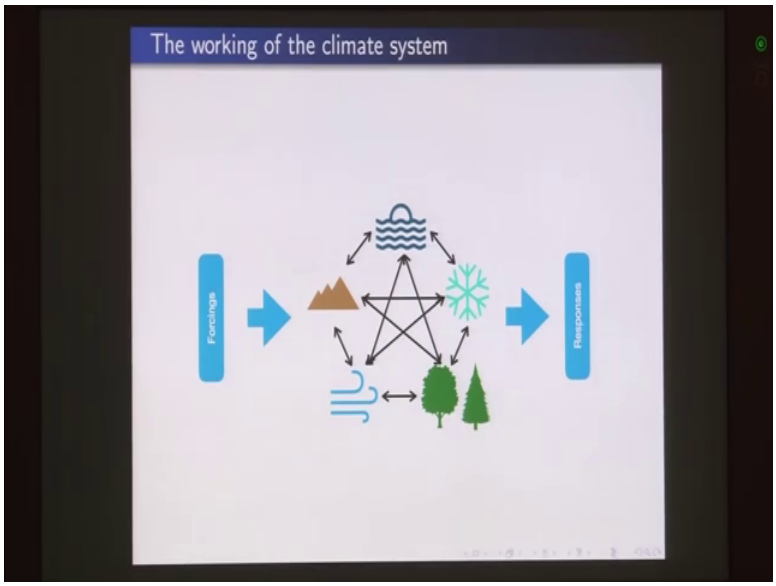

So, we next look it at the working of the climatic system. So, you have the climate system. And then if you have any forcings or any inputs that are given to this system. There would be some sort of output which we call as response.

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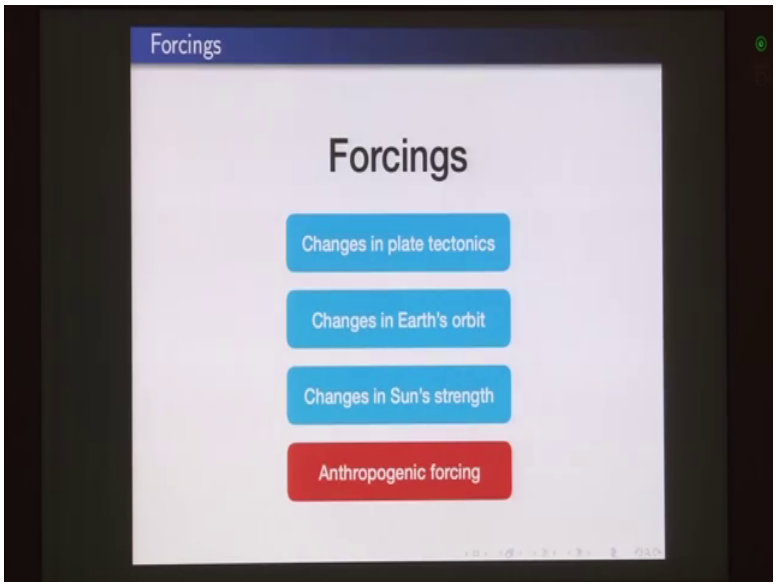

Now, this inputs and outputs are important to understand climate change. So, the inputs or the forcings include changes in the plate tectonics, changes in the earth's orbit, changes in the suns strength, and the anthropogenic forcings. So, essentially these are all four different things that can bring about a change in the climatic system.

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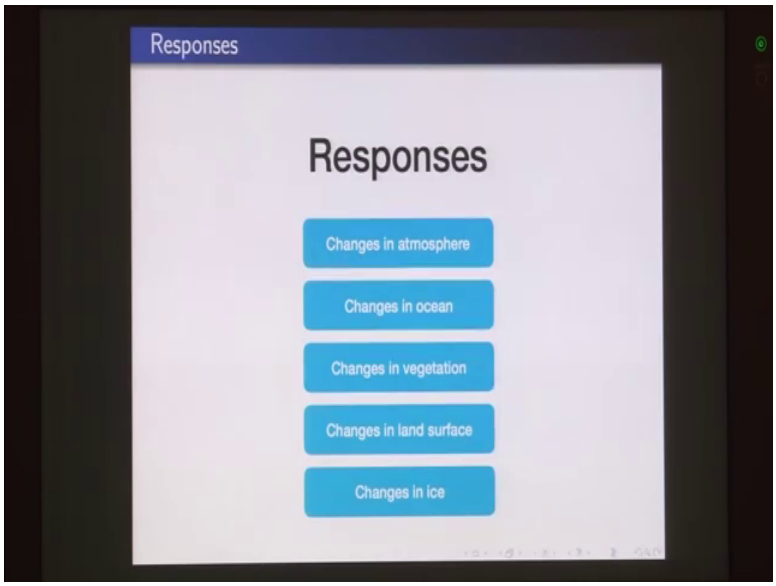

And when this change occurs what are the responses? So, there can be changes in all the 5 components of the climate. So, changes in atmosphere, ocean, vegetation, land surface and in ice. So, all these 5 different things are the responses of climate change.

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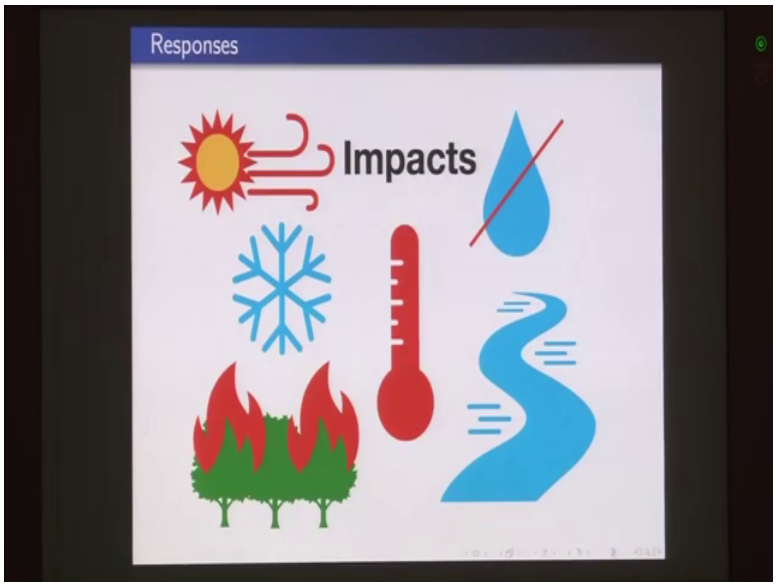

Then we looked at various impacts. So, things may become dry, things may become hot, things may become cold things may become wet. In the case of floods you can have more amount of forest fires, if they you can have more occurrence of diseases, new disease and so on.

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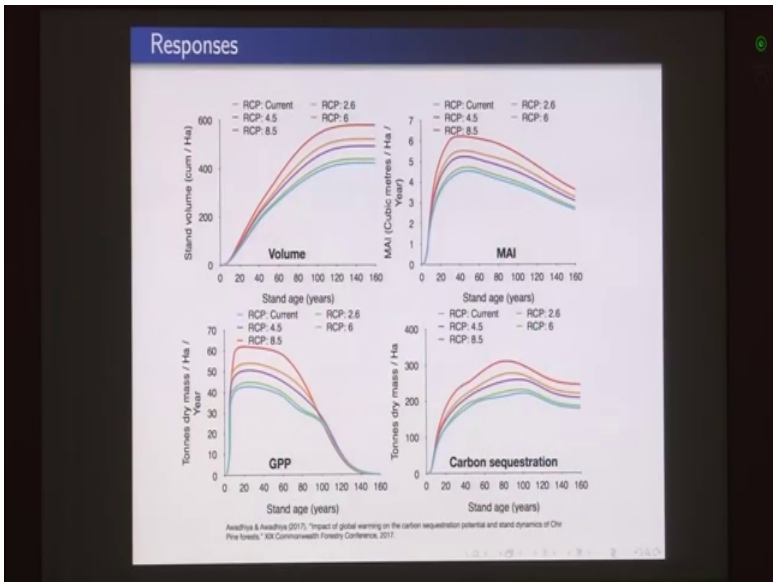

Then we looked at this example of how computer simulations can tell us about various responses.

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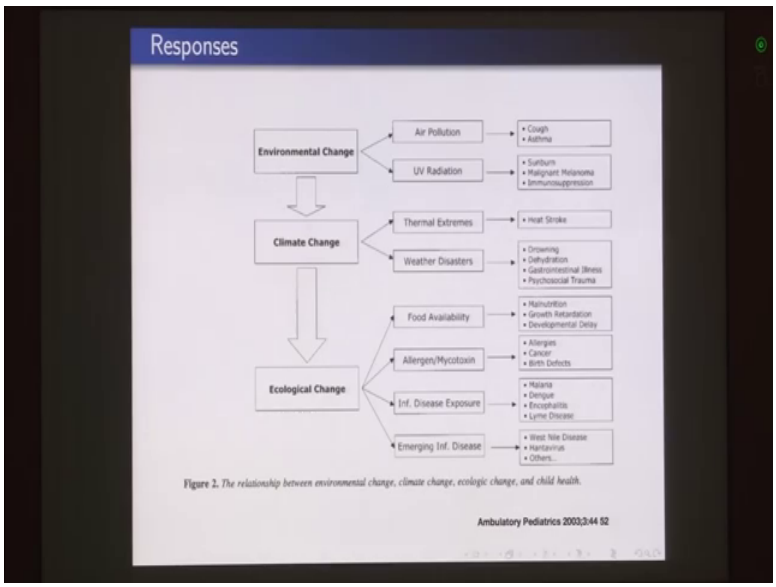

Different kinds of responses that we can have in our animals as well, different kinds of diseases, thermal extremes, weather disasters, food availability, allergens then more infectious disease, exposure emerging infectious diseases. All these things can show up in our conservation ah.

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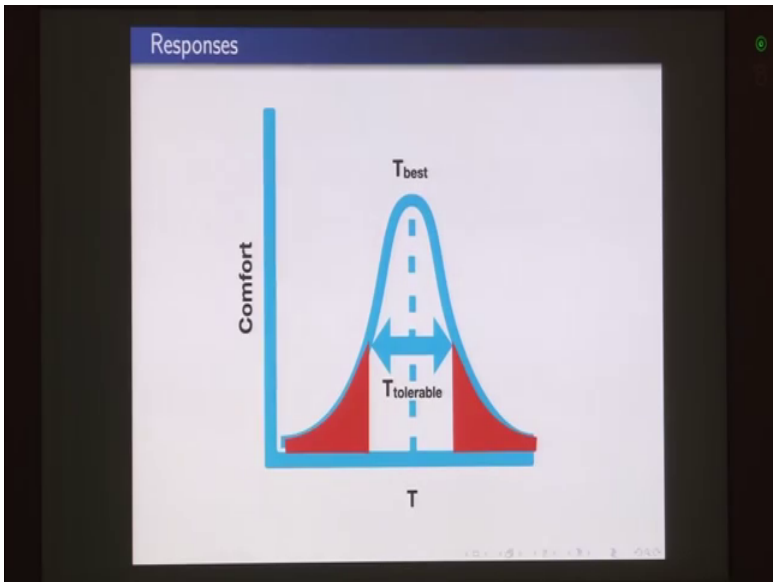

Now, next we will looked at responses.

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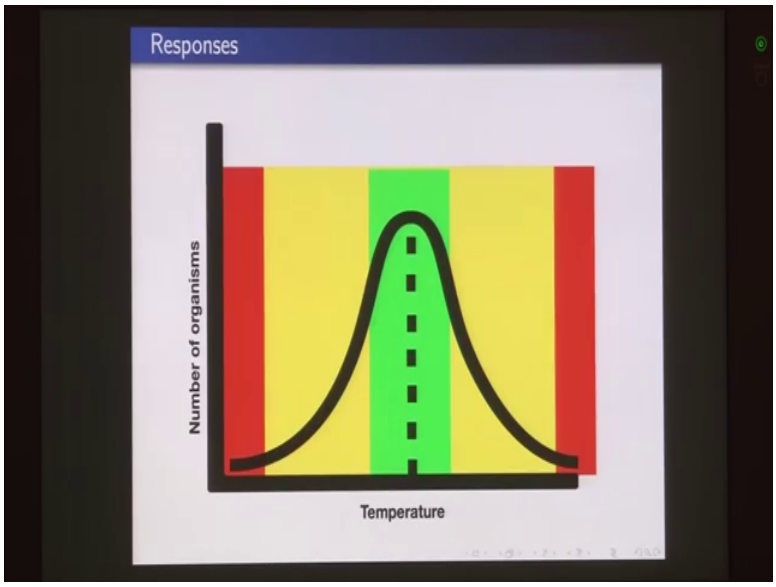

So, every animal has a tolerable range in which it can survive well. So, in when you provided with the most optimum situations you have a greater density of animals. When situations are not that optimum then there is a less density of animals, and then you go to the extremes then you will not find any organisms living permanently in those areas.

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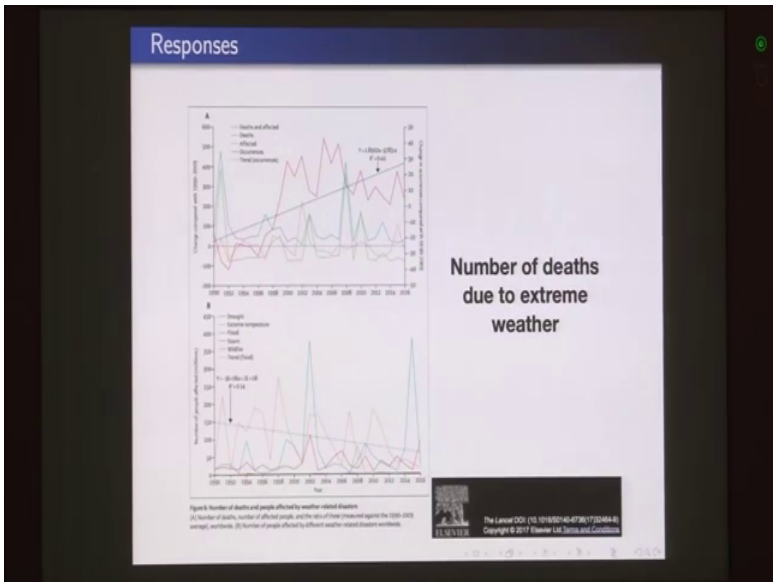

Then we looked at these studies of number of deaths due to extreme weather.

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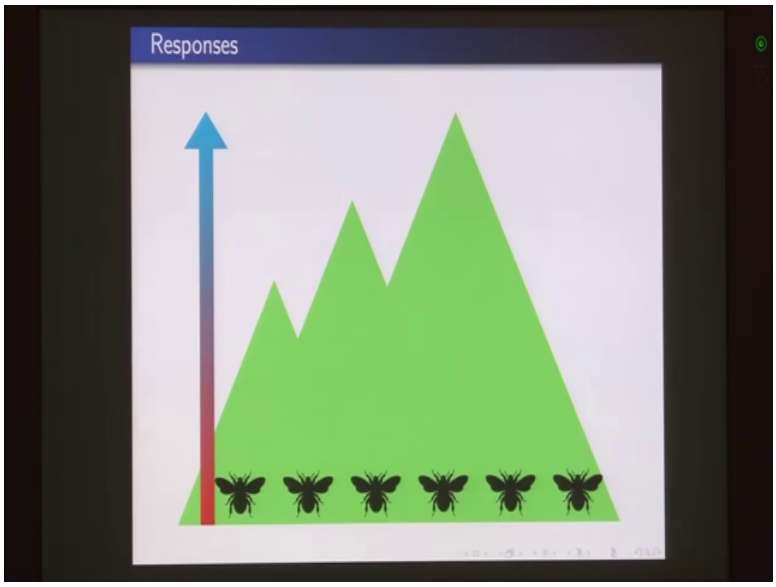

Another response is that in case temperatures increase. So, all the animals like these insects that are living at the bottom of the mountains when it is warmer, will start moving to the top which is cooler norm that will become warmer when they have a situation of climate change.

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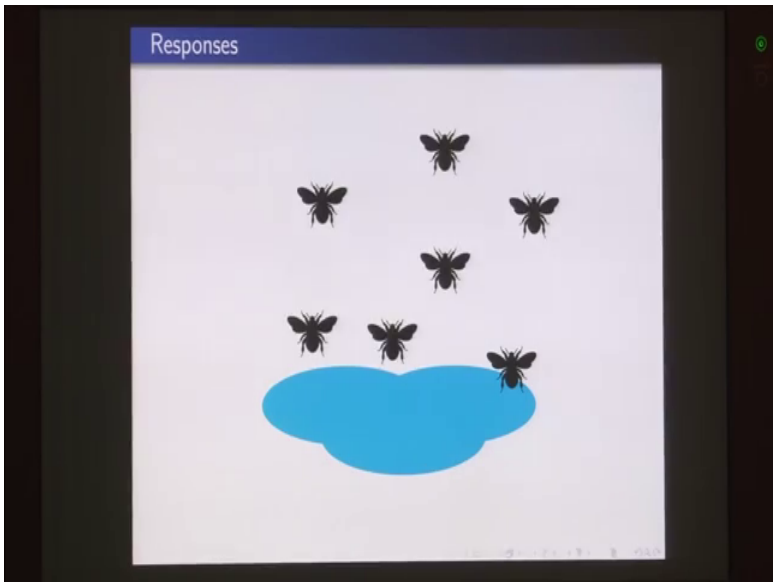

Also some insects may breed better because situations will be more hot, and more moist.

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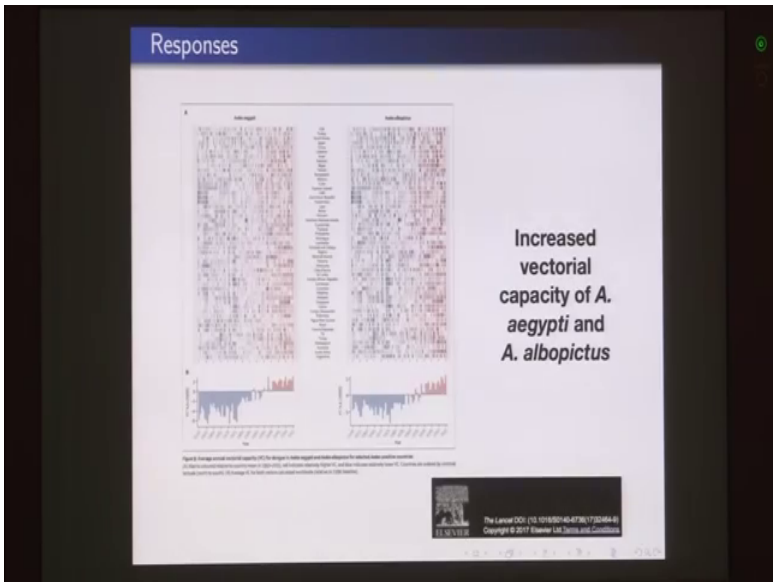

Then we looked at actual fields scenarios. There is an increased vectorial capacity of it is mosquitoes because of climate change.

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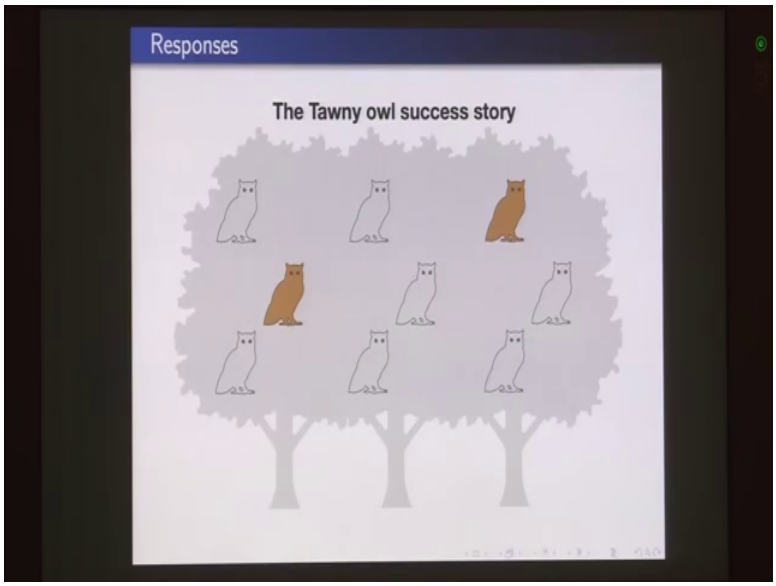

Then we had a look at how our organism in the forest would response? So, this is a tawny oil owl success story, so this is an owl that is present in two variants in the grey color and the brown color. Now, in case you have quite a lot of snow in the trees, so the white or the grey colored owls they become camouflage. And so in the in the prey enables like mice, or rats, or hares are not able to see these owls. So, they become better at hunting.

Whereas, in the case of these brown colored owls the prey animals are able to see them and so they run away. So, generally or say a few decades back we were observing that in the forest we had quite a large number of grey colored owls, and very less number of brown colored owls.

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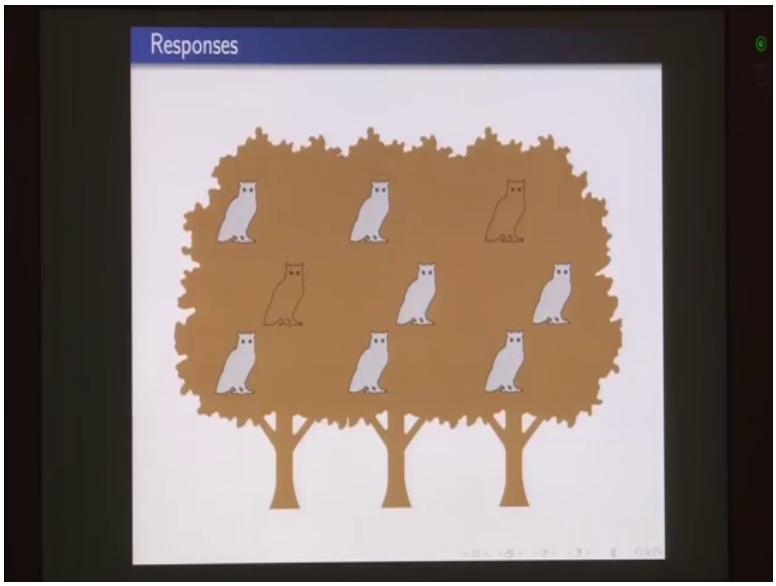

But then because of climate change now there is less amount of snow, and in those scenarios the grey colored owl becomes more conspicuous, and the brown colored owl is able to camouflage better.

So, now we are saying a change in the genetic frequencies or the allele frequencies. Now in place of more number of grey colored owls, now we have less number of grey colored owls, and the number of brown colored owls has gone up. So, these are the responses that we will see even in the animal kingdom.

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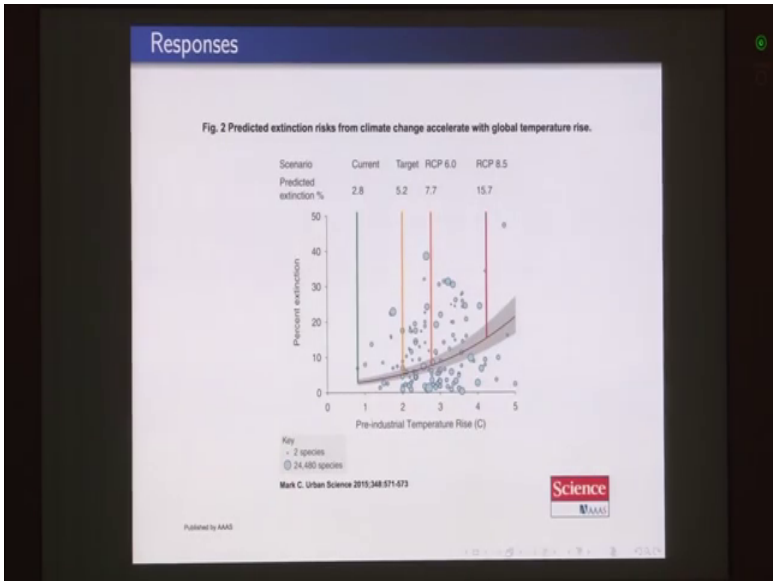

Next response would be the increased level of extinctions that we will observe.

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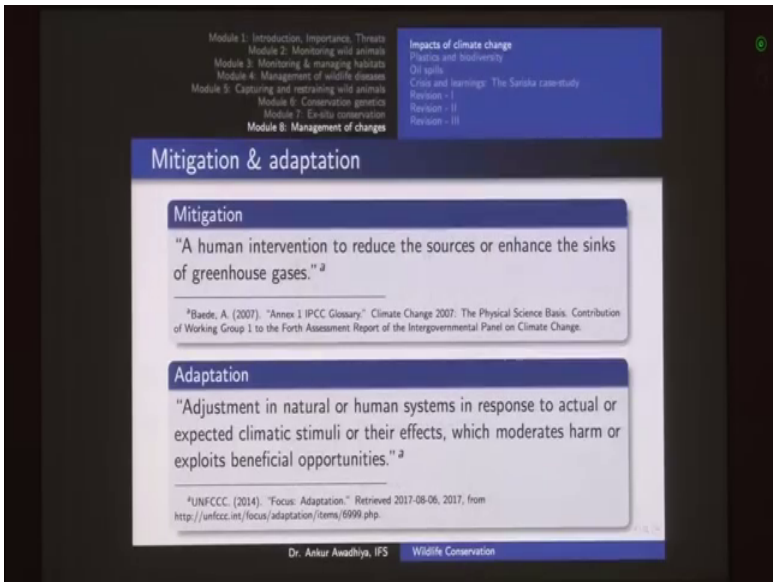

So, this is a paper from science now what can we do? We can do two things; one is mitigation, the other is adaptation. Mitigation is a human intervention to reduce the sources or enhance the sinks, so of greenhouse gases.

So, you want to reduce the amount of emission and any emission that is there in the atmosphere you want to take it away that is mitigation. Adaptation in a natural or human system is the response to actual or expected climatic stimuli, or their effects which moderates harm, or exploits beneficial opportunities. So, in the case of adaptation you are providing your system a capability to able to resist, or respond to climate change.

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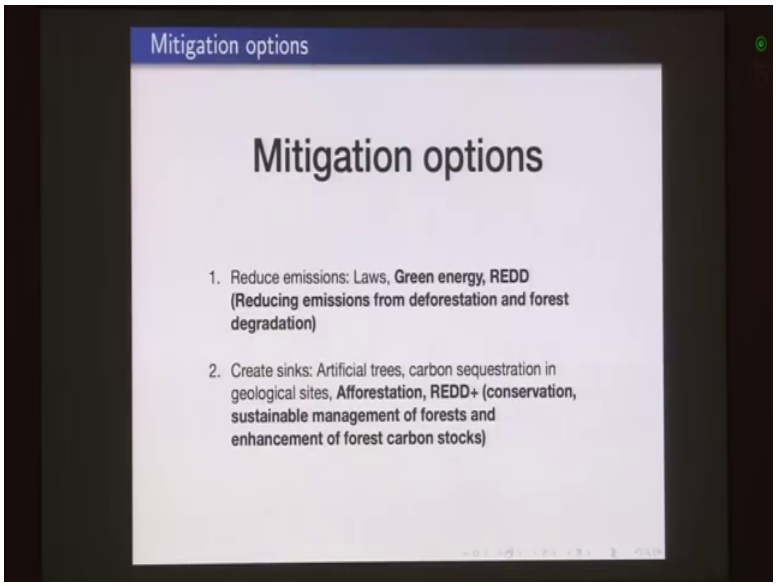

So, both of these things can go on together; then we looked at mitigation options. So, mitigation options are reduce emissions and create sinks. Reduce emissions through green energy say use of led light bulbs red that is reducing emissions from deforestation and forest degradation and so on.

Creation of things includes things like afforestation, grow more trees, REDD plus which includes conversation, sustainable management of forest, and enhancement of forest carbon stocks. Besides these a number other technological things can also be thought of.

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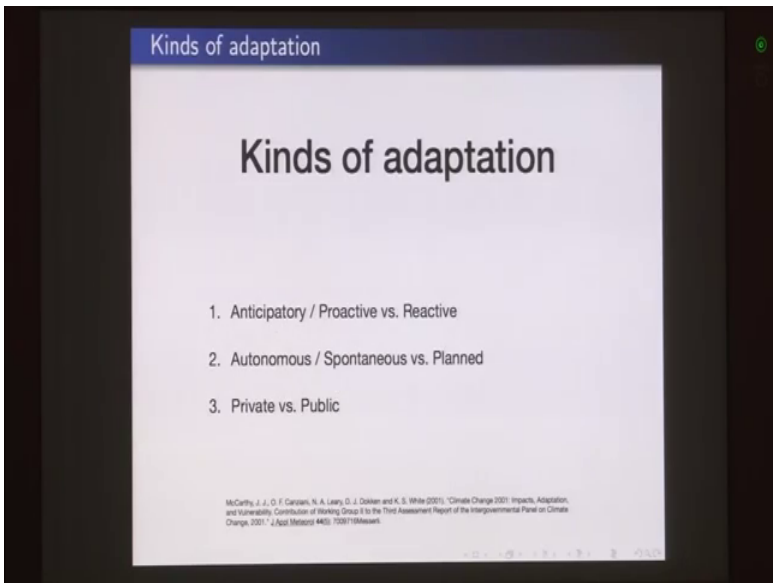

Now, there are 3 kinds of adaptation.

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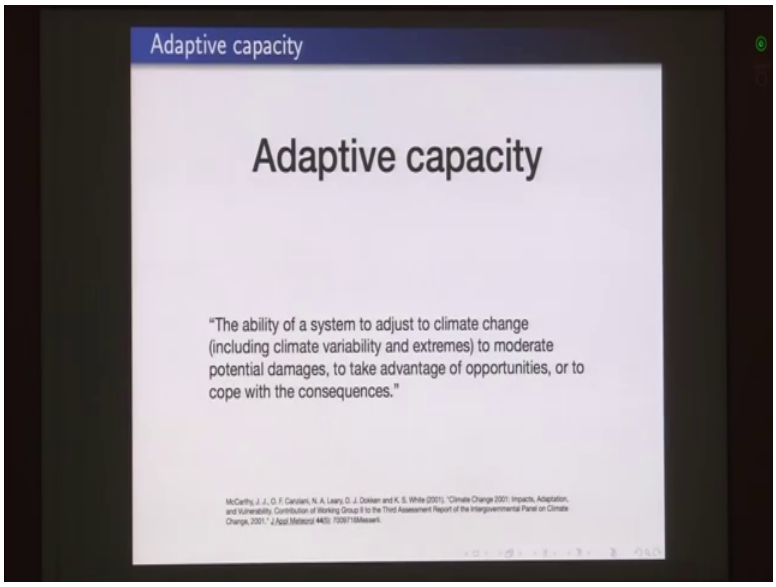

Then we also talked about adaptive capacity. The ability of a system to adjust to climate change to moderate potential damages to take advantage of opportunities, or to cope with the consequences is adaptive capacity.

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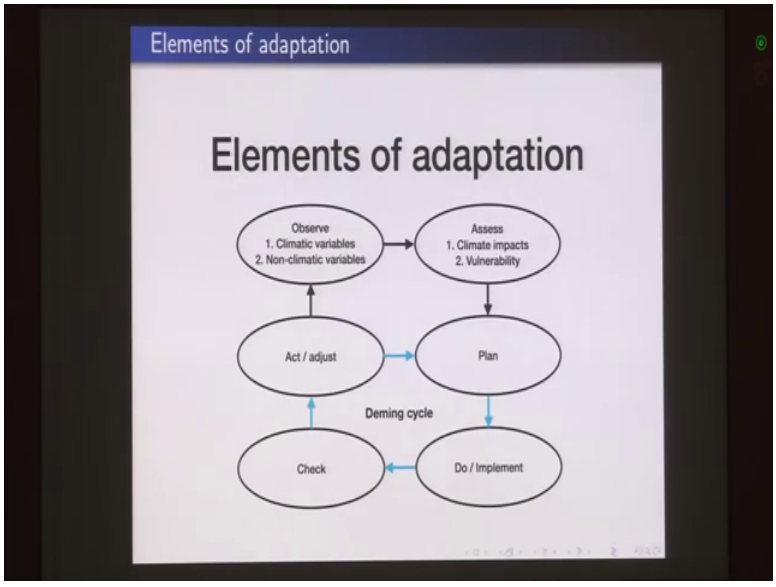

Then we looked at elements of adaptation. So, we have the Deming cycle, PDCA cycle plan do check and act and then we add these two things observe and assess. So, they become the elements of adaptation in the longer run.

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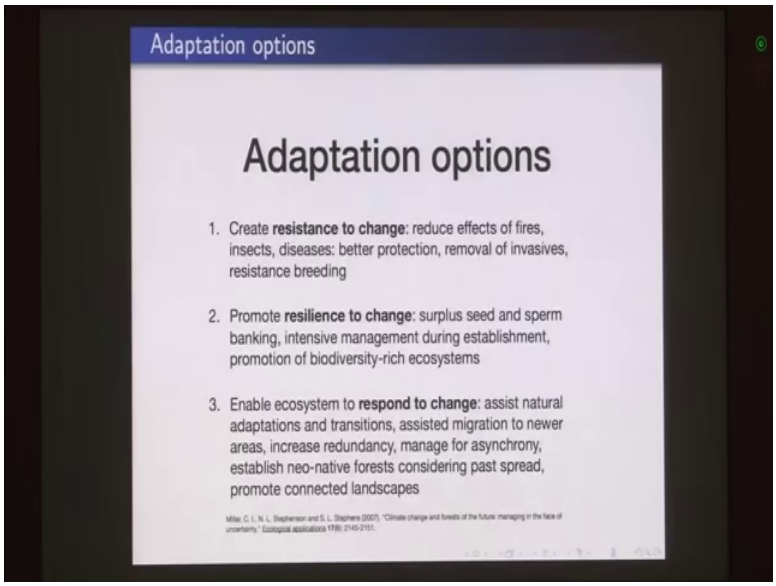

Then adaptation options are create a resistance to change, create a resilience to change, and create response to change. So, resistance to change is that if you expect that areas will become warmer. So, you can create situations in which the number of forest fires that would have gone up is more controlled.

So, in this case you forest will be able to resist the change. So, it reduce the effects of fires, or reduce the incidences of fires through better protection for instance. Resilience to change is that when impacts of climate change come in the systems productivity will go down, but then after a while it should be able to come back, so that is resilience.

So, for this we also go for things like surplus seed and sperm banking. So, when we talk about seed banking if there is climate change and if a forest is completely obliterated we can use these seeds to reestablish that forest. So, that is a resilience to change and third is response to change. So, you can assist natural adaptations and transitions. You can go for assisted migration of species and so on, so that is the response to change.

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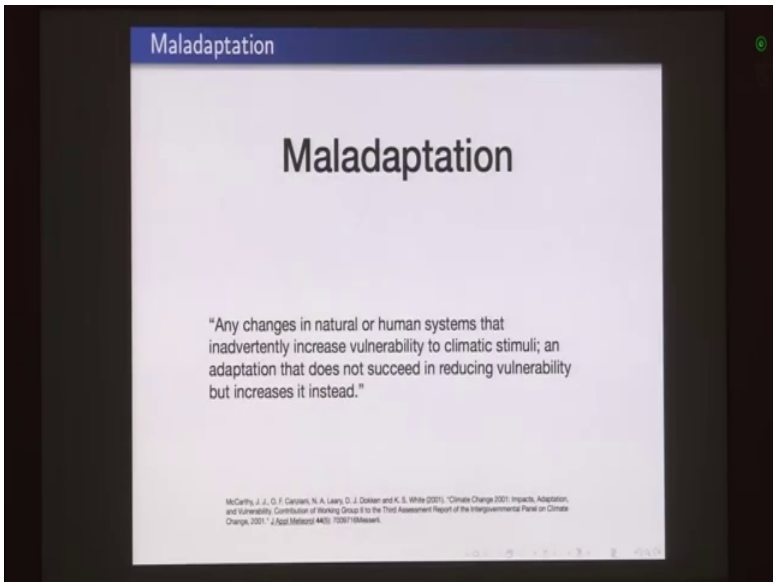

Next we looked at maladaptation. So, maladaptation is an adaptation that is not working properly or that is that has gone wrong. Any changes in natural or human systems that inadvertently increase vulnerability to climatic stimuli; or an adaptation that does not succeed in reducing vulnerability, but increases it instead is a maladaptation. Next we looked at plastics in biodiversity.

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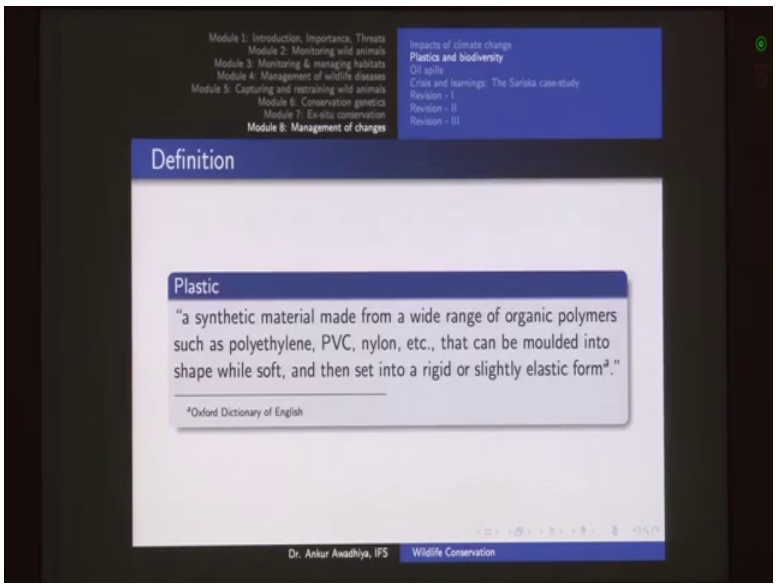

What is a plastic? So, it is a synthetic material made from a wide range of organic polymers. That can be molded into shape when soft and then set into a rigid or slightly elastic form.

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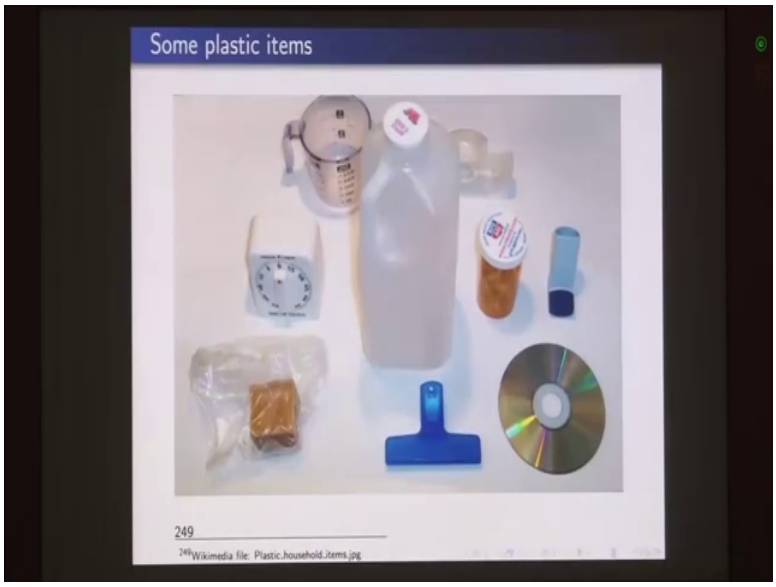

So, we are surrounded by plastics they have a very long history.

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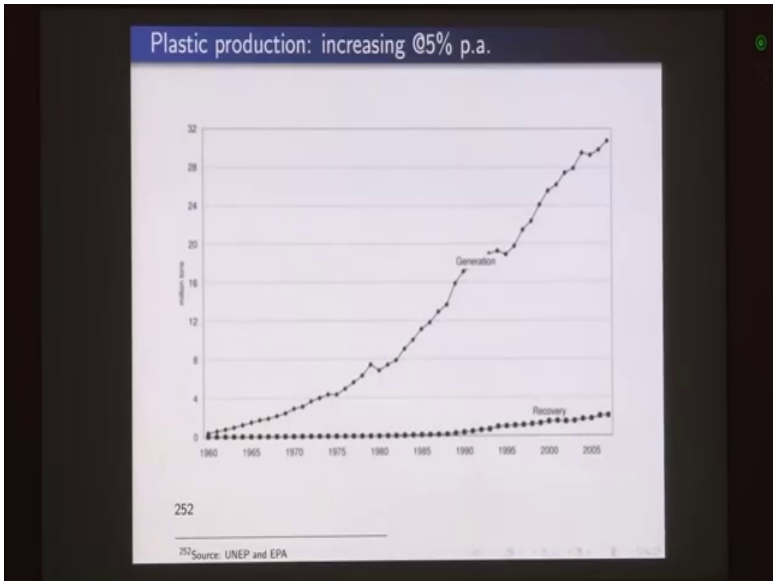

Then plastic production has been increasing, but the amount of plastics that has been recovered that is that has been recycled, or reused is very less.

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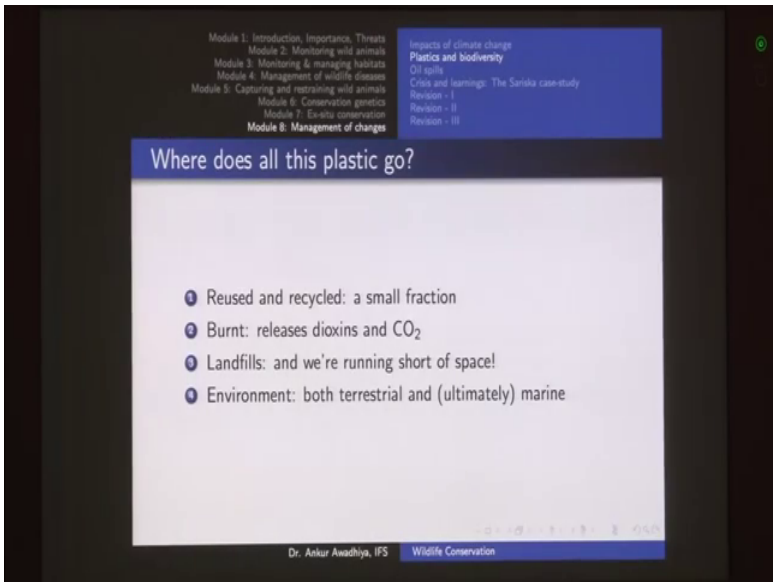

So, what are the options available for these plastics? Reuse and recycle is a very small fraction, otherwise they can be burnt in which case they release green course gases and also toxins such as dioxins.

Then you can put them in to landfills, but we are already running out of space. And then the rest of the plastics will go into is the environment which should be terrestrial as well as marine environment.

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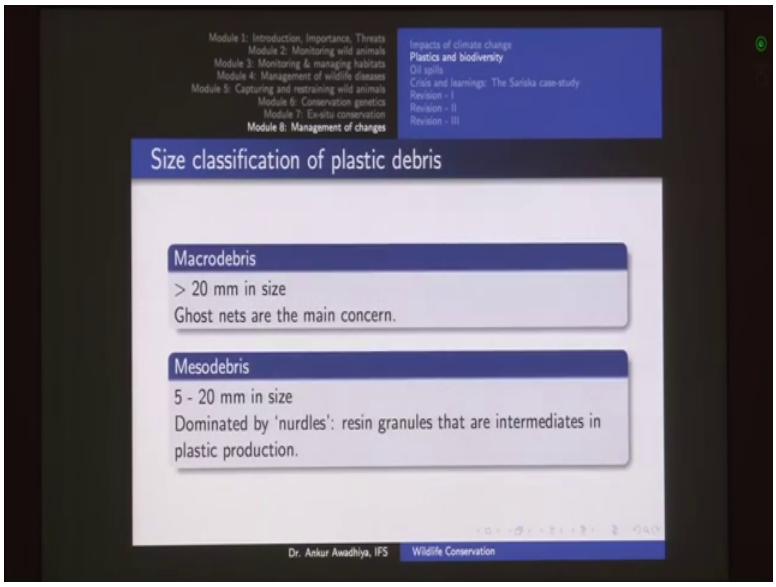

Next we looked at size classification of plastic debris. So, plastic debris that is greater than 2 centimeters in size is macro debris. So, this is greater than 20, 20 millimeter or greater than 2 centimeters meso debris is middle size. So, this is 5 to 20 millimeters, and micro debris is less than 5 millimeters.

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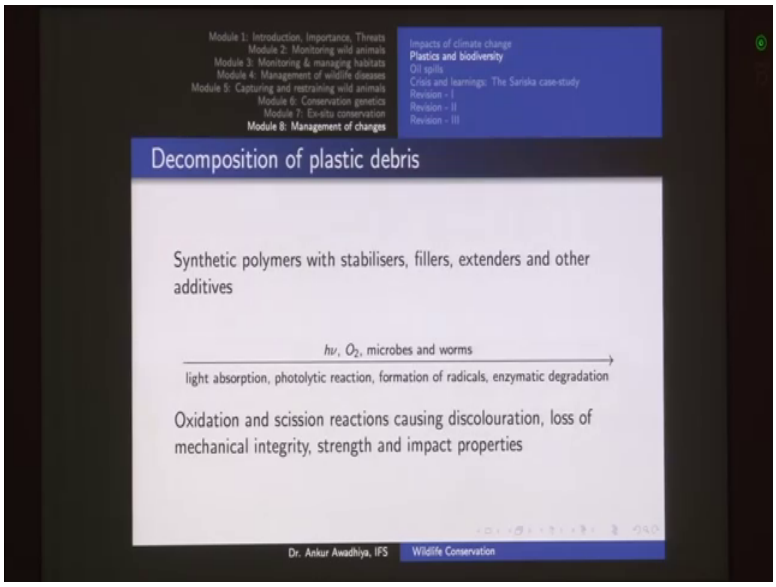

Next we looked at decomposition of plastic debris fate of marine plastics.

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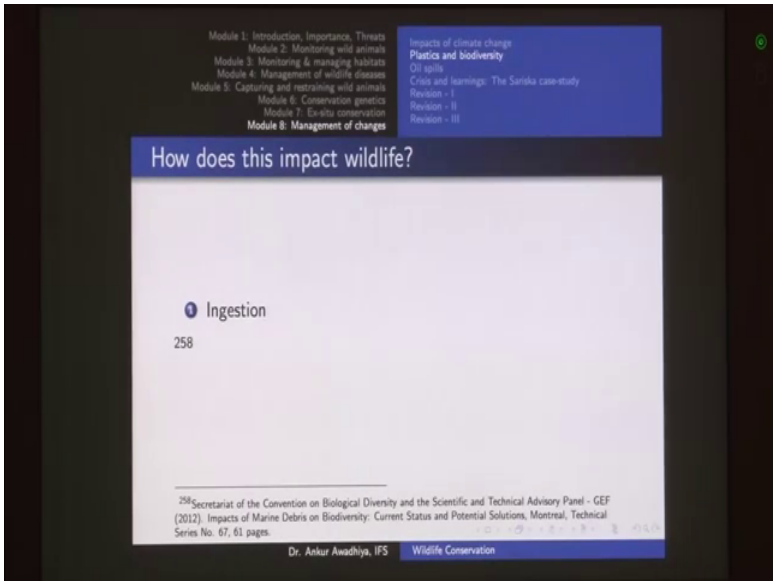

So, you have floating plastics, you have plastic that what ashore, and you have plastics that come on the see beds.

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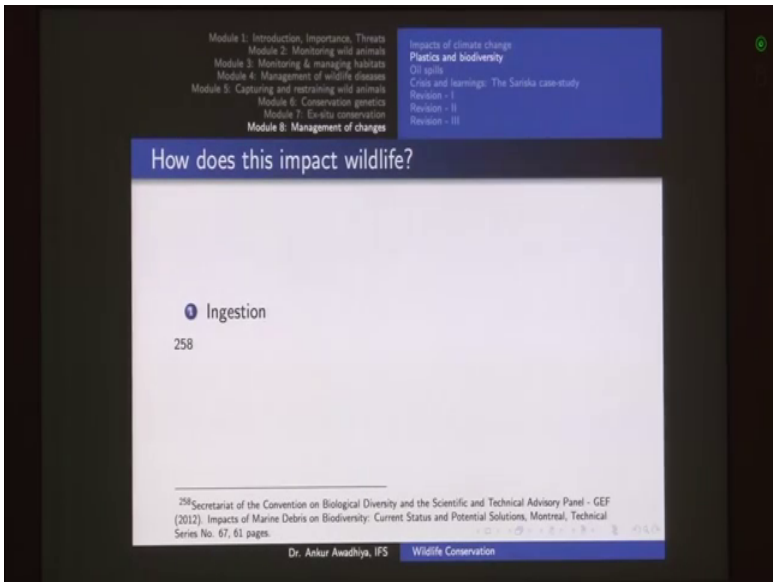

Now, does it impact wild life?

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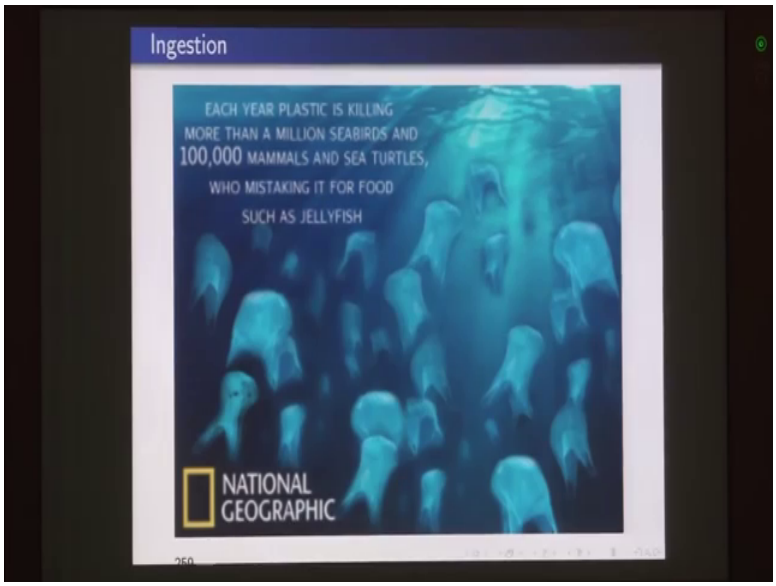

You can have situations of ingestion in which animals confuse plastics for food.

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And then this plastic completely blocks up the elementary canal. And the animal dies because it is not able to get any nutrition.

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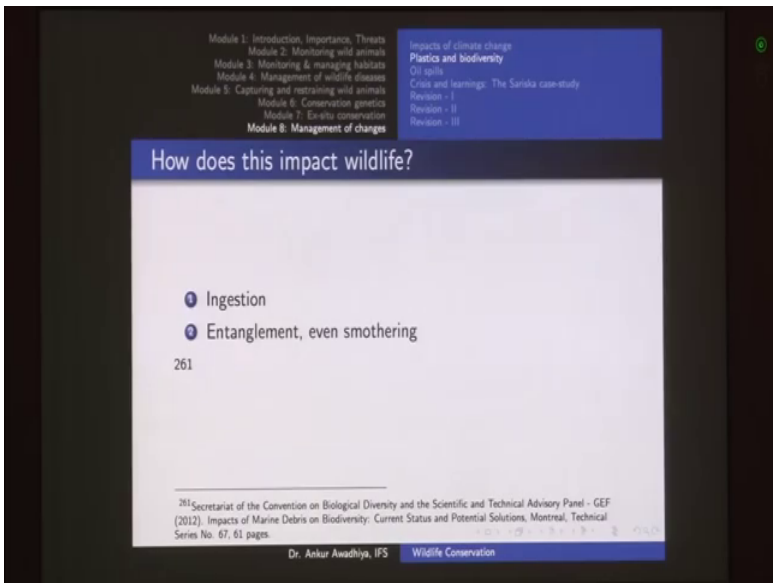

Next is entanglement or smothering of animals.

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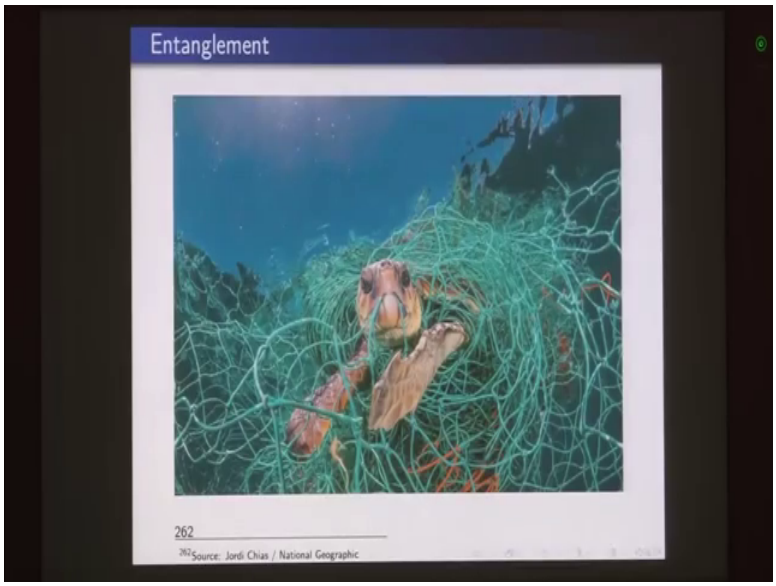

So, this is a turtle that has got entangled in a net.

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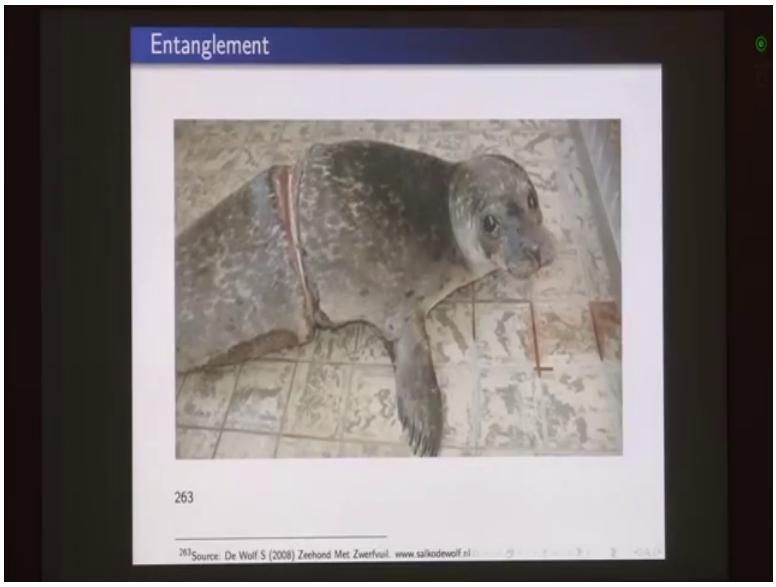

Here you have a seal that is whose body is being cut because of this plastic.

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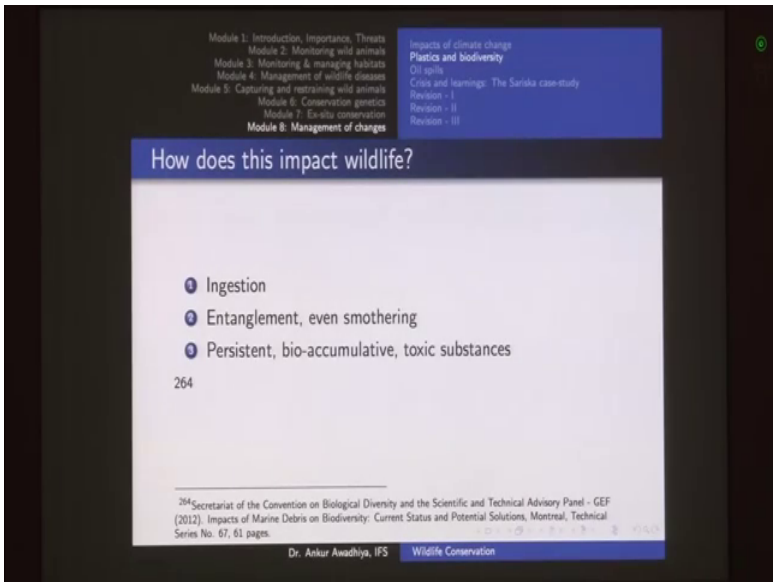

Then you can have persistent, bio accumulative, toxic substances like bisphenol A, and brominated flame retardants.

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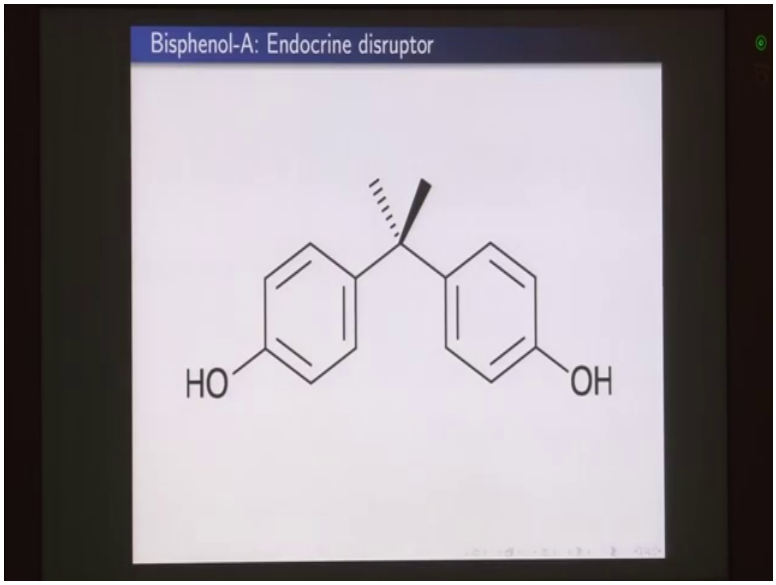

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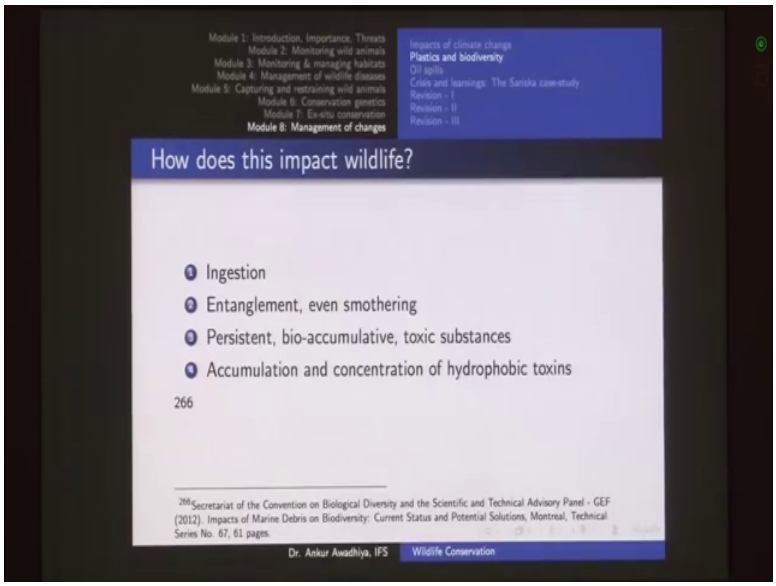

Then you can have accumulation and concentration of hydrophobic toxins, because plastics provide a hydrophobic substance.

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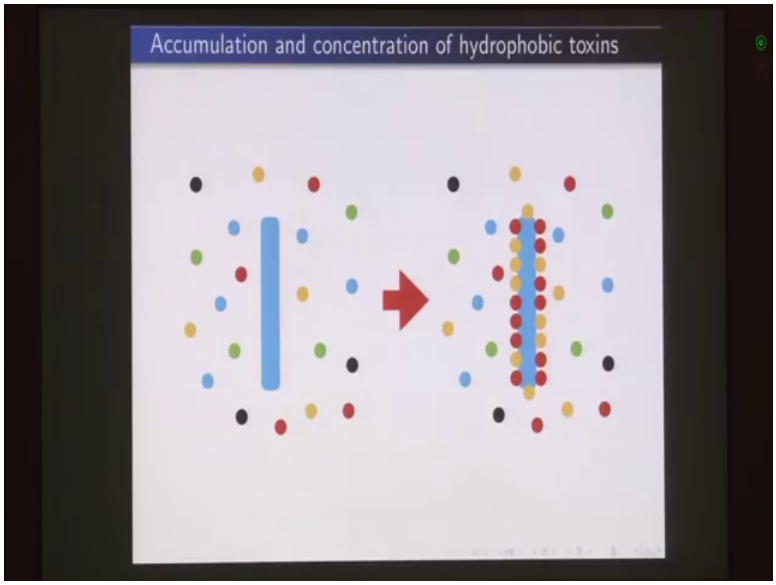

So, different hydrophobic substances would come together. And so the concentration of various toxins will increase on the surface of plastic and when an animal eats it then it will get a very high dose of the toxins.

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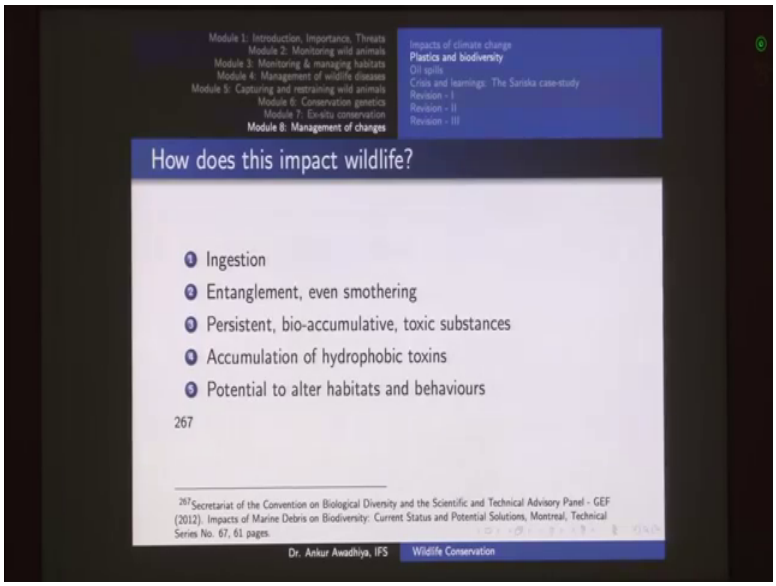

Next it has a potential to alter habitats and behaviors. So, here we looked at different examples.

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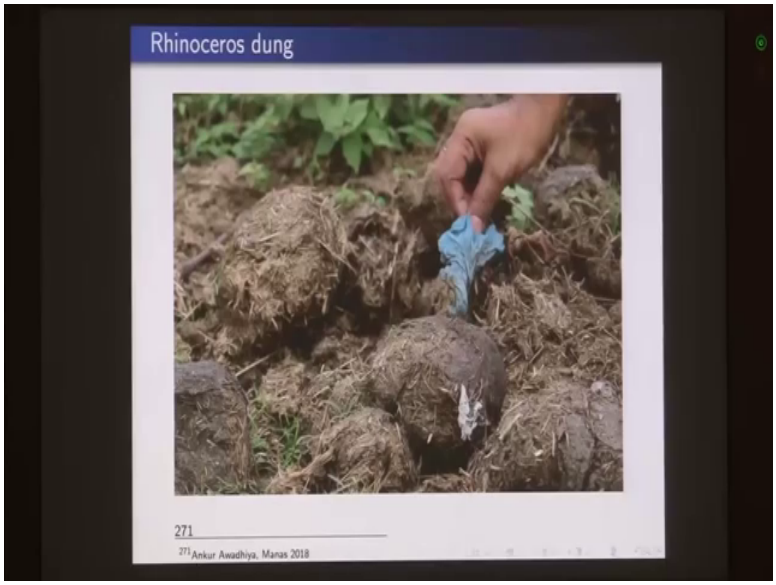

And even in the case of our protected areas even in the case of Manas Tiger Reserve we are seeing plastic in the rhinoceros dung. Then need also alters the dispersion of organisms.

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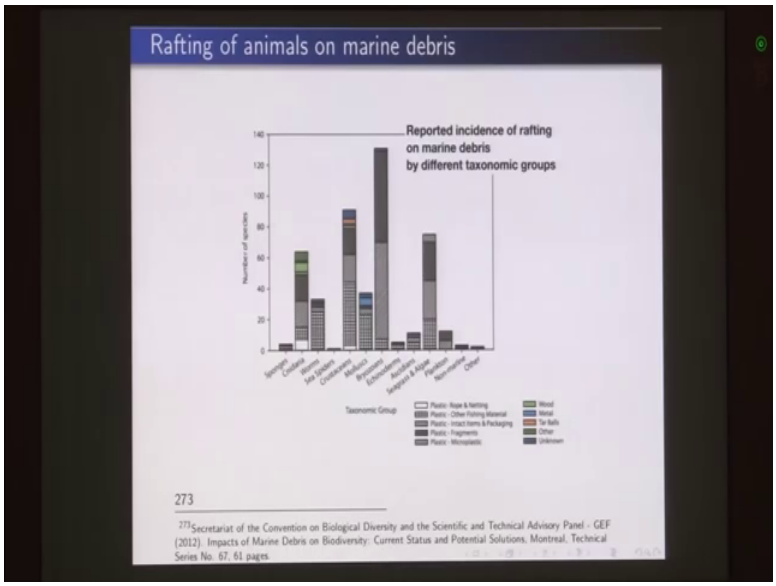

So, these days a number organisms are able to move because of these plastics and not because of the natural amount of dispersal. Dispersal agents that were available before.

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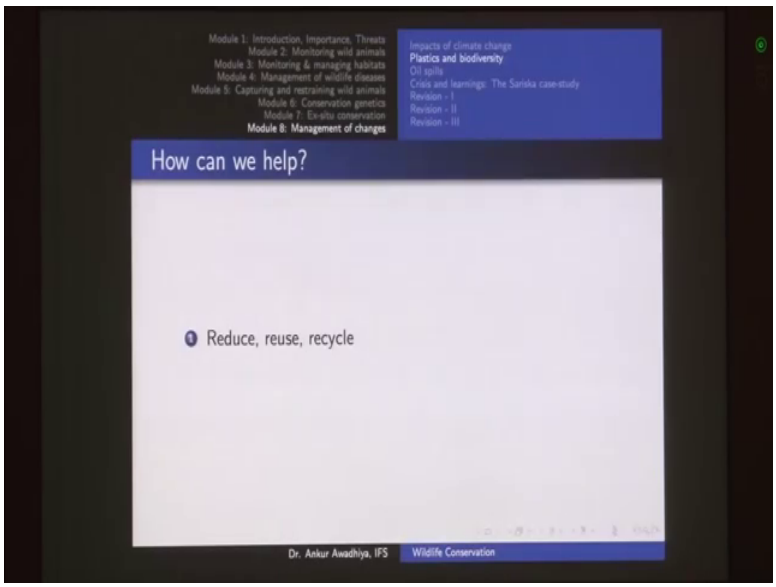

And some of these could even be invasive species. So, what can we do? We do to help reduce, reuse, recycle, life style changes or an alternative material such as bioplastics.

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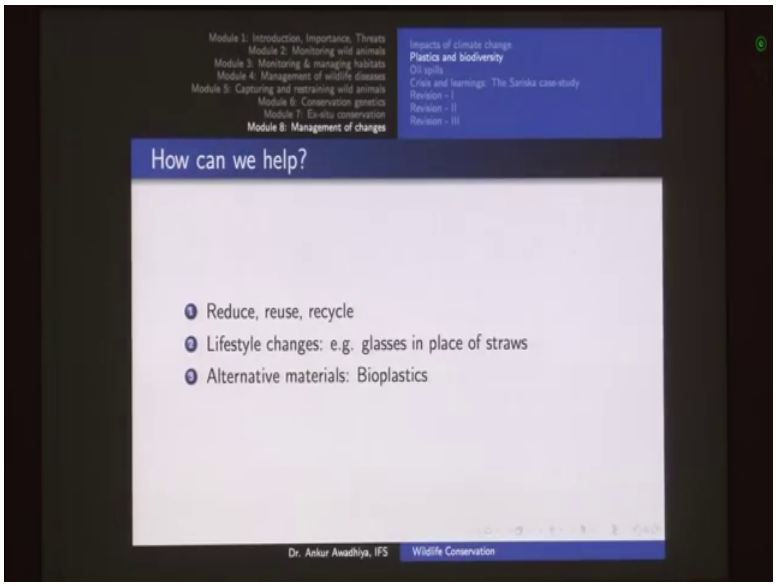

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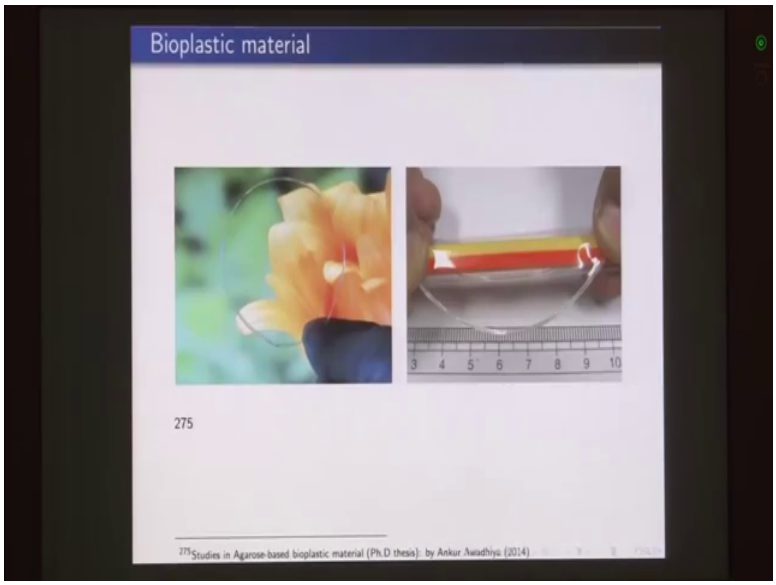

So, here we looked at this bioplastic which has all the properties of or most of the properties of polyethylene. So, this is transparent, this is flexible.

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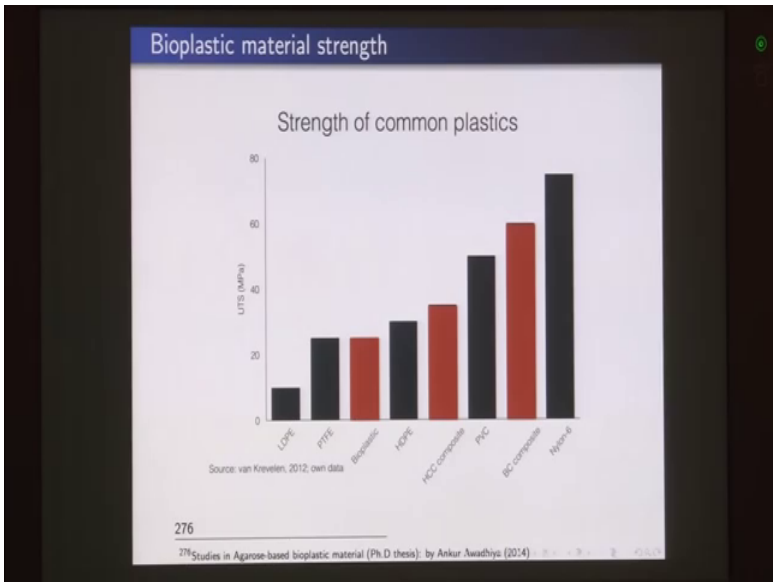

And then it is a strength is also much greater than that of your lower density polyethylene. And with certain other ingredients should can also increase to more than the high density polyethylene. So, such kinds of plastics which are completely biodegradable which can be eaten by animals need to be promoted.

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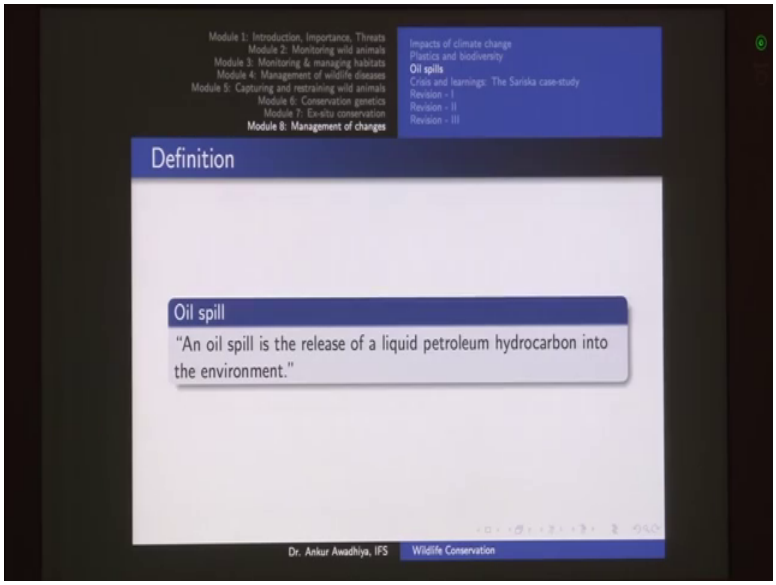

Next we had a look at oil spill. So, what is oil spill? It is a release of liquid petroleum hydrocarbon in to the environment, it can be terrestrial or marine.

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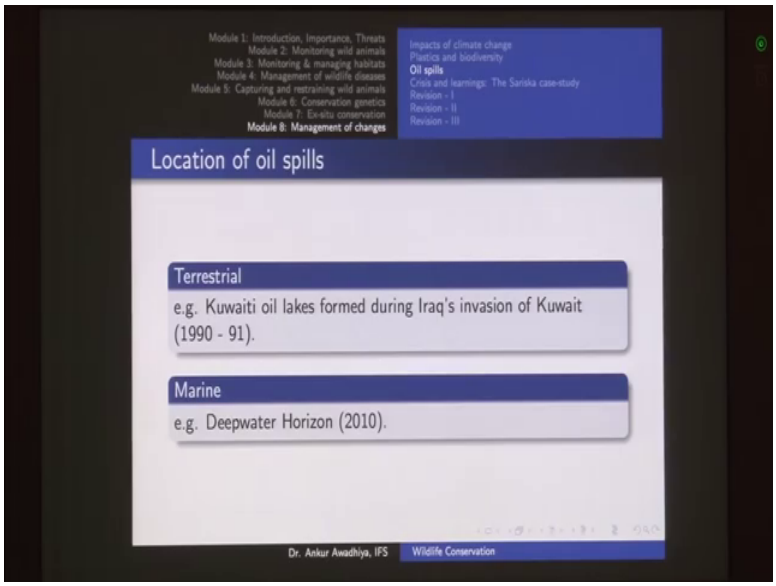

So, we looked at these Kuwaiti oil lakes that were created and this is a marine example.

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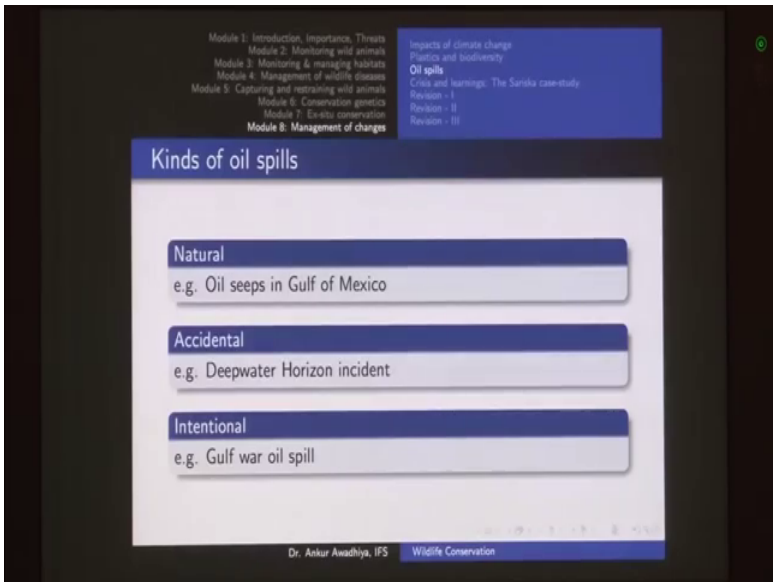

This can be natural accidental, or intentional.

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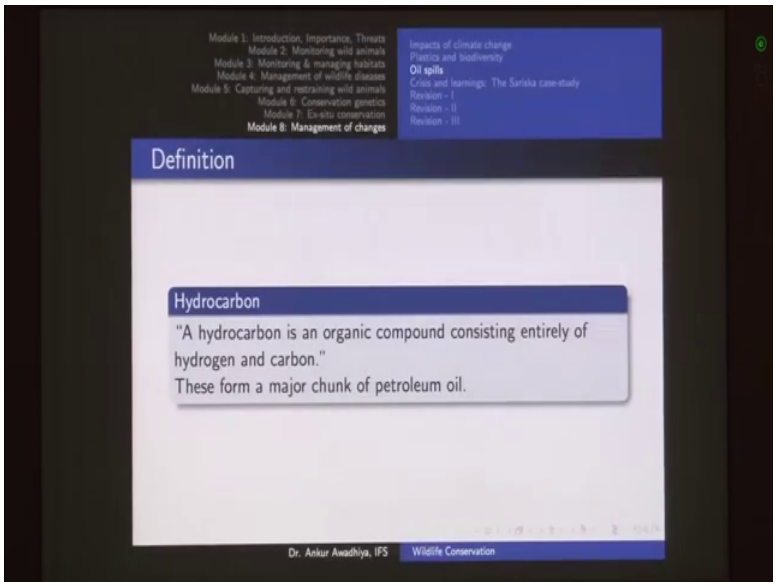

So, this is a natural oil lake. And then next we looked at what is a hydrocarbon? It is an organic compound consisting entirely of hydrogen and carbon. So, there are various hydrocarbons.

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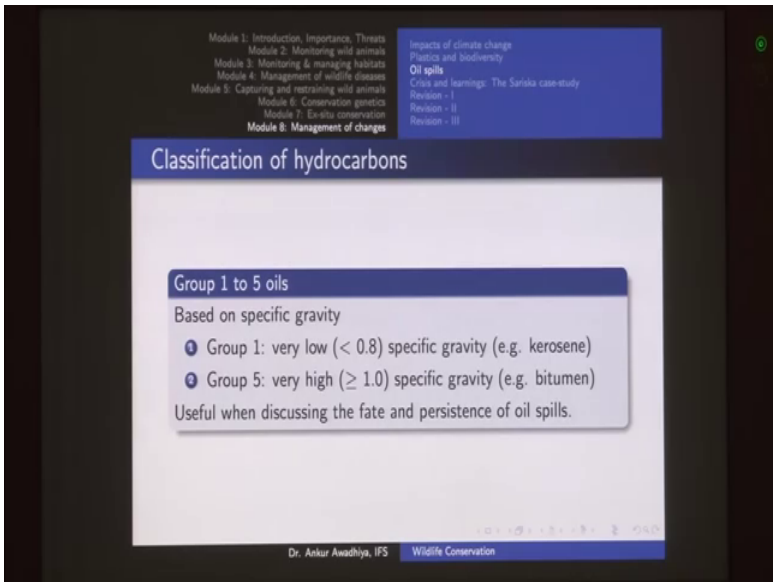

Next we defined or we classify hydrocarbons based on their specific gravity. So, you have group 1 hydrocarbons that are very low specific gravity. Group 5 hydrocarbons that have a very high specific gravity and others come in between why is this important? Because those with less specific gravity are going to float on water, those with higher

specific gravity are going to sink down. Also those with less specific gravity will be more volatile, those with higher specific gravity will be less volatile.

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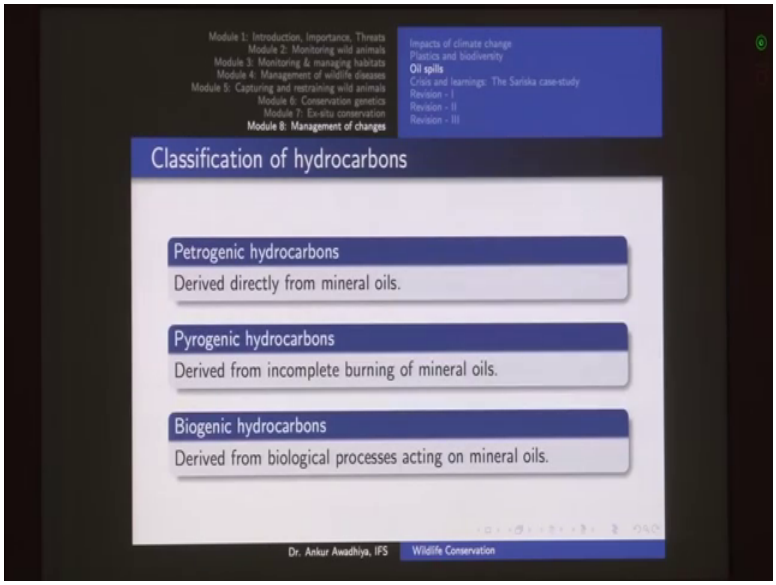

Next we looked at three different classifications based on the origin. So, you can have petrogenic which are directly derived from mineral oils. Then if these mineral oils are burnt then because of incomplete burning we will have pyrogenic pyro is heat. So, this is a heat formation this is rock formation and third is biogenic that is biological formation which is derived from biological processes acting on the mineral oils.

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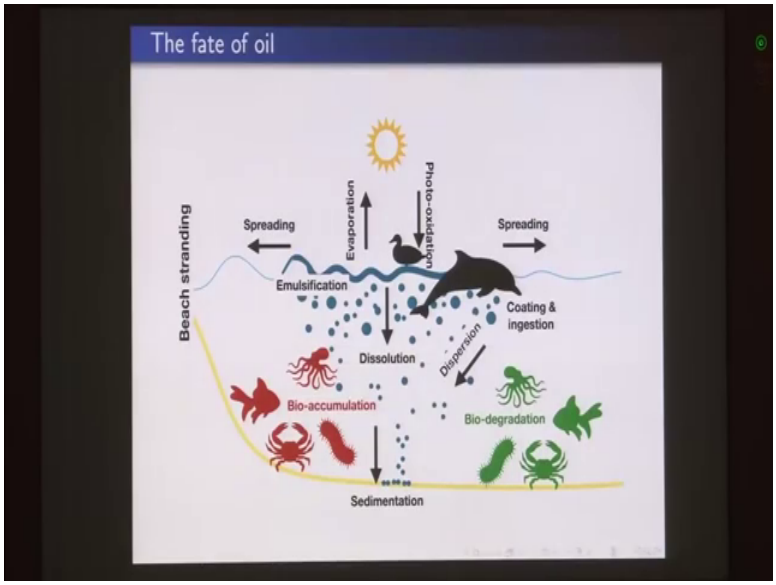

Next we looked at the fate of oil. So, if there is oil then it will spread that this may evaporate, there will be some photo oxidation there some will be emulsification some parts will dissolve, some parts we will dispose. And some parts will sediment down and then these will quote and these will be ingested by certain organisms. In certain cases there will be a bio accumulation in certain cases there will be a bio degradation of these oil components.

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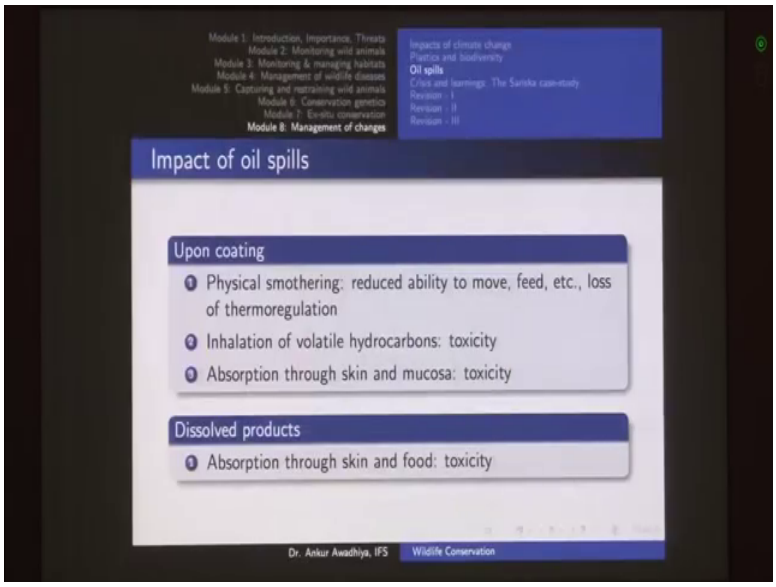

Next we looked at different impacts. So, impacts upon coating impacts of dissolve products.

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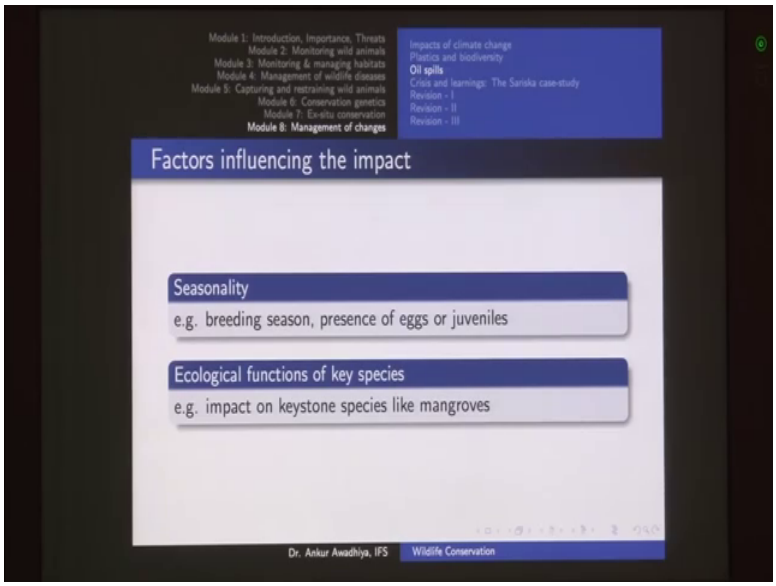

And then factors influencing the impact the seasonality. So, if there is an organism in it is breeding season it is it will have a greater impact, then the ecological function. If there is a key stone species; then the impact on the ecosystem will be much greater.

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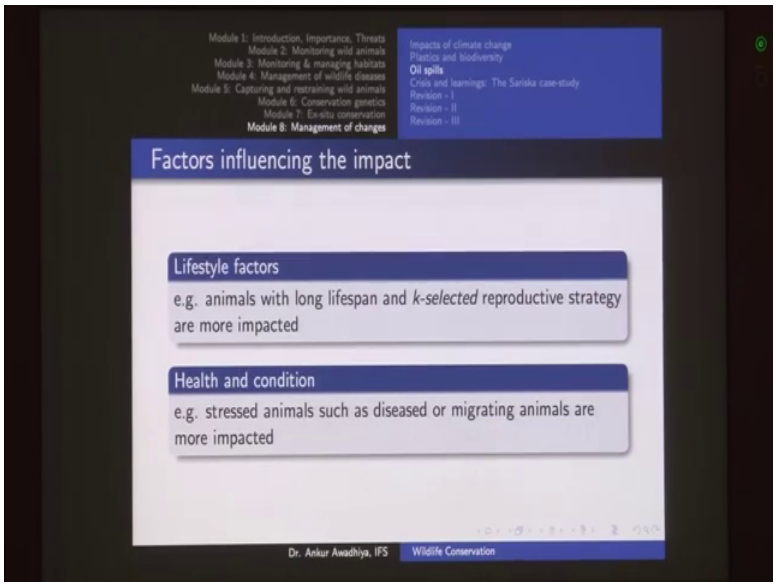

Life style factors animals with long life span and k selected reproductive strategy. So in this strategy there the animals go for less number of offspring's, and give much more attention. So, if those offspring's die then there is a very little chance that this a species

will be able to cope with this situation, and then health and other prevailing conditions in the animals.

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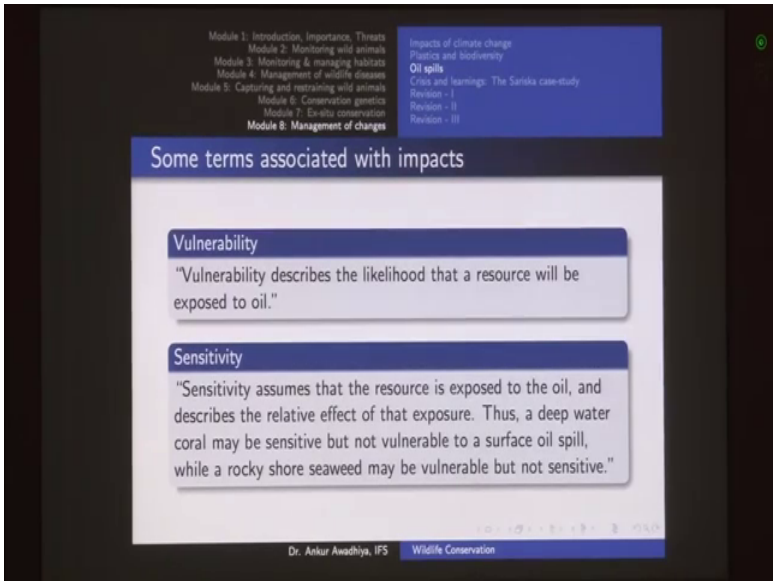

Next we had look at vulnerability and sensitivity. So, vulnerability is the likelihood that your resource or your animals will be exposed to oil. And sensitivity assumes that your resource or the animals are already exposed to oil and then it ask what is the relative effect of that exposure. So, there could be some species that will be highly sensitive and there could be some species that are more resistance to the impacts of oil.

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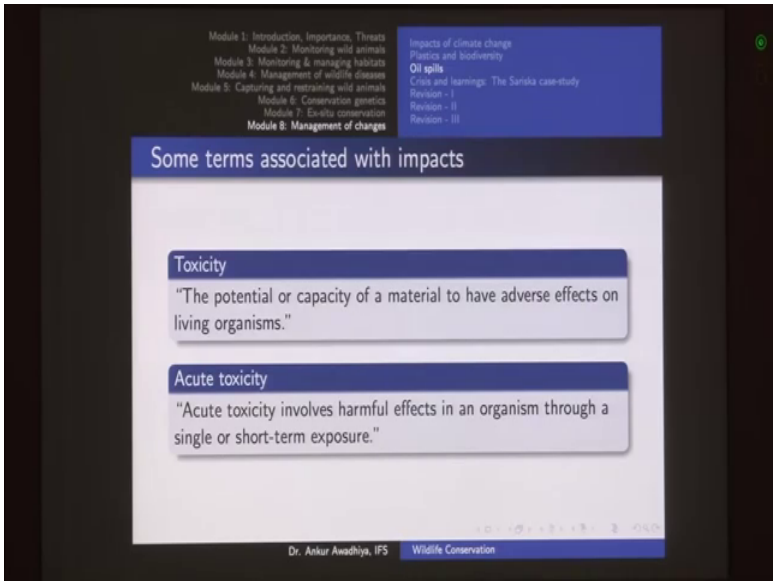

Next we looked at toxicity; toxicity is divided into two parts acute and chronic toxicity acute toxicity occurs in a very short period of time. So, if there is an animal that is given say cyanide and this animal dies so, this would be a case of acute toxicity.

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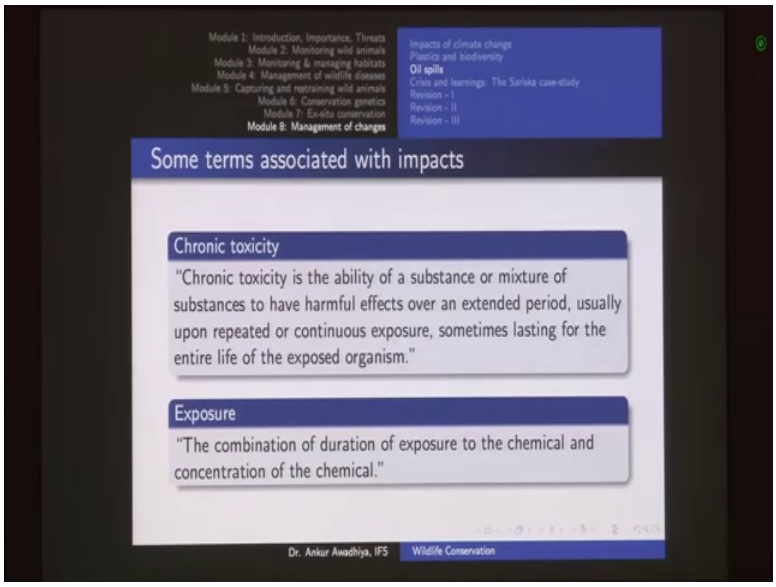

Chronic toxicity is something that occurs in a very long time spam. So, if there is a person who is living in a house that has lead paint. So, this person is exposed to lead for a very long period of time and will show impacts of chronic toxicity.

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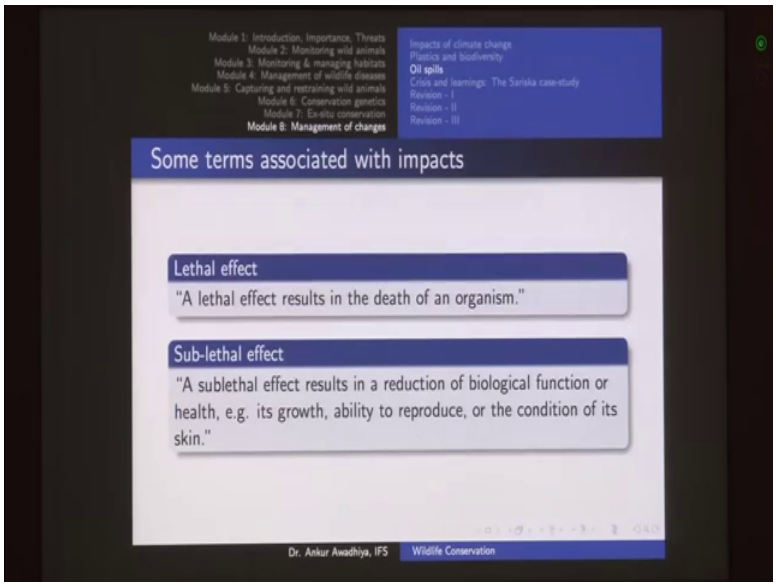

Next we looked at exposure root magnitude lethal and sub lethal effect. So, lethal effect is when an organism dies sub lethal effect is when an organism has a reduced biological function, or health.

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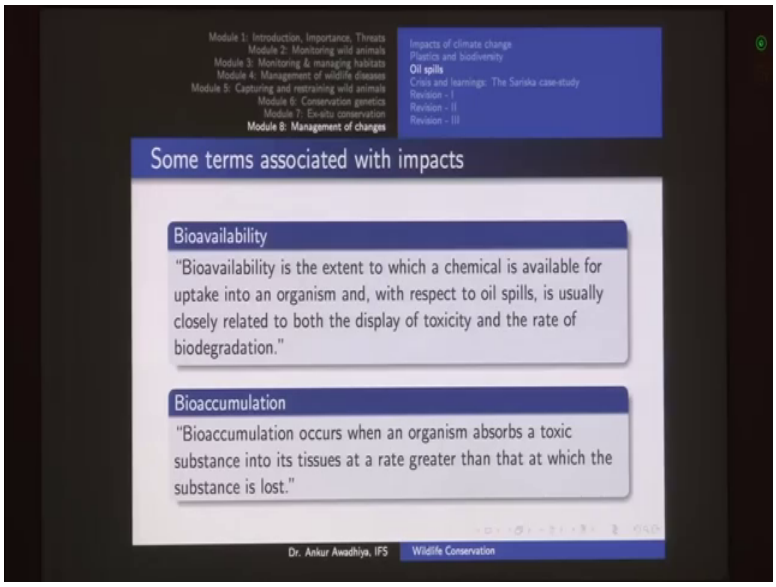

Next we looked at bioavailability, bioaccumulation.

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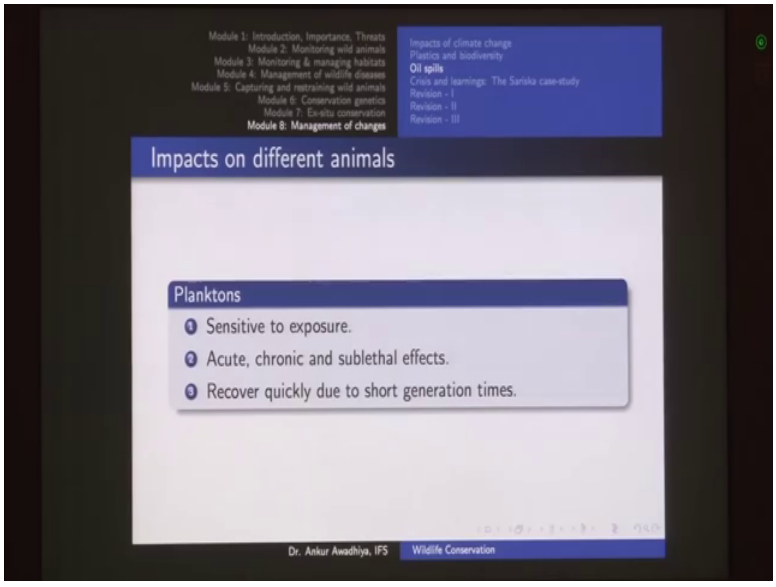

And impacts of on different animals like planktons, seabird life, fish, marine mammals, marine reptile's birds, shoreline and coastal habitats.

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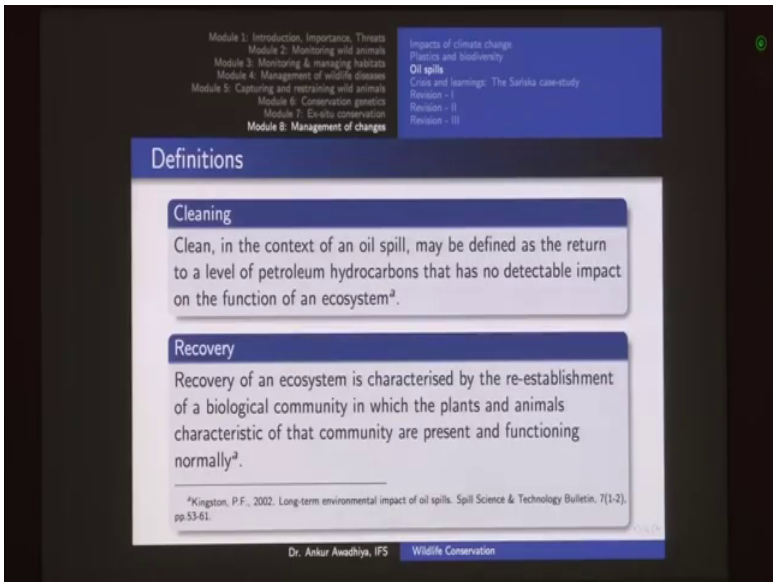

When there is an oil spill we go for cleaning operations, and our aim is to recover the ecosystem back to it is full productivity.

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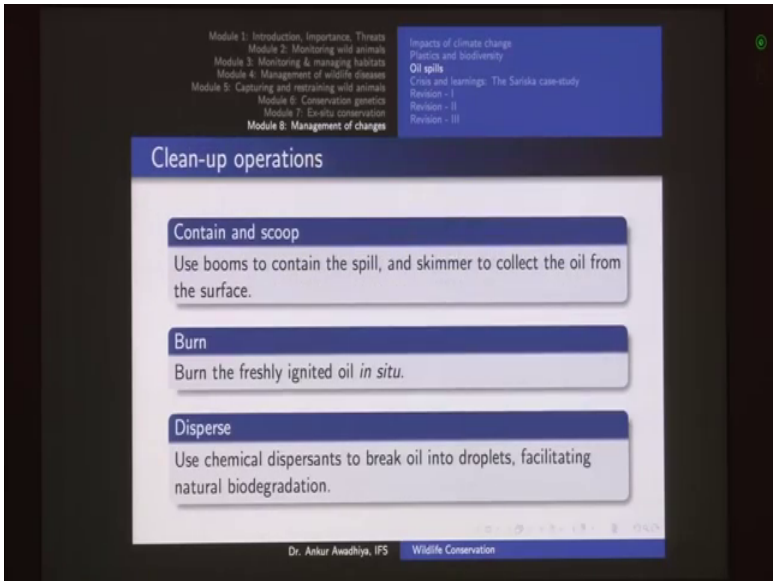

So, these cleaning operations could include clean and contain and scoop operations in which the oil is contained. And then it is taken away or you can burn this oil in on the site, or you can use dispersants to disperse the oil.

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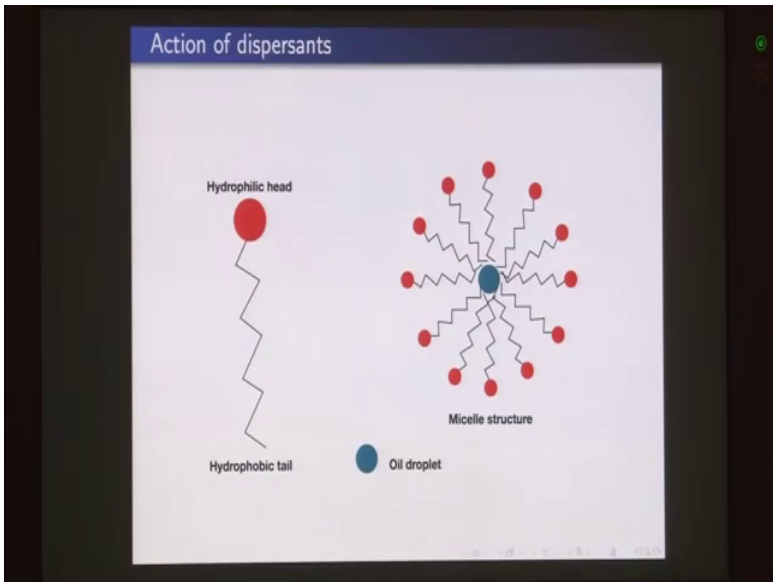

So, these dispersants are very similar to detergents they have a hydrophilic head, and hydrophobic tail. So, the tail attaches to the oil globule the head is able to move around in the water. And so this is able to break the oil into smaller pieces and then disperse the oil away. But then this could also have another unintended consequences on the habitat, or in certain situations if the impact is very less we can just nature act.

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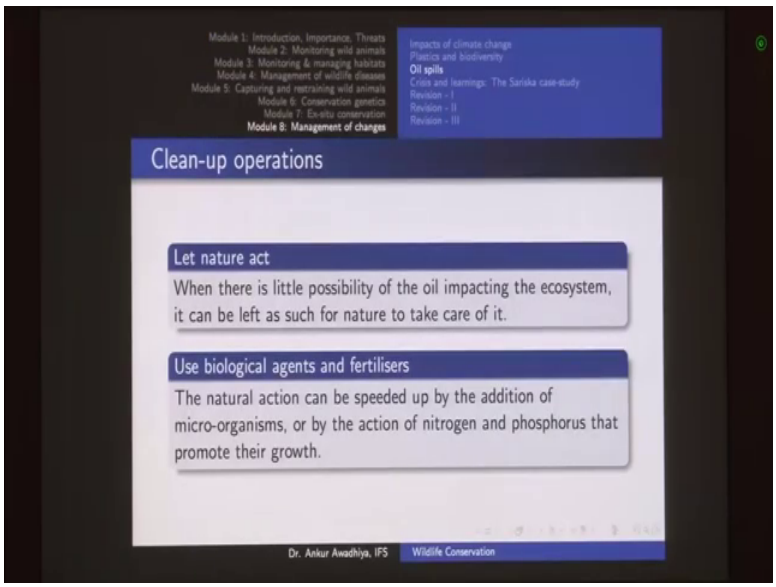

So, we will not do anything or we can just add some fertilizers. So, that the number of naturally acting microorganisms increase and so, the action of nature is expedited.

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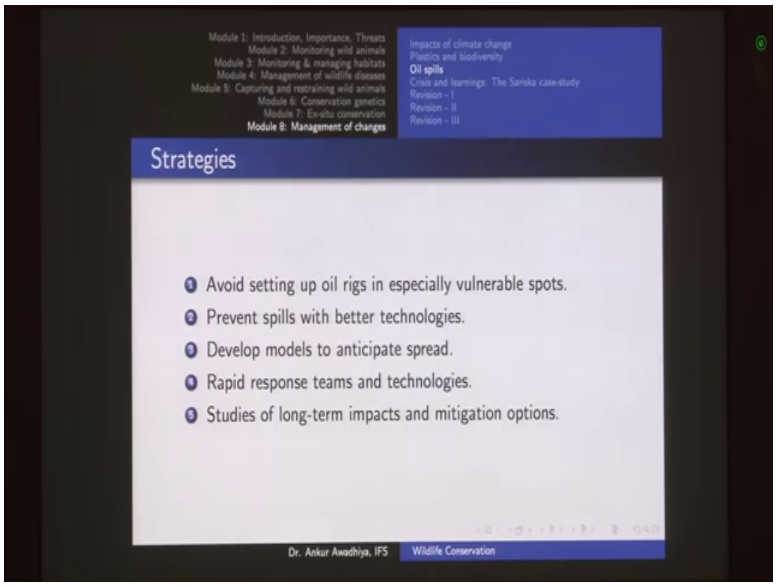

Other strategies are to avoid setting up oil rigs in vulnerable spots, use better technologiesm, develop better models to anticipate spread, rapid response teams and technologies with lots of trails and lots of simulated scenarios and studies of long term impacts and other mitigation options that can be developed.

Now, last we looked at crisis and learning's. Thus, the Sariska case study; so, Sariska is a Tiger Reserve that is located in the state of Rajasthan, it has an undulating topography.

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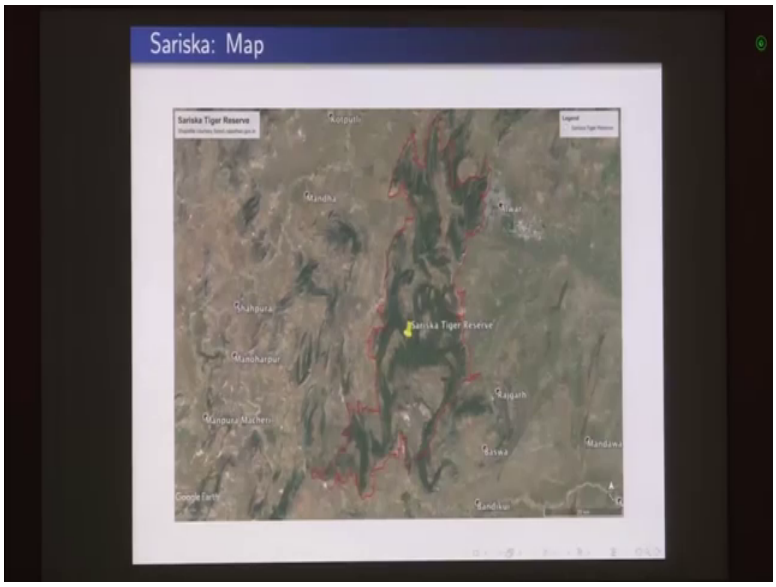

There are forested areas, there are non forested areas. So, tree areas with density, tree canopy in areas with less dense tree canopy. And if you look at now most of the other surrounding areas have very little amount of recover.

Now, in this area with undulating topography you have a very heavy footfall of tourist and very good amount of animal diversity, plant diversity, and a number of other tourist attractions.

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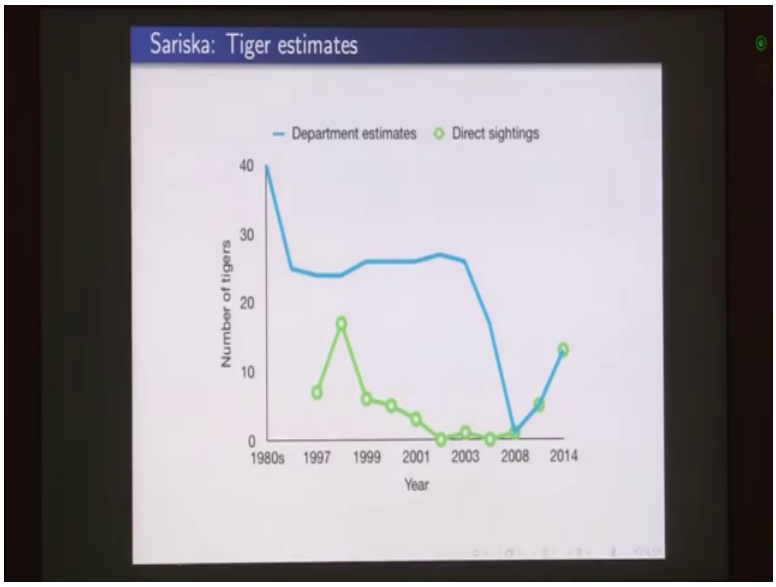

So, in this case we saw that we had very different estimates of the number of tigers by the department, and as figured out from the direct sightings. So, departmental methods earlier used the pugmark method which was not that accurate. And these are the direct sightings that were reported by the tourist.

Now, if you are not using a very good method for quantification then it is possible that even when your tiger numbers are going down, or have gone down you will not be able to detect that and this is what happened.

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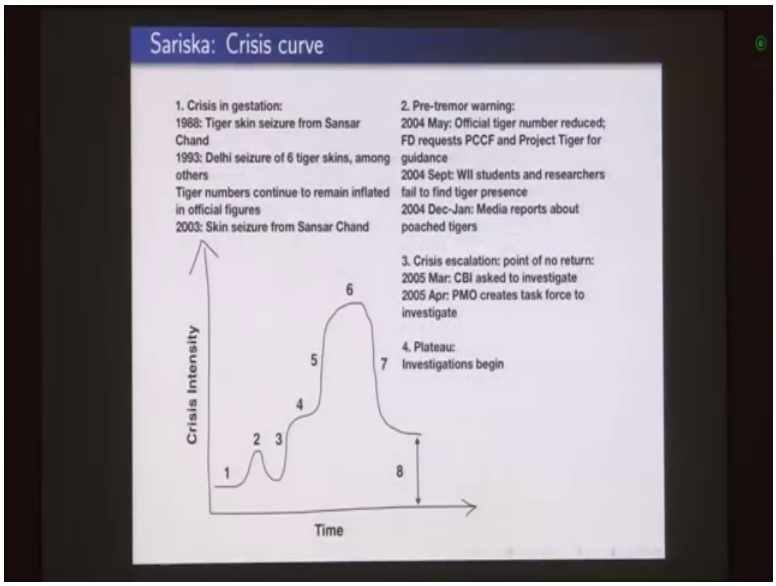

So, and so in this case we have the crisis curve we had a long gestation period in which we were getting Tiger skin seizures from a number of places that could be lend to a poacher known as Sansar Chand. But then we could not do anything because there was no way of correlating these tiger skins directly with the areas that is Sariska.

Then pre tremor warning came in 2014. Then official number of tigers had to be brought down and then there were researchers and students who did not find any tigers, and then by 2004 December the media started reporting about post tigers. Next there was a crisis escalation at this point when the prime minster office set up a task force and the CBI was also asked to investigate. Then there were was this period of investigations.

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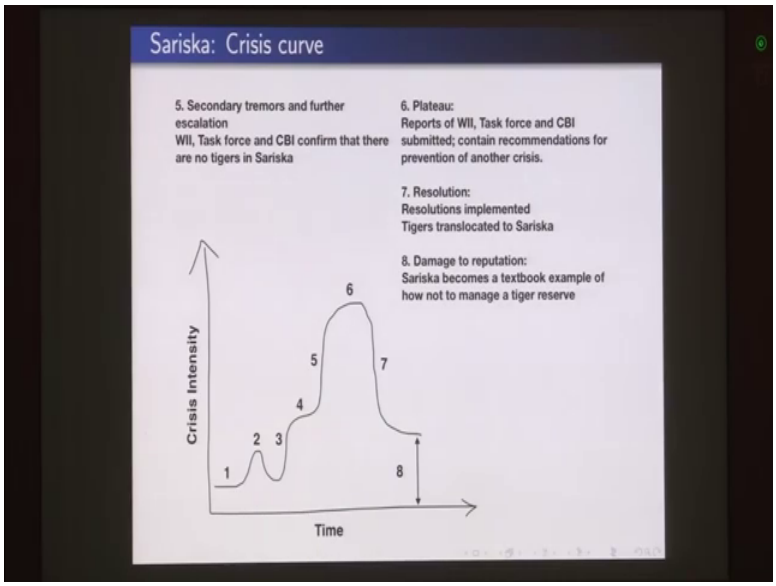

Now, after the investigations there were secondary tremors and further escalation. When WII task force and CBI all confirmed that there are no tigers left in Sariska. Then we came to this plateau region in which the reports were finally, submitted and they contained the recommendations that needs that needed to be used and then we have this resolution phase.

So, in the resolution phase all the recommendations were implemented and you we had tigers that were translocated to this area from other tiger reserves to recreate this populations. So, these tigers were reintroduced to this area, but even after all these there was a damage to reputation.

Because this became a text book example of how things should not be done? Later on this reputation damage was brought down because of all these translocations are with better protection strategies, we had a good text book example of how to overcome the crisis.

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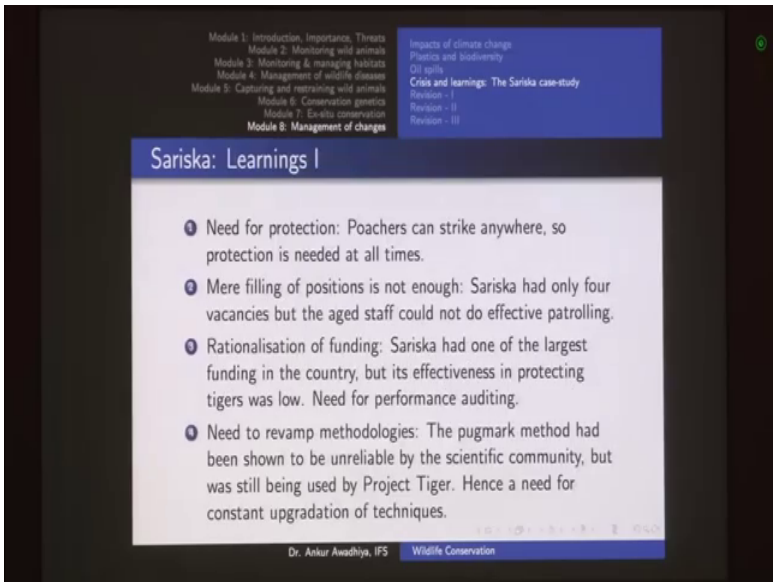

So, we look at turning points and the learning's. There is a huge need for protection of the areas. Poachers can strike anywhere and at all times then mere filling of positions is not enough you need more active staff, you need more trained stuff, there is a need for rationalization of funding. And there was a need for remapping of a methodologies. So, pugmark method has now been replaced completely by the camera trapping method. And then need for keeping channels of communication open.

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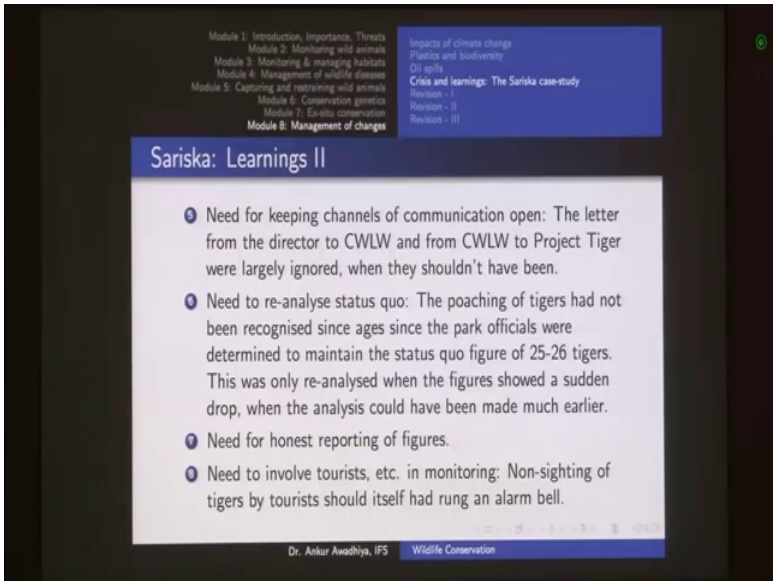

So, in this case the project tiger was replaced by the national tiger conservation authority. And so that is now providing much better channels of communication. Then need to reanalyze status quo need for honest reporting of numbers need to involve tourist. So, essentially conservation is not something that only the forest department is doing, or should be doing. Conservation is something that needs to be done by the society at large. So, you can you can and you should ask for information from the tourist, from the students, from the researchers, everyone. So, everyone should be able to give us these suggestions.

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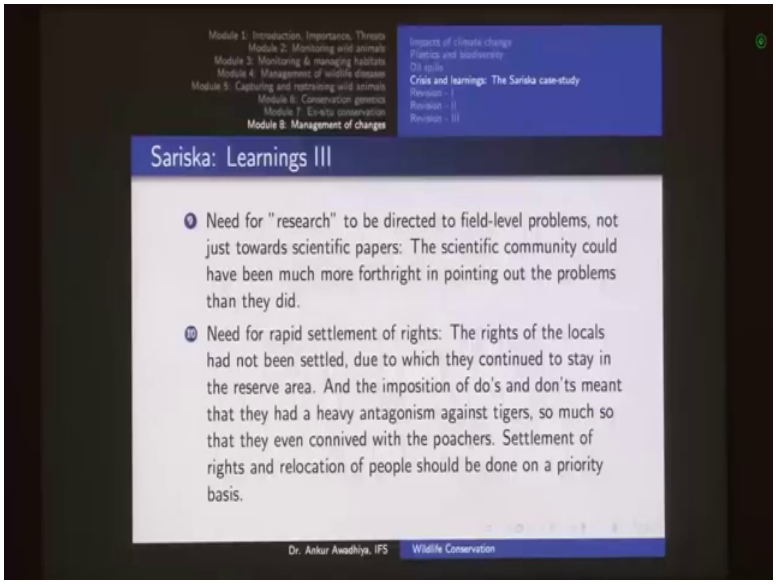

Then there is a need of research to be directed to field level problems. Need for rapid settlement of rights.

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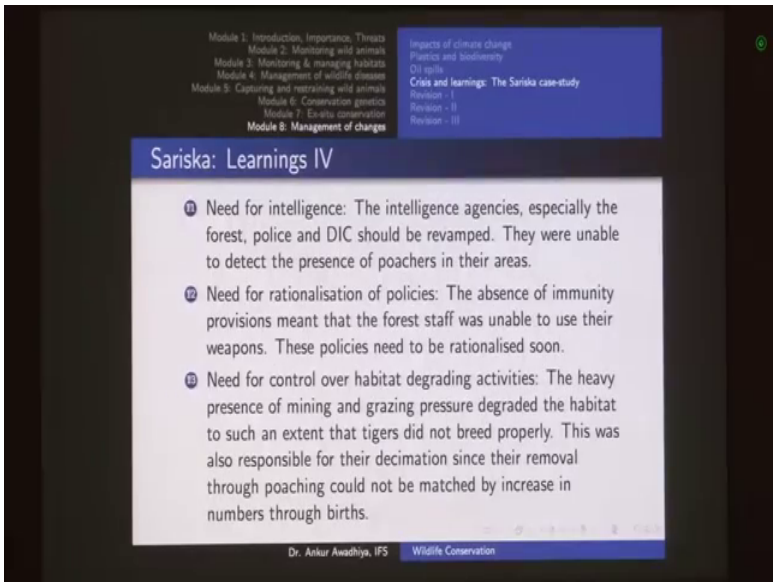

More intelligence, more rationalization of policies, then provisioning of immunity to the forest guards, need of control over habitat degrading activities and need to improve the habitat productivity and corridor connectivity.

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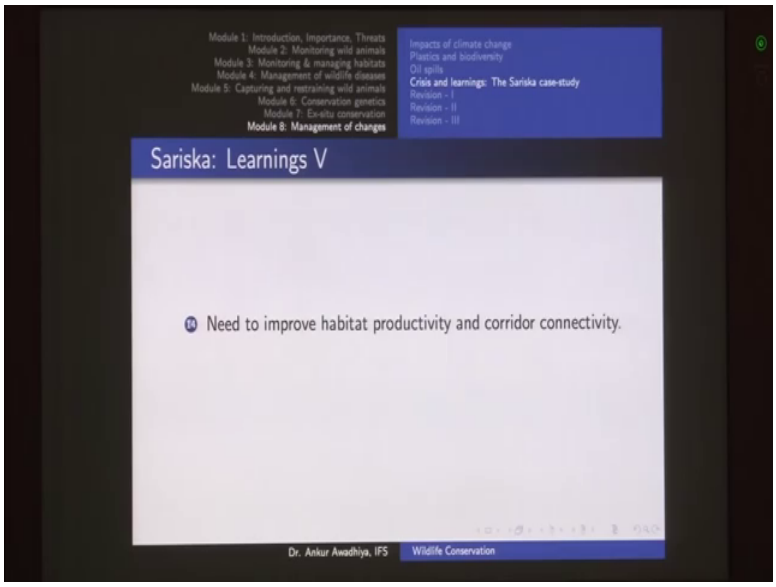

So, a number of these recommendations have now been put in place not only for Sariska, but all over the country, so that is all for today.

Thank you for your attention good luck for the examinations, do well be in touch [FL].