Environmental Science
Lecture 18

Methods to control Soil Pollution

Primarily reducing chemical fertilizers and use of fertilizers. Recycling is another important way to reduce and control soil pollution. When we recycle paper, plastics and other materials, it basically reduces the volume of refuse and landfills which is a major common problem of soil pollution. Reusing of materials. Deforestation - the cutting down of trees, causes erosion, pollution and the loss of fertility in the topsoil. Planting trees or reforestation helps prevent soil erosion as well as pollution of the soil.

Weeds soak up minerals in the soil. Reducing weed growth also helps reduce soil pollution. One of the more common methods of reducing weed growth is covering the soil with numerous layers of wet newspapers or a plastic sheet for several weeks before cultivation. This prevents light from reaching the weeds, which kills them. Designated pits should be used for the dumping of soil wastes. These wastes should be treated chemically and biologically to make them less toxic and hazardous.

Reuse, Recycle and Reduce consumption especially within our own homes we need to segregate the waste. Things that can be decomposed need to be put in a compost pit. Things which can be recycled like plastic and glass need to be put separately. As hazardous wastes like computer parts, batteries, cds, all that have to be collected separately.

Treatments of Soil Pollution - the conventional methods of soil pollution are very time-consuming and very costly. EPA officials excavate the soil to dispose of it elsewhere, a band-aid for the problem, no doubt but essential for toxic disasters in highly populated places. Soils can be aerated, heated up in a process called thermal remediation, contained with pavement or caps, extracted with an active electromechanical system of propagating the soil with microbes that will digest organic pollutants.

A basic case study of soil pollution - Love Canal is perhaps the most famous case study of soil pollution. In the snowy winter of 1976, chemical waste began to seep above ground in school playgrounds and communities in Niagara Falls, New York. The area suffered high incidences of stillborn births, miscarriages and birth defects. Officials soon realized that there were over 400 toxic substances in the air, water and soil, many of them cancerous. As it turns out, the area had been used as a chemical dumping ground for more than 22,000 tons of toxic waste at the turn-of-the-century when no one was actually aware of the hazardous impacts it could have decades later. That is what is very important about heavy metal poisoning. The effect needn't

be immediate and it needn't be immediate in the time frame, it could be felt many years later as well as in a different place completely.

Another important case study happened in Chernobyl, a small town in Russia A nuclear power plant exploded in April 1986, which caused a sevenfold increase in birth defects, a marked increase in cancer that was passed down to future generations, livestock death and mutation and tainted agriculture. It's estimated that 40% of Chernobyl is still uninhabitable due to radiation contamination that is ten times the normal level in some places that we are talking about today. Its nearly 30 years later and the effects are still felt. Within our country, a soil pollution site along Kalwa Bridge at the Thane creek in Maharashtra, soil pollution has been reported along the wetland of thane creek. Due to the depositions by Thane-Belapur Industrial Complex in South Bombay. Heavy metal pollution and physiochemical characteristic is detected. pH level, bulk density, alkalinity and chlorinity is recorded high during dry season. This is the Kalwa Bridge at the Thane Creek, you can see both soil as well as the water under the bridge is getting contaminated severely. If you look at the cycle of reaction, you have wet waste that decomposes and releases bad odour, you have poisonous gas leaks like Methane (CH_4). Then you have depletion of mangroves that in turn attracts insects, rats and flies that spread a lot of diseases that lead to a certain amount of problems. The other problems include plant and animal life. Then, stagnant water in rains leads to breeding ground for many mosquitoes which again lead to a series of diseases. Then you have pollution causing damage to road and property and basic bad looks that is there and that leads to economic deterioration because investments especially from foreign sectors reduce when the area does not look hygienic. It's prone to diseases and major thing is collection of plastics and plastic issues. Other impacts you have are; Waste workers are severely affected i.e corporation workers. Hospital and Industrial waste create major health hazards, Decrease in Oxygen levels causing breathing problems, Mosquitoes can carry life threatening diseases. Birds and other small animals die after ingesting toxic waste.

Preventive measures, what can be done; at household level, proper segregation of waste is actually very important. Plastics should not be used, completely avoided is better. Wheel cleaning facility in the sense you need to segregate what is there and in every dumping ground this segregation should happen before it is put in a landfill. Proper method of waste disposal depends on what is the waste. Everything cannot be burnt. If batteries are burnt, it leads to other severe problems. If CDs or computer parts are burnt, it leads to series of other problems. Hence, waste has to be segregated and dealt with its characteristics.

Soil pollution at Deonar dumping ground - this is the largest and oldest dumping ground in Mumbai. It extends over 132 hectares, receives around 5500 metric tonnes of garbage, 600 metric tonnes of silts and 25 tons of bio-medical waste every day. That amount of garbage

cannot be processed in one facility. The main problem is having more number of points at every locality and then brought down to a dumping ground so that the waste can be segregated before it is dumped. Soil pollution due to hazardous substances, this is mainly from hospitals, plastic bags from the neighbourhood, agricultural waste and chemical and biological properties from hospital waste is very crucial because you end up having birds, small dogs, rats; all of these go the dumping ground to get their food and if these hazardous wastes affect them, they bring it to the humans and other neighbourhoods around which will again affect the entire food chain and human ecological system.

Effect on Human Health - Hazard 90% of soil pollution and health on human beings who live on it. For instance; residents of Chembur, Govandi, Mankhurd and Shivaji Nagar. Smoke is affecting asthma patients and the number of asthma and bronchitis patients are steadily increasing.

Soil Pollution at Juhu - Maharashtra - Juhu is actually considered an affluent neighbourhood of West Mumbai. Most of the celebrities live there, it is also a home to a significant portion of Mumbai's Business Elite. Recently, it has been noticed that Juhu has become a place for disposal of wastes. All sorts of waste are dumped here. For example; plastic bags and bottles, paper plates, glass bottles and etc. This kind of garbage disposal has increased the number of mosquitoes and other insects that cause malaria, dengue, which can be fatal. Especially when you have poor people residing in slums nearby. The polluted soil stops the growth of plants and trees in that particular area which then leads to stunted growth or lack of trees that in turn leads to erosion of topsoil when rain happens and it creates an entire vicious circle. This is the polluted soil which leads to various problems. The pictures here represent parts of Juhu beach, a cleanup session that's held by Dominos regularly over there. Communities need to actively participate to do such things. The dirt that's beyond one's ability to get wiped out completely. No human being can clear this level of dirt when it's collected an entire layer of soil.

Preventive Measures- the Government of India should implement certain laws to be followed strictly. We can create awareness by holding marathons, beach clean ups and also raising posters. We need to reduce the use of plastics. Find out alternate materials that are suitable, that can replace plastics. The vendors can keep dustbins outside their shops for the waste to be discarded. Stop waiting for things to happen, we need to go out of our way and do it. Community approach is the most important when it comes to a cleaner process. Government can take care of the legislative level and the law and order level of it but when it comes to working at a grassroot level, its the community and people part of the society that can start it.

The first thing we need to go about with is the treatment of Soil pollution. While we have studied what can be done to prevent contamination but now that we know that the soil is contaminated, how can it be treated? New processes are being developed to combat the

problem in a natural, less laborious way. By studying plants that grew naturally in toxic mines, scientist Chen Tongbin discovered that certain plants loved to eat heavy metals like arsenic, bronze, lead, zinc, cobalt and cadmium. The contaminants can then be retrieved from the plant's leaves and used in industrial materials. This safe and effective method isn't perfect but it's a start. Naturally prevention is considered the cure for soil pollution. Most states have enacted tougher legislation to stop illegal dumping. For instance, one can expect five years in jail and a fine of $100,000 for soil pollution in Texas in United States. Educating consumers about the dangers of littering, while encouraging recycling programs, is a good way to ensure everyone does their part to keep debris where it belongs. Consumers can also make a concerted effort to buy organic foods to demand that chemical pesticides shouldn't be used on their foods.

Marine Pollution

What exactly is Marine pollution? Marine pollution includes a range of threats including from land-based sources, oil spills, untreated sewage, heavy siltation, eutrophication i.e nutrient enrichment, invasive species, persistent organic pollutants (POP's), heavy metals from mine tailings and other sources, acidification, radioactive substances, marine litter, overfishing and destruction of coastal and marine habitats. Marine Pollution - land based discharge takes a whopping 44 %, Oil exploration and production only 1%, Dumping of waste about 10%, Maritime transport i.e leaks from ships, boats and all of that is about 12% and Atmospheric Inputs is the next big chunk at 33%. If you look at the health of Marine life, Coral reefs are at risk from human activities. In the pacific if you look at it, it's a high risk, the you have the middle east a little better off. The Caribbean, the Indian ocean, the Southeast of Asia follow right behind. If you look at coral reefs, that is a testing theory, how polluted is a particular marine body by studying the different aquatic life within the particular marine body. Reeks are actually classified low risk, not considered in eminent danger and that is why, this is used as a control mechanism.

Causes of Marine Pollution - Most sources of marine pollution are land based. The pollution often comes from nonpoint sources such as agricultural runoff and wind blown debris. Ways of Pollutant Inputs - there are five main ways in which inputs of pollution are present in the ocean; 1. Direct discharge of waste into the oceans, 2. Runoff into the waters due to rain, 3. Ship Pollution, 4. Atmospheric Pollution and 5. Deep Sea Mining. If you look at the potentially toxic chemicals, they actually adhere to tiny particles which are then taken up by plankton and benthos animals, most of which are either deposit or filter feeders. In this way, the toxins are concentrated upward within ocean food chains. Many particles combine chemically in a manner highly depletive of oxygen, causing estuaries to become anoxic i.e where oxygen levels become pretty much negligible. This is direct discharge from factories or any industries, pollutants enter

rivers and then therefore the sea. Directly from the urban sewerage and industrial waste discharges, sometimes in the form of hazardous and toxic wastes. Inland mining for copper, gold, etc, is another main source of marine pollution. Most of the pollution is simply soil, which ends up in rivers flowing into the sea. Some minerals discharged in the course of the mining can cause problems, such as copper, a common industrial pollutant, which can interfere with the life history and development of coral polyps. Mining has a poor environmental track record. Mining we have seen, becomes a source of pollution at different sources right from water, soil, air, everything but it has become an intrinsic part of our life and economics as well where the country entirely depends on its GDP to be sustainable.

Pollution from Ships - Ships can pollute waterways and oceans in many ways. Oil spills can have devastating effects while being toxic to marine life, polycyclic aromatic hydrocarbons (PAHs), the components in crude oil are very difficult to clean up and last for years in the sediment and marine environment. The discharge of cargo residues from bulk carriers can pollute ports, waterways and oceans. In many instances vessels intentionally discharge illegal wastes despite foreign and domestic regulation prohibiting such actions. Ships create noise pollution that disturbs natural wildlife, and water from ballast tanks can spread harmful algae and other invasive species. Invasive species can take over one's occupied areas, facilitate the spread of new diseases, introduce new genetic material, alter underwater seascapes and jeopardize the ability of native species to obtain food. This is an image of a cargo ship that pumps ballast water over the side. This Ballast water is collected from a place elsewhere and it is released in an entirely different place. Along with this water comes algae, bacteria, other organic and inorganic matter that will alter the characteristics of the location that its being poured into, affecting not only the life that its carrying but it will also jeopardize the native species that are present in the ocean or sea the ship is travelling at. Surface runoff from farming because this has urban runoff as well as runoff from the construction of roads, buildings, ports, channels and harbours can carry soil and particles laden with carbon, nitrogen, phosphorus, and minerals. This nutrient-rich water can cause fleshy algae and phytoplankton to thrive in coastal areas, known as algal blooms, which have the potential to create hypoxic conditions by using all available oxygen, altering the level of dissolved oxygen as well as the amount of dissolved oxygen that is going to be available to thriving aquatic life. Polluted runoff from roads and highways can be a significant source of water pollution in coastal areas. About 75% of the toxic chemicals that flow into Puget Sound are carried by stormwater that runs off paved roads and driveways, rooftops, yards and other developed land.

Atmospheric pollution - wind blown dust and debris, including plastic bags are blown seaward from landfills and other areas. Dust from the Sahara moves into the Caribbean and Florida during the warm season. That's how far dust particles can actually go. Since 1970, dust

outbreaks have worsened due to periods of drought in Africa. Drought is mainly because of the loss of topsoil on which no plants can grow and because no plants are growing, the top soil gets flown away and blown away by the wind and it is a cyclic reaction that occurs. The USGS links dust events to a decline in the health of coral reefs across the Caribbean and Florida. Dust effects in Africa have effects in the Caribbean as well. Climate change is rising ocean temperatures and raising levels of carbon dioxide in the atmosphere. These rising levels of carbon dioxide are acidifying the oceans, creating imbalance in salt content, pH balance, levels of alkalinity and acidity.

Deep Sea Mining - Ocean mining sites are usually around large areas of polymetallic nodules or active and extinct hydrothermal vents at about 1,400- 3,700 meters below the ocean's surface. One might wonder as to how can it actually affect the level of aquatic life but that also has serious impacts because mining that anywhere causes some amount of pollution and when huge pumps and drilling machines are used at that level, at that pressure, these deposits and parts of the ocean floor get disrupted. This disrupts the habitat of many local organisms, possibly depending on the type of mining and location causing not only temporary disturbances but permanent disturbances and change in biodiversity. Near bottom plumes occur when the tailings are pumped back down to the mining site. Surface plumes cause a more serious problem. Depending on the size of the particles and water currents the plumes could spread over vast areas. Aside from direct impact of mining the area, leakage, spills and corrosion would alter the mining area's chemical makeup.

Human impacts on Marine environments; 1. Eutrophication - this is basically an increase in chemical nutrients, typically compounds containing nitrogen or phosphorus, in an ecosystem. It can result in an increase in the ecosystem's primary productivity, an excessive plant growth and decay, and further effects including lack of oxygen. The biggest culprit are rivers that empty into the ocean, and with it many chemicals used as fertilizers in agriculture as well as waste from livestock and humans. An excess of oxygen depleting chemicals in the water can lead to hypoxia and the creation of a dead zone. Dead zone is basically where you'll see a large water body with no thriving life because dissolved oxygen has become negligent.

Acidification - the oceans are normally a natural carbon sink, absorbing carbon dioxide from the atmosphere. Structures made from calcium carbonate may become vulnerable to dissolution, affecting corals and the ability of shellfish to form shells. Oceans and coastal ecosystems have removed about 25% of the carbon dioxide emitted by human activities between 2000 and 2007 and about half the anthropogenic CO2 released since the start of the industrial revolution. You can see the change in that. Since the advent of industrial revolution and since the turn of the century, you can notice how things have completely changed. You can see the level of turbidity that has completely changed, the leaves of coral leaves as well as the quality of corals.

Plastic Debris - 80% of marine debris is plastic which is a component that has been rapidly accumulating since the end of World War II. Discarded plastic bags, six pack rings and other forms of plastic waste which finish up in the ocean present dangers to wildlife and fisheries. Aquatic life can be threatened through entanglement, suffocation and ingestion. Fishing nets, usually made of plastic, can be left or lost in the ocean by fishermen. Plastic debris also tends to accumulate at the centre of the ocean. In particular, the Great Pacific Garbage Patch has a very high level of plastic particulate suspended in the upper water column. In samples taken in 1999, the mass of plastic exceeded that of zooplankton i.e the dominant animal life in the area by a factor of six. Plastic debris is actually exceeding the animal life in the particular water body. Midway A toll, in common with all the Hawaiian islands, receives substantial amounts of debris from the garbage patch. Ninety percent plastic, this debris accumulates on the beaches of Midway where it becomes a hazard to the bird population of the island. Other toxins apart from plastics ther e are several other problems that are there with toxins that do not disintegrate rapidly in the marine environment. Examples of certain persistent toxins are PCBs, DDt, pesticides, furans, dioxins, phenols and radioactive waste. Heavy metals are metallic chemical elements that have a relatively high density and are toxic or poisonous at low concentrations also. Examples are mercury, lead, nickel, arsenic and cadmium. Such toxins can accumulate in the tissues of many species of aquatic life in a process called bioaccumulation. They are known to accumulate in benthic environments, such as estuaries and bay muds; a geological record of human activities of the last century.

Noise Pollution - Marine life can actually be susceptible to noise or sound pollution from sources such as passing ships, oil exploration seismic surveys, and naval low-frequency active sonar. Sound travels more rapidly and over larger distances in the sea than in the atmosphere. Marine animals, such as cetaceans often have weak eyesight, and live in a world largely defined by acoustic information. This applies also to many deeper sea fish, who live in a world of darkness where sunlight does not permeate to that level. Between 1950 and 1975, ambient noise in the ocean increased by about ten decibels and that is a ten-fold increase. Noise also makes species communicate louder which is called the Lombard vocal responses.

Mitigation - Either the human population is reduced, A way is found to reduce the ecological footprint left behind by the average human being. The second way is for humans, individually to pollute less. That requires social and political will, the most important strategy for reducing marine pollution is education, awareness, research and dissemination.

Solutions to Marine pollution - Marine pollution is a part of the problem of too much pollution by humans in general. There are only two ways to reduce this; either the human population is reduced or the ecological footprint has to be reduced. Obviously the first way is easier said than

done, there is no way we can go about reducing the number of people now but we can definitely reduce individual ecological footprint, our carbon footprint if that is not done, ecosystems will falter and cease to support us. How do we go about protecting Marine life? We need to protect it from Oil pollution, Garbage pollution, from accidental loss or discharge of fishing gear, plan to reduce and store your garbage, garbage waste management on-board and shore facilities have to be improved.