Environmental Science

Lecture 15

Effects of Global Warming

Now if we move onto the effects of global warming especially on agriculture which is like the basis of anything from the ecosystem, the first hit will receive is in the laws of biodiversity, especially in fragile environments like tropical forest, then you have laws of fertile coastal land which is caused by raising sea levels and then you have unpredictable forming conditions and tropical areas and because of this unpredictable condition, Farmers are lead to start or led to start using new advanced techniques of agricultural practices which have not been completely research to pawn and their after effects are not known, especially with the use of genetically modified crops or let it be the use of in chemical or natural fertilizer. Increased frequency of whether extremes that is in certain parts could have storms, floods and extreme conditions of water and the other side of the spectrum you would see droughts and ferments conditions, longer going seasons in cooler area, increase in incidence of pests and vector borne diseases and the dramatic change in distribution quantities of fish and sea food. So the long time fluctuation in weather patterns could have extreme impacts on agricultural production, slashing crop yields and forcing farmers to adopt new agricultural practices in response to altered conditions.And the effect of this practices are still not completely researched upon

Moving onto ozone depletion

Ground level Ozone

- Ozone (O3) is a key constituent of the troposphere.
- Ozone is a pale blue, highly poisonous gas with a strong odor.
- Ozone is considered to be a pollutant especially at ground level
- Breathing O3 or ozone affects both the respiratory and nervous systems, resulting in respiratory distress, headache and exhaustion
- Ozone is damaging to plants, resulting in leaf mottling and reduced growth

So once it starts affecting the plants system, it is the lowest level of the food chain and the transpiration is going to happen from henceforth, if it is affects photosynthesis and fruit production it's going to affect all the tropic levels of the food chain and essentially the food web. So the very important to keep ozone completely under control or avoided completely.

- Earth's atmosphere consists of a number of different layers
- The troposphere is the lower atmospheric layer
- The stratosphere is often referred to as the upper atmosphere

- The stratosphere contains the ozone shield, a layer of ozone about 50km above the ground

Now if we look at the layer of the atmosphere above the earth surface, you have sunlight coming with strong ultraviolet rays which again is very consider very harmful. You have the earth surface and right above the earth surface about 10km, you have the troposphere from about 10-50 km is the ozone and the stratosphere. So they pretty much absorb the ultraviolet rays and send the clean sunlight without any form of radiation to the troposphere and eventually the surface of the earth.

Hazards of UV radiation or Ultra Violet radiation

This can include increased mutation rate, which can lead to skin cancer and cataracts, depression of the immune system, impaired crop and tree growth, and the death of planktons. Planktons are nothing but found in the water bodies and it's very important part of hydrological cycle as well as the water cycle.

What are the Health effects of Ozone Depletion?

- Each 1% drop in ozone is thought to increase human skin cancer rates by about 4-6%
- The United Nations Environment Program predicts a 26 percent rise in cataracts and non-melanoma skin cancers for every 10% drop in ozone.
- This translates to 1.75 million cases of cataracts and around 300,000 more cases of skin cancer every year

Ozone Hole above Antarctica

Now what about the ozone hole which has been found above Antarctica

- During the 1980's scientists discovered a " hole" in the ozone over Antarctica
- By the 1990s atmospheric scientists had detected an annual loss of 40-50% of the ozone above Antarctica, which produced an ozone hole every spring
- One CFC molecule can destroy 100,000 ozone molecules.

The largest Antarctic ozone hole ever recorded in September 2006

- The Antarctic ozone hole is an area of the Antarctic stratosphere in which the recent ozone levels have dropped to as low as 33% of their pre-1975 values. So this is pretty much the size that is been exposed right now and because of this leads to other condition the first thing being acid rain, so we will discuss what is acid rain and what are its causes and effects.

Environmental Impact of Acid Deposition

- Sterilization of lakes and forests
- Reducing the populations of small invertebrates and decomposers
- Reducing agricultural yields
- Causing extensive structural damage by corroding marble, metal, and stonework
- Degrading water supplies by leaching heavy metals from the soil into drinking water supplies
- Increase in lung cancer as well as colon cancer

Wet as well as dry acid deposition

This is caused by Sulphur dioxide and Nitrous dioxide. Alone causes dry acid deposition, so which forms the all forms of water vapor is inclusive in this, this could be sulphuric as well as nitric acid and this forms the acid rain which is the downwind of sides of emission. So especially about factories nearby factories if there is a deposition of precipitation, anything of this acids in vapor form and the precipitation nearby is going to develop as acid rain

So normal rain water around pH is 5.0-5.6. Acid rain is much lesser than 5.0, so this affects the industrialized areas worldwide Scandinavia, eastern Europe, north east united states, Developing countries do have more pollution and fewer controls than developed countries.

So because of this even though we do developing countries, under developing countries might have episodes of acid rain, it is not recorded and studied as trenevously as it done in developed nations.

So if we look at Acid Precipitation, you can see the different sources of acid, you have SO_2, NO_2 or NO_3 depending on whatever component it is Mercury, VOC all of this are different sources, they get pollute and they get collected as gaseous pollutant in the atmosphere, the same time this is dry deposition this could have happen just settling over leaves of trees, this could have happen just settling over plants, animals, skin or even human which cause irritation watering of eyes, irritation in skin, blisters, rashes all of this could be because of this write opposition but then when you have particulate pollutants in atmosphere and then you have other water molecules present, pollutants especially in cloud water as well as precipitates than it comes down as acid rain of wet deposition, again the wet deposition what happens is it reaches the ground level directly and that could join and combine the water level below the ground as well as reverse seas and all of the other water bodies. So when it comes down as dry form has own effects and when it comes down as it rain has its own effects.

Acid Rain

- The term “acid rain” is commonly used to mean the deposition of acidic components in rain, snow, fog, dew or even as just dry particles.
- The more accurate term is “acid precipitation”, because it could be in any form
- “Clean” or unpolluted rain is obviously slightly acidic, its pH value being about 5.6, because carbon dioxide and water in the air react together to form carbonic acid which is a very mile a weak acid
- Now the extra acidity in rain comes from the reaction of primary pollutants which is mainly sulphur oxides, the oxides, nitrogen oxide with the water in the air to form stronger acids like sulphuric and nitric acids
- The main sources of these pollutants are vehicles and industrial plants and power-generating plants.

Effects of Acid Rain

- Acidifying lakes and disrupting the normal cycling of nutrients
- Leaches metals out of rocks and soil
- It is essentially kill fish; stress and defoliate trees due to moss growth, insect attack, and loss of nutrients.

The primary causes of acid rain is sulfur and nitrogen compounds from human sources, such as electricity generation, factories as well as automobiles or motor vehicles. Coal power plant are one of the most pollutant in the country or in the world and the effluence that come out of this if it’s going to be sulphur or oxides of sulphur and nitrogen. Acid rain in those areas are understood and accepted

Sources of Indoor Air Pollutants

- Mainly building materials and construction works nearby that are going on cigarette smoking, pesticides, volatile organics from paints, furniture, rugs, insulation etc.
- So you have 11 common pollutants which is about 2-5 times higher indoors than actually outdoors
- Air inside a car 18 times more polluted than air outside
- 17% of commercial buildings have serious indoor air pollution problems which is refer to as sick building syndrome. And one of the main problems, main causes of this is bad air-conditioning, lakh of cleaning facilities in air-conditioning dugs, filters in all of that which is not done in an regular basis as it’s supposed to be done

Are there any natural indoor air pollutants?

- Radon gas accumulates in homes located in areas built on granites, phosphates, shale’s

- Synergistic effect with tobacco smoke; secondary leading cause of lung cancer
- So next sources you have is soil, groundwater, building materials
- All of this cannot be filtered out, must be vented out

In the sense we have to remove out physically using certain filtration systems and only then can it be moved out from the indoor system. If it is not going to be moved into similar way there is no way that can be completely avoided.

1. You cannot avoid certain materials on earth.
2. When you have ground water that is being polluted building materials and other construction work that is being going on, you cannot accept that this things are not going to enter the indoor atmosphere

Most dangerous indoor air pollutants

- Cigarette smoke
- Formaldehyde
- Radioactive radon 222 gas
- Asbestos
- Others include: bacteria, fungi, dusts and other particulates, pollen, carbon dioxide, carbon mono oxide, ozone, nitrous oxide, sulphur dioxide building materials such as fiberglass as best as etc,
- What can we do for the Future to basically we have to prevent pollution, but how do we go about doing in strategic manner
- We need do have full cost pricing that is shift costs to the production of air pollutants
- Improve energy efficiency
- Reduce the use of fossil fuels
- Reduce or decrease slow population growth

So only when the population is brought under control can the usage of all fossil fuels on any energy consumption be brought under control and if that is not goanna be possible we need to start using alternate forms of energy, so that it dependency on fossil fuels and non-renewable resources comes down drastically we need to improve energy efficiency of buildings, vehicles every possible venue that is there we need to make ourselves more energy efficient and self-sufficient while providing energy.

How serious is the problem of indoor air pollution?

People with respiratory ailments are most affected like brankaytes, asthma patients they are going to be affected right away. Asbestos inhalation may cause: asbestosis, lung cancer, and

mesothelioma. As best of workers, insulators pipe fitters, shipyard employees. All of these peoples are prone to search diseases and an another important sources when asbestos is used in certain constructions like schools and office buildings or even collages or another institutions even the people using those buildings or under threat

General Solutions

- Switch from coal to cleaner fuels - natural gas preferably
- Reduce the energy consumption and we need to improve efficiency of energy
- Burn less coal, use lower sulfur coals, coal gasification
- After burning the SO2 can be cleaned out by scrubbing
- Taxing emissions

So certain industrial plants that to have emissions or in that sulpho compounds or nitric compounds, they have to be taxed or they have to be bare the brine of baring the economics cleaning the atmosphere, cleaning the air surrounding these plants.

General solutions to indoor air pollution:

Mainly to be well ventilated fans and it's going to be centralized air conditioning that's one of the main problems. You need to ensure your filter system is really good and its going to be clean in regular basis, we need to ensure that there is no smoking allowed in any indoor atmosphere. Source modification: more efficient stove design. So that the consumption of fuel while cooking is optimized. Pollutant removal like filters every possible way and basic education at every level not just schools, collages but also organizations, institutions, offices every level man has to be educated on different sources of indoor air pollution as well as the effects and the ways to reduce it.

What are the special problems associated with urban areas?

We need certain urban trends that you would find is

- We need to discourage auto use, reduce the number of cars. We need to increase public transportation and the number of people using public transportation drastically increase.
- Stricter emission controls
- Require electric cars or hybrid cars
- Improve public transportation
- Mandatory carpools
- Industrial & household controls

- To realize how much fuel is being consume and if it all there is any emission how much of it is getting emitted
- Reduce emissions completely burn less fuel use more energy efficient appliances as well as energy efficient homes, offices and lifestyles
- Control NO_x by recirculating exhaust
- Catalytic converters removes Carbon monoxide and hydrocarbons by converting to CO2 and water which is completely safe, CO2 absorb by plants, so plants are going to be around that area it's going to be rally useful and waters always welcome by product.
- Effluent fees and emissions tests to assure catalytic converters are maintained

So if anyone our breaking this rules they have to be penalized in the right way and not let go Scott free, so if we look at different prevention methods, consumption should be less use of catalytic converters and how do we go about car cooling using a lot of bicycles walking went possible, avoid using a lot of fuels, motorbikes or private transportation or for public transportation

Special problems associated with urban areas

- Meteorological conditions along with topography can affect air pollution
- Natural ventilation occurs when winds are strong and turbulent; mixing is good, large mixing volume.
- Atmospheric inversion – temperature inversion, warmer air above cooler air, prevents dissipation of pollutants. Pollutants collect and therefore there is no wind
- Urban air pollution, this is basically determined by
- Rate of emission per unit area
- Distance downwind that a mass of air can move
- The speed of wind
- And height of mixing above the ground level

Now Government level prevention if you look at it. There are lot of laws and enforcements that happening around now, some governments are investing in wind energy, solar energy or the renewable source are being given importance to minimize burning of fossil fuels which does cause majority of air pollution.

Governments are also forcing companies to be more responsible with their manufacturing activities, so that even though they still cause pollution they are controlled and if it all any effluence or coming out, they are aware of the effluence rate at that which effluence are coming out and weather the effluence are being treated and not left unattended enter the ground water of the atmosphere. Companies are also building more energy efficient cars, which

pollute less than before. Government should provide local transport to people to reduce burning fossil fuels.

Water Pollution

If you look at the seen over here, you can see the froth over here, it's not beautiful froth because of the force of the water, this is the part of effluence coming from a small factory, this is not even a large industry. It's a small time factory effluence or causing severe damage to the water, gradually we will see these plants dying and then you will see the fish inside the river or stream dying. So this kind of effluence need to be recognized and not thought of something else, what has to be constantly treated and whatever the size of the industrial plant, any kind of industrial manufacture is going on that area has to be sealed away from entering into the open atmosphere or entering the ecosystem, either by ground soil or water or air

Water Pollution exist in so many ways, even in rural areas it occurs due to if we are going to use chemical fertilizer and that's going to be again entering the food system, ground water everything else. It could happen if it use it while construct building, you can see what are literally considered dead, in the sense it cannot support any life form let it be planktons or fish you will just find them choking and dying in so many areas. It just because of high level of pollutants the water especially metals like Mercury and led.

So what exactly in Water Pollution?

- Water pollution occurs when pollutants are discharged directly into water bodies such as rivers, lakes and seas
- It also occurs when air and land pollutants are blown by wind or washed by rain into water bodies

So basically this is seen mostly in urban settlements when discharge comes from different form of pollutants into canals, drains and sewer pipes and even rain water pipes which is lay down separately which eventually finds it way to reverse and seas. So sources of pollutants include factories, sewage treatment plants, runoff of chemicals from agricultural plantations and live stock forms.

If you look at the scene over here you can see the different sources of pollution here it is entering the rainwater directly the storm water rain here you can see if you use fertilizer abundantly on your lawn to just make look the green flourishing, its goanna affect and here people are just taking care of their car but again the fumes or the fuel any leakage from that is going to the water and anything that we throw or whatever that we through around in the ground, it's going to clock the drains and again if it does get in contact with the water it pollute

the water. So every small action of ours does cause damage to the environment especially our water.

Importance of Water

Water is obviously essential to life on earth that is irrespective of any type of life

Organisms are composed of much water as much as 70% - 95%

- Supportive external environment for aquatic organisms
- Cellular medium within which biochemical reactions can occur
- Transport medium for food, oxygen and other things required by cells
- Means of transportation that is Turgid plant cells or Hydrostatic animal support systems

Three forms of water

Solid, liquid as well as gases

Solids: When water becomes very cold and freezes it will change from a liquid to a solid state and this has a definite form and shape

Liquids: When water takes the form of its container is consider to be in a form of liquid form

Gases: When water is seen in a vapor form and has no definite size or shape and cannot be contained in such it is in a gaseous form.

Distribution of Earth's Water

Saline that is salt water is about 97% and mere 3% is fresh water and within the fresh water, 68.7% it encompass in icecaps and glaciers then you have ground water is about 30% and the other sources is about 0.9% , now the surface water that we see what how does it come under lakes is 87%, swamps 11% and the rivers is mere 2%. So if we actually look at the water can be consumed directly by man and plants are just 3% of the total earth's water volume. 97.2% of the earth's water is salt and barely 3% is fresh water.

So like we just say Glaciers, Permafrost and Perennial snow encompasses nearly 70%, fresh subsurface water nearly 30% and rivers a mere point 0.006% , swamps 0.03% , soil moisture that is the top soil has been a permanent moisture set across and that acts like a storehouse most plant organism that's about 0.05%. Atmosphere as an water vapor you have 0.04% and fresh water lakes about 0.25%

If you look at the water supply, you can see the decreasing percentage

- From whapping 97% of salt water
- To the right 00.001% of atmospheric moisture

Which is basically responsible for any form of precipitation, only these comes down as a snow, rain, fog, smog whatever that is there only there small percentage.

- Earth is considered as a Water Planet Its unique among the other planets because of its abundant water let it be in oceans in the atmosphere in glaciers as well as fresh water on the land
- Without water life can basically not exist
- Like we just discuss about 3% is only fresh water or portable water, 2% of the earth water is all in solid form which is found in icecaps and glaciers,
- 1% of all earth's water is in usable form to humans and land animals
- This fresh water is found in lakes, rivers, streams, ponds and in the ground. A very small percentage is in vapor form in the atmosphere

DISTRIBUTION OF WATER

Ocean Water, Fresh surface water this is basically reverse, lake, streams, ponds and similar bodies of water

Ground water is under the ground has storage reservoirs. The majority of the planets liquid fresh water is stored in underground aquifers or reservoirs. Water that enters an aquifer remains there for an average of 1,400 years but now that percentage is again reducing because of constant demand and the supply is not enough to meet this demand

So if we are going further and further deeper and deeper into the womb of the earth get more and more water. Water is been there for thousands of years and now we are getting consumes with the matter of few years and not getting replenish as fast as the way we are consuming it

Water: A precious Natural Resource

- We use it for drinking, irrigation, industrial purposes and energy production
- Agriculture and energy production takes about 80% of the chunk
- Industrial and public use that is human use is about 20%

Water is used in many ways

- We use it is a nourisher of plant and animal life
- A bearer of food

- A prime element of industrial processes
- A medium for transportation like a ships and boats

Significance of Water

- Water is an integral part of life on this planet
- It is an odorless, tasteless, substance that covers more than three-fourths of the earth surface
- Most of the water on Earth is found to be in oceans as salt water and we cannot consume this water or use it for crops because of the high percentage of salt content
- But we do have now methods to remove salt from the ocean water but this process is very expensive.