

# THE AILING PLANET



## **THE DEVELOPMENT COMMITTEE**

We thank our fellow classmates for the stimulating discussions, the collaborative work and sharing of knowledge and for all the fun we have had during our interactions.

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## **ABSTRACT**

This is a comprehensive study of Ailing Planet. Why is the earth said to be an ailing planet? It is due to the insensitive exploitation by humans for their survival and development. The earth has lost almost all its vital/important resources. At this vital and critical time, it's a transcending concern as earlier the people were worried about their existence but now their problem is more serious. The natural resources of the earth are eroding fast and the living race along with the precious planet is likely to be extinct. Therefore humans must conserve the planet. Hence we the students of Class 11 A, Alwin Memorial Public School have stepped in to provide awareness among our society through this thesis which is an extended learning from our English Hornbill textbook, chapter "Ailing Planet".

This thesis deeply examines the actual root cause of the ailing of our planet. It lays emphasis on the aftermath of human intervention in the working of the natural system. We must first understand the nature to live within its grasp. The thesis gives a basic idea and structure of the delicate nature and then proceeds to explain the present day condition on the splendid three domains of our planet which together constitute the life system – Land, Water and Air and how we have intervened in all of these domains and destroyed their natural working, aggravating the pace of destruction and annihilation of life. It holds Ineffective management and wrong way of technological advancement as the key to the present day degrading global condition rather than the development of technology itself.

The thesis further explains what must be done to recover our planet from failing. It introduces the concept of sustainable development and Eco – restructuring, and how we should use Technology in a right way – a great power which is not used wisely today. It also lays emphasis on the education of the Youth – The creation of a great army which will fight against all the problems we face today in the future, to defend themselves, in a peaceful manner.

It finally concludes with the hope for the future and the progress we did so far to recover our planet, and the long progress which is yet to be done to repair our planet. In short, the journey of the thesis is from making the Ailing planet - Earth, a Hailing planet once again against everything...

## **DEDICATION**

We dedicate this thesis to the feet of Mother Nature. We dedicate this project to the Parent of Mother Nature, God Almighty – our creator, our strong pillar, and our source of inspiration, wisdom, knowledge and understanding.

We dedicate this work to our beloved Chairman Dr. N. Vijayan Sir who has encouraged us and stands as a pillar of support. We express our heartiest wishes for your sincere and valuable guidance and encouragement extended to us always.

Thank you sir, our love for you can never be quantified.

## **ACKNOWLEDGEMENT**

Our deepest gratitude goes to the God, who has provided all that was needed to complete this project and the program for which it was undertaken for. There was never lack or want.

This project would not have been possible without the support of many people. Many thanks to our mentor, Ms Divya Sharon, who assisted us in numerous aspects. It is through her guidance and path that we were able to contribute our minds in such an eye opening topic which is linked to our English lesson "The Ailing Planet".

We would like to express our sincere gratitude for the continuous support, for her patience, motivation, and immense knowledge.

We place on record, our sincere thanks to the Dean of the Faculty, Our Principal and Vice Principal for their continuous encouragement.

We would also like to acknowledge our parents, who fuelled us to contribute to the content of this thesis. It is with their support and willingness that enabled us to work efficiently.

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## **UNIT 1 - INTRODUCTION**

The entire universe revolves around a simple concept which most people do not take deeply – Balance. Everything is delicately balanced. One tries to go down while the other tries to go up. A state of balance is attained and maintained. Nature is no different from this concept. It acts as a delicate balance that keeps things how they are, beautiful and simple. When we talk about nature, we do get an image of the green forests and peaceful flow of rivers – yes, the landscape of nature is splendid and calm. It is truly fascinating to know that a really complex system keeps all the other systems within it, simply.

But where do we find such a beautiful natural system like we do on our planet Earth? The other planets do not welcome us. The domain of land allows us to stand with pride, which is absent in half of the planets in our solar system. The domain of air allows us to breathe by having ideal temperature and gas composition, while others planets have either burning hot or freezing cold temperatures, as well as gases which are not for living things to survive. The rare part which we find on Earth is the Domain of water. It is the pulse of the natural system in our planet.

Our space explorations reach far and wide, across light years and galaxies and clusters, yet we fail to find one single planet (Not even a natural satellite) similar to earth which can sustain life. Time to time we get information about the discovery of earth-like planets yet no one proved that these planets can sustain life or not. Our beautiful and rarest earth has all its elements just suitable to call the place “home”. Lots of factors such as the suitable distance from the sun, our atmosphere's gas composition, etc... contribute to the sustainability of life (We shall not emphasize on how earth sustains life here. The idea is that it sustains life by a complex and delicate system of immeasurable amount of things). Hence something called ‘life’ is sustained in the balance of this beautiful part of the nature of cosmos.

Planet Earth is a gift of our universe, which is rarest of the rarest, to sustain life. It flourishes with millions of species, billions of plants, and trillions of individuals. The natural music of the million trees refreshes our minds, relaxes us and brings peace and prosperity to this planet. The clear blue skies astonish us. It amuses us and provokes curiosity of what is beyond it, and the wonderful domain of water does its proud work of going through a cycle to fill in the gaps of nature then and there and renews and replenishes everything. Nature's beauty is something which most of us admire and must admire.

However, is nature only beautiful? Of course, not. We neglect the dark side of the nature since we do not dare to look at the other side of nature. Where there is light, a shadow is casted.

## **DESTRUCTIVE PART OF NATURE**

Where there is creation, there is destruction. We take nature lightly, as something which manufactures only 'creation' for eternity, and we take it for granted. The other half (Destruction part) is as aggressive as the beauty of creation. Together, construction and destruction go hand in hand in an endless cycle to make things beautiful as well as scary. Therefore nature is not just the typical greenish environment as most people assume. It is much beyond and much below to the depths of decimation.

Nature is not always constructive. It maintains a balance by creating new things as well destroying old things. Let us take an example of the mass extinction events which took place on our planet.

## **NATURAL MASS EXTINCTION EVENTS**

There were 5 such extinction events, each of them had the potential to put a stop to the flourishing of life. They had something in common – they extinguished the most abundant species. The destructive part of nature is often scary, which is capable of wiping out 70% - 95% of life in each extinction event.

In fact, nature has wiped out more than 99.5% of species (irrespective of class of the organism) which ever existed. We would not like the part of nature where a super volcano literally explodes and ends up blocking sunlight globally for over 10 years (It is also hypothesized that the human population dropped somewhere below 10000 to even as low as 100. Fascinating isn't it?).

Today humankind has developed itself to such a great extent that they try to use all the resources on planet earth to satisfy its needs. But this soon turned out more like satisfying our greed. We never want something less than excess nowadays. We forgot that we are supposed to share this rare place with fellow living things. We ignored all our moral values and started to aggressively destroy the environment for our own profit. It is a misassumption that humans are the sole reason why the environment is getting destroyed. It was not always the humans who destroyed things. There were several natural catastrophes which destroyed life to a great extent even before the birth of humankind as we have seen earlier. Perhaps the reign of humans on planet earth is just a fraction of the reign of earth in the solar system. We did not create anything new to destroy anything, other than messing up the existing delicate system of nature to destroy itself.

Thence we have aggravated the destructive side of nature. When we talk about global crisis - For example global warming and greenhouse effect - we humans did not create them. It was natural for the poles of earth to shift so that it enters an ice age then natural warming takes place so that polar caps melt and get to the normal stage (like what we see today).

The honour and pride of humankind includes destroying most of the world's natural forest cover (Including half of the biggest forest – the Amazon), degrading all three domains of earth – land, water and air, wiping out much of the species during our reign (A separate chapter is allotted for the destruction of Amazon rainforest due to the issue's alarming condition and is a desperate try to create the awareness needed). Our reign is a despotic absolute dictatorship, sweeping anything and everything in its path to leave nothing else but ruins. Under our dictatorship and the reign of curved sceptre, we have managed to destroy the gleaming forests, turning the clear blue skies and shining water to suffocating black and disturbing red. These achievements will go down in history, but it is a mystery if someone will actually exist to read it.

### **THE BUTTERFLY EFFECT**

Even though nature is complex and powerful and humans are too weak, it is something which is delicate, and vulnerable to the "Butterfly effect". The deep meaning of this sentence can be realised when we get into the text. A good example is a 'complex system' of dominos. A slight disturbance crumbles everything down because every piece of domino has reach with one another. This is exactly what the idea of "Butterfly effect" suggests. A relatively minute change can result in a drastic change in the outcome. This is also how nature works. It is very complex, and each of its constituents is interconnected to each other.

Even seemingly contradictory elements are interconnected and interdependent on each other (Concept of Daoism – A human philosophy). When you affect some component in nature, it connects to other components and they are affected too. If a minute change brings a drastic outcome, then what is the outcome when a drastic change is done by our reign of disturbance and chaos?

It is said that we now experience the 6th mass extinction, termed as the 'Holocene extinction'. When this ends, we humans will have the achievement of irony – The reason for this extinction would be humans, and since we humans are the dominant species, we will get hit by our own doing. Hence the reason for the extinction of humans will be humans themselves. This is not only about the destruction of humans. This extinction event will be different in one aspect than the others – In each event, life somehow after a long time of perishing flourished gradually. This time, there will be absolutely no life to flourish. We will put a stop to the beautiful and wonderful cycle of life and nature...

When we mess with nature, nature has a delayed response but it messes with us back. Nature can take the mere hits of humans. But can we take the hits of nature?

We humans consider gold and silver and platinum and diamond to be rare stuff, but we fail to realize there are more valuable things other than that stuff – such as life itself. Spit on diamond since in Neptune it rains literally in diamonds. Scientists even claim a super-earth whose mantle is made of graphite and diamond. Other elements

like gold and platinum are formed by supernova explosions. But how is life formed? Where is life? It is the rarest of everything in our cosmos – so rare that we either are the only ones who exist or too difficult to find some other form of life. Must we destroy something which is truly rare, which cannot be replicated from scratch, which cannot be found across light years? Must we destroy the rare habitat where the beauty of the rare life flourish and exist? Must we destroy ourselves for absolutely no reasonable cause? Are we actually going to choose mere greed for nothing over everything?

Reversing the damage is now no more about just one nation or just about humans as a whole, since we have surpassed the stages where we can perform a surgery to the planet. Now it's about the entire healing of our ... Ailing Planet

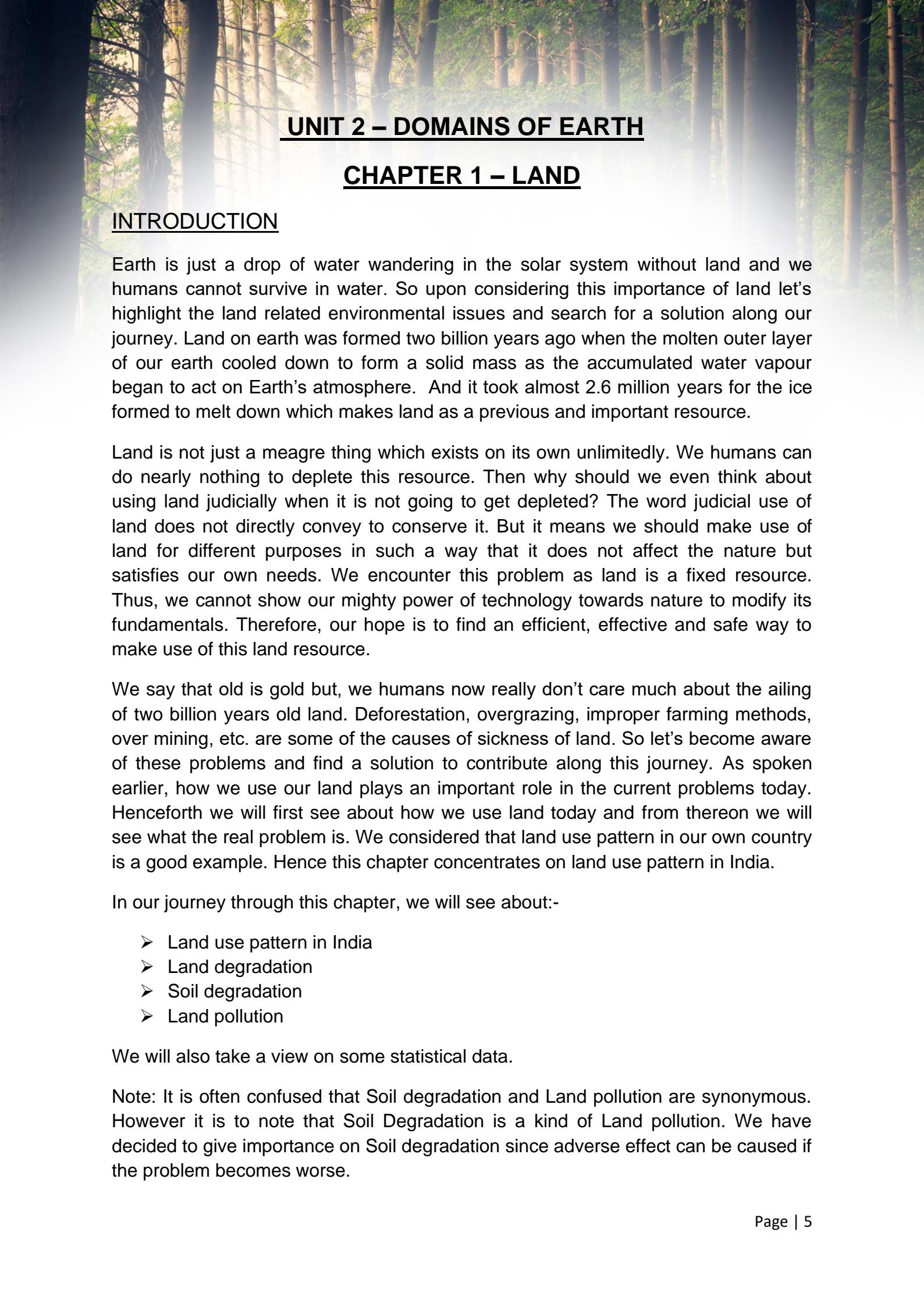
The thesis has been divided into 5 units. The First unit is the introduction to understanding the nature (The current Unit)

The second unit talks about the different domains of our planet earth, which functions together to make life possible today. Each domain is allotted its very own chapter – Terra (Land/Lithosphere), Aqua (Water/Hydrosphere) and Ventus (Air/Atmosphere). Each chapter emphasises the importance of that particular domain and how it contributes to the cycle of nature. Then it talks about how we have intervened in that particular domain and the causes of its pollution and degradation.

The third unit is about the disturbance created in the natural working of the environment. Human Intervention and Technological Advancement have their respective chapters. This part of the thesis discusses how we did things wrong, which lead to the present day condition. We have also highlighted the Amazon forest fire issue of 2019 in one separate chapter. This is because the issue shows how we lack awareness on environment today and teaches us few important lessons.

The fourth unit gives the actual solution to the existing problems. The concept of sustainable development and Using technology in the right way have their separate chapters.

The thesis concludes itself at the Fifth unit with the conclusion part, where it talks about fixing the mess we have created, to make our planet hail over its clouds... **once more...**



## **UNIT 2 – DOMAINS OF EARTH**

### **CHAPTER 1 – LAND**

#### **INTRODUCTION**

Earth is just a drop of water wandering in the solar system without land and we humans cannot survive in water. So upon considering this importance of land let's highlight the land related environmental issues and search for a solution along our journey. Land on earth was formed two billion years ago when the molten outer layer of our earth cooled down to form a solid mass as the accumulated water vapour began to act on Earth's atmosphere. And it took almost 2.6 million years for the ice formed to melt down which makes land as a previous and important resource.

Land is not just a meagre thing which exists on its own unlimitedly. We humans can do nearly nothing to deplete this resource. Then why should we even think about using land judicially when it is not going to get depleted? The word judicial use of land does not directly convey to conserve it. But it means we should make use of land for different purposes in such a way that it does not affect the nature but satisfies our own needs. We encounter this problem as land is a fixed resource. Thus, we cannot show our mighty power of technology towards nature to modify its fundamentals. Therefore, our hope is to find an efficient, effective and safe way to make use of this land resource.

We say that old is gold but, we humans now really don't care much about the ailing of two billion years old land. Deforestation, overgrazing, improper farming methods, over mining, etc. are some of the causes of sickness of land. So let's become aware of these problems and find a solution to contribute along this journey. As spoken earlier, how we use our land plays an important role in the current problems today. Henceforth we will first see about how we use land today and from thereon we will see what the real problem is. We considered that land use pattern in our own country is a good example. Hence this chapter concentrates on land use pattern in India.

In our journey through this chapter, we will see about:-

- Land use pattern in India
- Land degradation
- Soil degradation
- Land pollution

We will also take a view on some statistical data.

Note: It is often confused that Soil degradation and Land pollution are synonymous. However it is to note that Soil Degradation is a kind of Land pollution. We have decided to give importance on Soil degradation since adverse effect can be caused if the problem becomes worse.

## LAND USE PATTERN AND ITS ANALYSIS:

The land pattern indicates the spatiotemporal sequence of area under different uses. Land use means utilization of land in a particular area. Land use pattern includes types of land and how much land is being utilized under different uses. Land is basic resource of human society and land use is the surface utilization of all developed and vacant land on specific point at a given time and space. It is a systematic arrangement of various classes of land on the basis of certain similar characteristics mainly to identify and understand their fundamental utility, intelligently and effectively in satisfying the needs of human society.

The measure of effective usage of land is 'land use pattern'. Agriculture land use firstly studies the land under different uses like net sown area, agricultural potential land, fallow land, forest land etc. Land use is very vital to understand the geographical adjustment of agricultural resources. It is also very important resource for man, so it should be put for right use according to its capability and according to its type. Fertile land should be used for cultivation purposes and infertile land should be used for non-agricultural purposes. Thus, land use classification helps to make rational land use planning, because land resources are the most important national wealth. Land capability depends upon factors such as relief features, climate, Soil, vegetation, socio-economic and institutional factors. Today, the population pressure is increasing at a faster rate so the land is put under cultivation more (higher pressure) to fulfil the growing demand of food grains.

Even though land use is important and the pattern must be rational so that it is both efficient for humans and safe for nature, it is impossible to generalise a perfect land use split up for the whole world as it just depends upon the needs, the status, the topography, the climate, and the relief features of the place at a particular time, which is certainly variable. Thus a rational split up of land use varies from place to place.

The study of land use pattern is of prime concern to geographers to know the relationship between man and natural environment. Land use is an important study particularly relevant to agricultural geography. According to J. L. Buck an American agricultural economist, Land utilization is the satisfaction which the farm population derives from the type of agriculture; develop the provision for future production and contribution to national needs. The study of land use forms a significant part of geography and has assumed a place of pride in the field of applied geography.

According to the geologist Symons (1978), the land use study forms the sphere head for the advance of geography into the applied sciences as maps of land use have been recognized as essential tools of regional planning and development. Land utilization research can be described as leading with problem situations in which people in a given locality are in the process of transformation from activities with certain land requirement. According to Lillesand and Kiefer (1987) two environment

engineers and authors; "The term land use relates to the human activities associated with specific piece of land, fractures present on the earth surface". The study of land utilization is of immense value in tracing out the past use of land its future trend. Only through the study of past land utilization one can be able to predict its future use and evolve land use planning of a particular region. Thus, to make plans for sustainable development we need the analysis of land use pattern and it is a very important factor.

### **CLASSIFICATION OF LAND USE:**

Land use classifications are the systematic arrangement of land on the basis of certain similar characteristics mainly to identify and understand their fundamental utilities intelligently and effectively. The land use pattern is complex and dynamic. The international geographical classification of world land use along with colour scheme is mainly suited to local condition. The classification is as follows. World land use survey was drawn up under the auspices of UNESCO

1. Settlement and associated non-Agricultural land (Dark and light red)
2. Horticulture (deep purple)
3. Tree and perennial crop (light purple)
4. Crop land: continental rotation cropping (Dark brown) land rotation (light brown).
5. Improved permanent pasture (light green).
6. Unimproved permanent pasture (yellow)
7. Wood lands: dense (dark green) open (medium green) scrub (olive green) swampy forest (blue green)
8. Swamps and marshes (blue)
9. Unproductive land (grey)

Some land is for a specific use depending mostly on the physical characteristics of land to its suitability for particular use is related.

## ANALYSIS OF EACH DOMAIN OF LAND USE:

The domains of land use are:

- ❖ Forests.
- ❖ Land Not Available For Cultivation.
  - Area under Non-Agricultural use.
  - Barren and Uncultured Land.
- ❖ Other Uncultivated Land except Fallow Land.
  - Permanent Pastures and Other Grazing Lands.
  - Miscellaneous Tree Crops.
  - Culturable Waste Land.
- ❖ Fallow Land.
  - Current Fallow Land.
  - Other than Current Fallow Land.
- ❖ Net Sown Area.

These classification of domains show how much land is allotted for each purpose like farming, buildings, forest, etc. in India. We will see the shift in the land use pattern over these years from 1990 to up until recently, 2018. In the upcoming section we have provided the data on land use pattern.

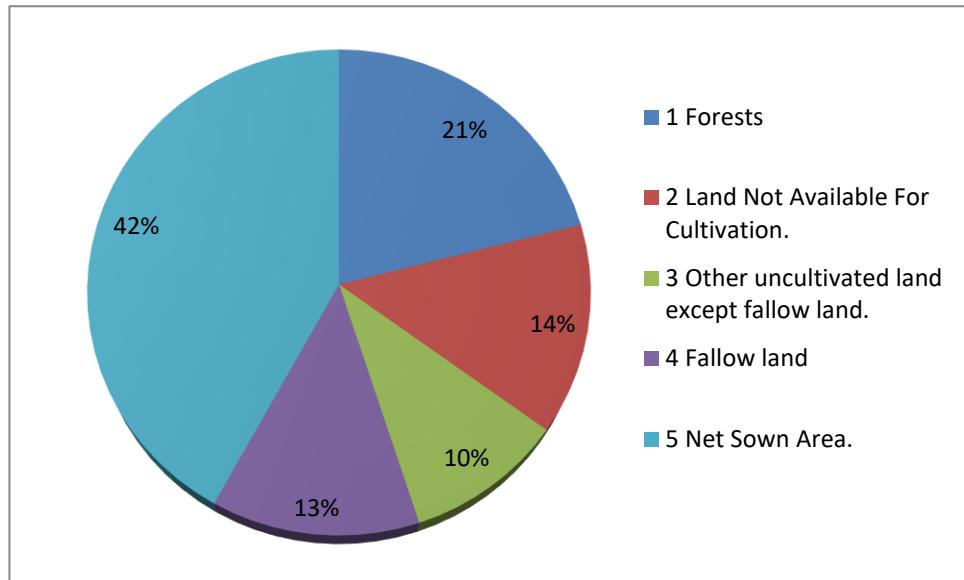
## LAND USE PATTERN IN INDIA

The land use pattern of India has been undergoing changes regularly. It has not been a regular and uniform pattern as planned by the government. Total geographical area of India is 3.28 million sq. km. But land use data, however, is only available for around 94% - 95% of the total geographical area due to some international political problems.

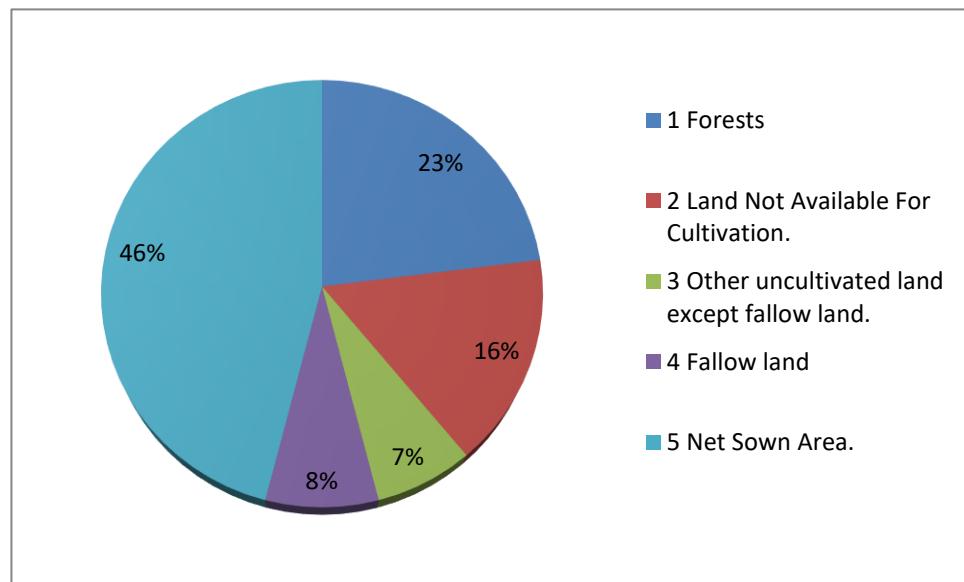
Census of India have classified land utilization in nine different categories, but at the present study these have been grouped into five major land use categories as the percentage of area under individual categories is relatively insignificant. Here is the data about the land use pattern of India in the years 1990 and 2018.

S.No	LAND USAGE PATTERN	1990	2018
1	<b>Forests</b>	21%	23%
2	<b>Land Not Available For Cultivation.</b>	14%	16%
	<b>1. Area Under Non-Agricultural Use</b>	8.02%	9.40%
	<b>2. Barren And Uncultured Land</b>	21.57%	26.88%
3	<b>Other uncultivated land except fallow land.</b>	10%	7%
	<b>1. Permanent Pastures And Other Grazing Land</b>	11.40%	10.26%
	<b>2. Miscellaneous Tree crops</b>	3.82%	3.10%
	<b>3. Culturable waste land</b>	15.06%	12.47%
4	<b>Fallow land</b>	13%	8%
	<b>1. Other Than Current Fallow Land</b>	11.09%	9.66%
	<b>2. Current Fallow Land</b>	15.09%	13.70%
5	<b>Net Sown Area.</b>	42%	46%

## LAND USE PATTERN IN INDIA FOR 1990 AND 2018



Graphical representation of land use pattern of India in 1990



Graphical representation of land use pattern of India in 2018

An explanation on each of these major domains of land use is provided in the following sections – starting with forests.

## FORESTS – THE PULSE OF NATURE

Forests are something which is always present in our image when talking about nature. They are fascinating and at times mysterious. However their importance is much more than that. The forests act as the lungs of our Earth. Natural forests are the places where interaction of all kind of living things takes place without any kind of intervention of humans. They are essential in part of our human life because, we are depended on forests directly or indirectly in order to meet our needs. Forests are essential not only for the survival of humankind but also for the survival of animals, who are our fellow friends, with whom we shall share the world.



India is a home to many types of forests and wildlife. From the ancient period, many European colonizers came to India because of its rich resources that are available in the forests. Our ancestors satisfied their daily needs by obtaining firewood from the forests, collecting fruits and vegetables, hunting wild animals for

food etc. And till the present day forests have proven themselves to be useful for humans in many ways. Up until British intervention, our ancestors established a symbiosis relation with forests. Even when they intervened to some extent, the overall effect on nature was negligible. During the British rule, there was extensive deforestation to satisfy their needs (More accurately, greed). After Independence, no major plans were taken to improve the forest area as the government mainly focused on other fields of development during that time.

Through passage of time, we have forgotten (Or more precisely, failed) to show gratitude towards forests and started to destroy them under the name of 'development'. This is the worst betrayal done to nature. We must understand that if we tend to destroy them, we are indirectly destroying our planet (As well as ourselves, whose domain lies within it).

In India, the lands covered by forests are not adequate for proper development of nature and environment. Forest area in our country is far lower than the desired 33 per cent of geographical area, as was outlined in the National Forest Policy (1952). It was considered essential for maintenance of the ecological balance. The livelihood of millions of people who live on the fringes of these forests depends upon it. As we see from the data of land use pattern (refer above) in India, in 1990 forests covered just 21% of the total land area. Later we see that in 2011 the forest area has increased, but not significantly.

We can see that India has achieved only 2% improvement in over 5 decades of time. Many reasons include improper implementation of laws and plans made by the government. Another major reason affecting this would be overpopulation (Growing demands) as whenever we try to clear land for forests, the demand of land for settlement increases. Thus, most of the cleared land gets used up for satisfying the need of people at the cost of nature's wealth.



*Image: Deforestation – large scale felling of trees.*

## LAND NOT AVAILABLE FOR CULTIVATION – AN OBSTRUCTION IN PATH OF DEVELOPMENT

The area which cannot be used for agriculture due to human needs or other reasons comes under land not available for cultivation. (The percentage values given here are their sub constituents of the main classification)

### Area under Non Agricultural use:

The lands which are occupied by buildings railways, roads, or under water ways such as rivers and canals are called as area under non-agricultural use. This land is for human use and settlement. The factors which affect the area under this are population and political framework of the region. The area under non-agricultural use has increased from 8.02% in 1990 to 9.40% in 2018 due to increase in needs of human. This affects the overall agricultural development of India due to declining of cultivating lands.

### Barren & uncultivable land:

The areas which are covered by extreme natural conditions like mountains, deserts, etc... come under this category. These lands can only be brought under cultivation at an exorbitant cost. The area under barren and uncultivable land has increased from 21.57% in 1990 to 26.88% in 2018. The increase of land under this category is caused by human destruction by coal mining, deep earth excavating etc. since these projects are driven by the concept of pure profit, people do not bother about fixing up the mess they have created. Hence they leave behind these scars without proper management. Hence these lands cannot be used for any other purposes.

### OTHER UNCULTIVATED LAND EXCEPT FALLOW LAND:

#### Permanent Pastures:

Land used to grow grasses or other herbaceous forage, either grown naturally (self-seeded) or through cultivation (sown artificially), which has not been included in the crop rotation for five years or more are called permanent pasture lands or permanent pasture is land growing grass for five years or longer – whether or not it has been reseeded.

Now the definition of permanent pasture as per UK's legal frame work is as follows:

- The definition of permanent pasture that applied before the reform of the Common Agricultural Policy (CAP) excluded areas set aside under the Single Payment Scheme or some agro-environment scheme options (*Article 2(c), Regulation (EU) No 1120/2009*).
- Under the reformed CAP, permanent grassland and permanent pasture are together referred to as permanent grassland. Permanent grassland may include other species, such as shrubs and trees which can be grazed, provided that the grasses and other herbaceous forage remain predominant (*Article 4, Regulation (EU) No 1307/2013*).

#### **NOTE:**

The definition of permanent pasture is important, as European Union legislation requires each member state to maintain the ratio of land under permanent pasture in relation to the total agricultural area. If the area of permanent pasture declines below a certain percentage, the member state must take steps to prevent further reduction. Farmers who converted permanent pasture into other uses might be obliged to reconvert land.

### Other Grazing lands:

Grazing lands are areas which are mainly used for livestock feeding. These lands are lands which are put to no use such as cropping, building, forests, etc. Those wild lands, excluding forest areas, which are habited by animals also come under this category.

Land types like grasslands, heath land, maquis, moorland, savannah, prairies, and wood pastures are commonly classified as grazing lands. Grasslands are areas where the vegetation is dominated by grasses however, sedge and rush families can also be found along with variable proportions of legumes, like clover, and other herbs. Heath land is a shrub land habitat found mainly on free-draining infertile, acidic soils and is characterized by open, low-growing woody vegetation.

### Culturable waste lands:

Culturable waste is the land available for cultivation but not used for cultivation for one reason or the other. This land was used in the past but has been abandoned for some reason. It is not being used at present due to some constraints as lack of water, salinity of soil, soil erosion, water-logging, or human neglect.

As compared to 1990 in 2018 we have achieved in reducing the land under other uncultivated land except fallow land from 10% to 7%. This is due to improvement in livestock management and agriculture.

### Fallow Land:

Fallow lands are generally the lands which are left uncultivated after continuous farming process in order to recover its fertility. To maintain the natural productivity of the agricultural land, farmers leave the land without cultivating for a season to allow the soil regains its fertility over time by natural and biological processes. Keeping land fallow between couple of seasons is actually a safe and eco-friendly method.

There are two types of fallow land classified under land use pattern, namely, current fallow land and other than current fallow land. The areas which are currently left fallow for less than 5 years come under current fallow land. These current fallow lands majorly belong to places where fixed agriculture is practiced. The areas which are left uncultivated for more than 5 years come under the category of other than current fallow lands. Major parts of this classification belong to shifting agriculture where the land under cultivation is not fixed. The former one is actually more environment friendly than the later as mostly the area under forest is being used for agriculture in shifting agriculture.

The area under fallow land has decreased from 13% in 1990 to 8% in 2018. Which shows signs of improvement.

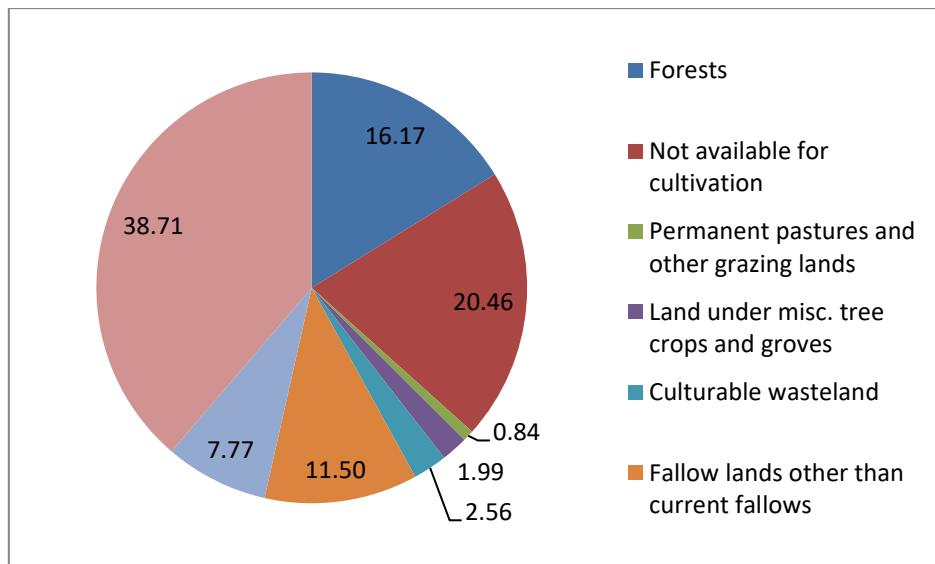
## Net sown area

Cropped area in the year under consideration is called net sown area. This area has a special significance in an agricultural country like India because agricultural production largely depends upon this type of land. There is an urgent need to increase the net sown area for meeting the requirements of rapidly increasing population in India. Net area sown has increased from 118.7 million hectares in 1950-51 to 142.6 million hectares in 2010-11. And as we see here, it has increased from 42 % in 1990 to 46 % in 2011. The increase in net sown area is a positive development as this increase the productivity of India and reduces the pressure on land. Thus the use of chemical fertilizers and pesticides can be reduced. The net sown area just has a little say in affecting the nature.

## LAND USE PATTERN OF TAMIL NADU IN 2011:

Land Use	Area (in thousands) (ha)	Percentage
Total geographical area	13006	NA
Reporting area for land utilization	13027	100.00
Forests	2106	16.17
Not available for cultivation	2665	20.46
Permanent pastures and other grazing lands	110	0.84
Land under misc. tree crops and groves	259	1.99
Culturable wasteland	333	2.56
Fallow lands other than current fallows	1498	11.50
Current fallows	1013	7.77
Net area sown	5043	38.71

## Graphical representation of land use pattern of Tamil Nadu in 2011



From this data of land use pattern of Tamil Nadu we can see that the land use may be different in many parts of the country. Here the major land is net sown area. But the forest is just 16.17 % of the total area available, which is very low as compared to the national target. Even though the land under forest here does not have a major say in India's area, it is important that the amount of forests is split up rationally. In Tamil Nadu land not available for cultivation occupies the second place, as most of the land here other than that used for agriculture is used to satisfy other needs. We can also see that there is 7% of Culturable wasteland in Tamil Nadu. If proper methods were followed these lands could be used for agriculture or even forests can be spread over here thus increasing over support to nature.

Here in these data even though there is around 23% of land under forest in India, not actually all of these are forests! Because, some areas might be included in forest area but there will be dried up and dead trees. Approximately around 3% to 4 % of these lands do not have actual forests.

## LAND DEGRADATION

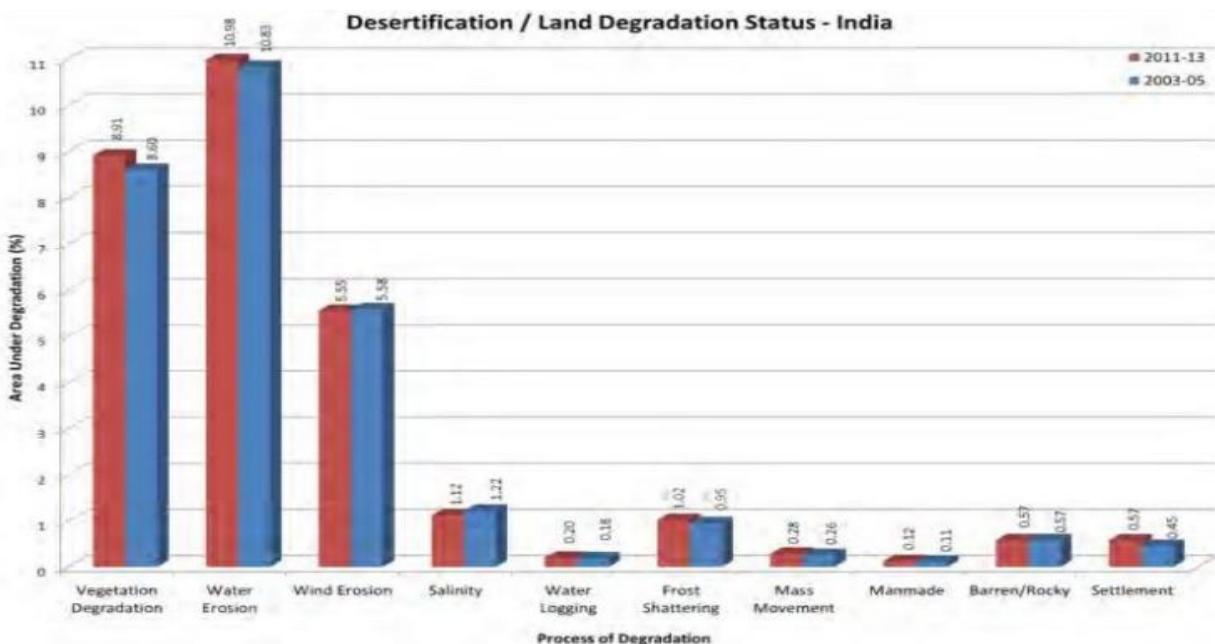
Degradation is literally defined as some “change to the worse” in terms of quality. In the fast developing world, environmental degradation is a main cause of many environmental problems.

Among these, land degradation is a main cause affecting environmental degradation and environmental pollution. So in this part of our journey we will take a look at land degradation and causes of land degradation. Land degradation is defined as the temporary or permanent decline in the productivity capacity of the land, and the diminution of its productive potential. Waste lands are considered to be degraded lands. These include rocky, barren arid and desert areas.

The major causes of land degradation are as follows:-

- ❖ Water erosion
- ❖ Wind erosion
- ❖ Soil fertility decline
- ❖ Salinization
- ❖ Water logging
- ❖ Depletion of the water table

The follow graph shows a clear idea about the causes of land degradation in India:



The environmental impact of land degradation matters more than its scientific meaning and its statistical data. Moreover talking in terms of economy, it is a disaster. Land Degradation involves low efficiency of agricultural lands and if agricultural lands are going to be hit, that's not going to be a tolerable condition.

Countries like India which solely depends on agriculture and where like 50% of working population is employed in agriculture must take this as a serious issue. It is the backbone of India. If agriculture is going to be hit, millions will lose their employment, and the yield of the crops will reduce. This will lead to food shortages and increase in prices of food crops. The above picture is of an agricultural land degraded area.



Moreover since agro based industries also depends on agriculture products, they will also be severely hit. Overall the economy of India will crash since its backbone is now broken. It does not end there. Ever increasing food prices and shortage of food will only lead the availability of food to a small portion of our overwhelming population, either leading to chaos or crisis.

Therefore land degradation must be taken seriously. It is reported that 40% of world's agricultural land is degraded. In India, at the year of 2011, land degradation stood at 29% of total area available.

Next we will talk about land pollution. Please note that it is also assumed that the terms degradation and pollution are synonymous, however this is false. Land pollution also comes under land degradation.

## **LAND POLLUTION:-**

Land pollution is the phenomenon of degradation of earth's land surfaces often caused by human activities and its misuse. Hazardous and unmonitored disposal of urban and industrial wastes, exploitation of minerals, and improper use of soil by inadequate and improper agricultural practices are a few of the contributing factors. Increasing demands on the environment and its resources are of great consequence to many countries of the world.

Sources of land pollution can be *direct*, for example, from dumping toxic chemicals directly on to a site, or *indirect*, for example where toxic chemicals leach through the soil from particulates that have settled from air pollution from a nearby smelter. It can also simply be degradation from transforming the land by clearing it so that beneficial organisms can no longer provide services supporting growth and protect it from further erosion. The expansion of housing developments, businesses, industry, infrastructure and agriculture all necessitated by an unprecedented population explosion over recent years accounts for humans modifying over 50 % of the earth's topsoil. This human activity appears more than a little reckless when considering that it takes 500 years to naturally produce 2.5 cm topsoil in ideal conditions.

## **CAUSES OF LAND POLLUTION:-**

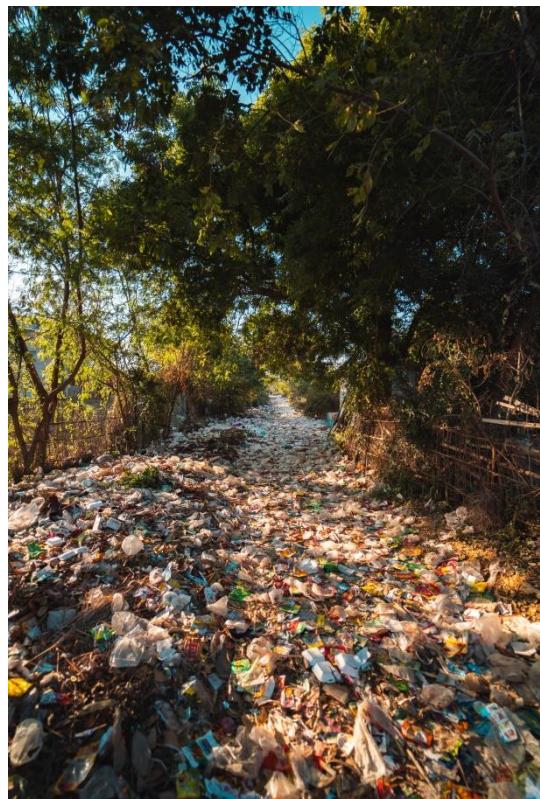
There are many ways by which we humans cause land pollution, which is threatening our environment. Let's now consider the main causes and types of land pollution:

### **WASTE DISPOSAL:**

Humans produce vast quantities of waste—in factories and offices, in our homes and schools, and in such unlikely places like hospitals. Even the most sophisticated waste processing plants equipped with plasma torches where it is used to turn waste materials into gaseous form, produce solid waste products that have to be disposed off somehow. There's simply no way of getting away from waste.

Waste disposal problem didn't always mean land pollution. Before the 20th century, most of the materials people used were completely biodegradable. Therefore when they are dumped somewhere on land, the waste products would decompose naturally and cause no harm to the nature, since the wastes which we dispose in earth are nothing but the resources which we took from it in the first place. Hence nature knew how to deal with the resources created by self.

But during the 20th century, the development of plastics and composite materials has produced a new generation of materials that the natural environment system has no idea how to break down. For example, it would take more than 500 years for a plastic bottle to biodegrade. While it's easy enough to recycle simple things such as cardboard boxes or steel cans, it's much harder to do the same thing with computer circuit boards made from dozens of various electronic parts, themselves made from countless metals and other chemicals, all tightly bonded together and almost impossible to dismantle. The site of plastic garbage among our beautiful nature is depreciated.



### **RADIO-ACTIVE WASTE:-**

Nothing illustrates the matter of waste disposal problem more clearly than the disposal of radioactive waste. When scientists discovered a way to produce energy by splitting or fusing atoms in nuclear power plants, they conjointly created the world's hardest waste disposal problem. Nuclear plants produce toxic waste that can remain dangerously radioactive for thousands of years and it will contaminate anything that comes into contact with its radioactive emissions. Nuclear plants that have suffered catastrophic accidents are generally sealed with concrete and abandoned indefinitely. Examples include Chernobyl incident of Russia, where they have recently built concrete wall on another previously existing concrete wall as to desperately contain the radioactive waste. Other one includes the town of Fukushima, which is abandoned even till date after 6 years of its incident. Not surprisingly, local communities object vociferously to having nuclear waste stored anywhere near them. A more detailed analysis on these problems is provided in *Unit 3 Chapter 1*.

## **MINING:**

Although there are many responsible mining companies, and environmental laws now tightly restrict mining in some countries, mines remain among the most obvious scars on the landscape. Surface mining requires the removal of topsoil to get to the valuable resources below. The destruction of topsoil is the worst that can happen. It can turn a productive landscape into a barren one, which is a kind of pollution. You might think a mine would only remove things from the land, causing little or no pollution, but mining isn't so simple.

Most metals occur in rocky mixtures called ores, from which the resources are extracted by certain chemical, mechanical and electrical processes. This process leaves behind the waste products and also the chemicals which were used to extract them, which will simply be dumped back on the land. Since all those wastes were dumped in the area around the mines, the concentration of pollution over there is often very high. When mines are completely scraped out, all that would be left behind will be contaminated land that couldn't be used for any other purpose.

Often old mines are now-a-days been used as landfills, which is a good solution as a land which can be used for nothing is at least used as a landfill.



## **URBANIZATION:**

Humans had made permanent settlements for at least 10,000 years. Most of the cities and towns we've created way long before, and the infrastructure that keeps them running, will remain with us for even more years. We cannot directly classify the cities and other human settlements as factors which cause "land pollution"; In present day scenario, people definitely need to live and work somewhere or the other. Urbanization may not be a main cause of land pollution but it influences it drastically.

With over 7.7 billion people on the planet, it might come as a surprise to find that humans have urbanized only about 3 % of Earth's total land surface, though about 30–40 % of the total land area has been transformed if we include agriculture.



According to the Global Footprint Network, the ecological footprint of most countries hugely exceeds their bio capacity: in India, 2.2 times bigger. One of the problems that come after urbanization is that, by concentrating people, it concentrates their waste products produced and released. So, as an example, simply disposing of

sewage from a big city without proper management systems automatically creates water or land pollution, whereas the same number of people and the same volume of sewage might not have created a major problem if we had dispersed the concentration of the population in 10 smaller cities or 100 small towns instead of a big metropolis. As concentration is always a key factor when we talk about pollution, it is good to have people spread out while speaking in terms of recovering our ailing planet. But it is also important to remember that urbanization can also help humans to live very more comfortably. The picture above is of Tbilisi, Georgia; one of the urbanised cities. A more deep account on urbanisation is given in Unit 3 – Chapter 2.

## EFFECTS OF LAND POLLUTION

Land pollution, whether it is a barren space where nothing can grow but a few weeds or a site that harbours garbage and debris, like old tires, gas cans and plastic bags is an aesthetic drain. Studies consistently show the health benefits of enjoying nature at its finest, with its lush growth, clean air and water renewing world-weary urbanites. There are further consequences for us as part of the chain of life .The web has been broken when the biodiversity that enables life has been destroyed. Where there are no plants, there is no oxygen-generating mechanism (photosynthesis), no food or habitat for wildlife, amphibians, insects, and probably few, if any microorganisms to aerate, detoxify and regenerate the soil.

Land that is filled with toxic chemicals will not sustain life and poses a health risk to people living nearby. Toxic chemicals can leach into the soil and reach the water table below, often a source of drinking water for the nearby community. When it rains, a soil without plants, to hold it in place will erode and the chemicals it contains on its surface and within the soil itself will runoff and pollute rivers and streams the water empties into, or bays and oceans, either directly or via tributaries.

The toxic chemicals can lodge in the ground sediment of the stream, adversely affecting the aquatic life that sustains itself by sheltering and feeding there. The toxic chemicals absorbed via ingestion or skin absorption make their way up the food chain as they are stored in the tissue of the marine life and magnified as larger fishes eat more of their tinier prey. So the meal can be quite toxic by the time the fish makes it to our dinner plate.

Hence it must be understood that it is not just the direct pollution of toxic chemicals that can cause problems, nor is the problem confined to abandoned lots, or illegal dumpsites.

## SOIL DEGRADATION:

Soil degradation means loss of nutrient content in soil followed by decline in soil fertility, soil erosion, and increase in salinity, alkalinity or acidity. Soil is the mother of all living things in our planet. Land-based life cannot exist without soil. Increase in human population has increased the rate of soil degradation. Soil degradation occurs mainly due to human made mistakes like converting forest land into agricultural land, grass lands, and pastures. Soil degradation also occurs mainly due to climate, vegetation etc. humans have destroyed the fertility of soil over the past 150 years. The top soil rich in minerals and nutrients are always used for making fine clay. But this practice affects the fertility of soil and the plants that live in that area will not get sufficient amount of nutrients for their growth. The uses of top soil is high because it is used in many ways such as create new beds, borders, provide base for turf laying and also for sowing seeds. Due to the above mentioned reasons top soil is used in a tremendous way but this use satisfies the human greed but does not satisfy everybody needs. There are different types of reasons for the soil degradation they are as follows:

### **1) HIGH AGRICULTURAL PRESSURE**

To satisfy current human need there were many reforms which resulted in more yield from limited area. This causes a high pressure on land. As discussed earlier this is reason why the percentage of fallow land has been decreased over these years. We do not allow the land to replenish its contents naturally and work it to death (Means draining its potential and making the land useless)

This is done by the use of highly toxic chemical fertilizers and pesticides. Over use of these things have a major negative impact on nature. Improper agricultural methods are one of the main reasons for the degradation of soil because agricultural fields replace natural vegetation and the top soil gets less nutritive due to agriculture. The amount of microorganisms in the soil decreases due to agriculture. Soil fertility decreases and the nutrients present in the soil get washed away.

Soils can also be blown by winds and storms during the rainy seasons. Sometimes farmers cultivate small plants like pulses, shrubs etc. during this short duration of time water and wind erodes the soil because small plants like shrubs cannot withstand strong wind and flood that is their roots are not strong enough to hold the soil in these tough situations so this causes soil degradation. Tillage and other types of practices performed up and down field slope creates pathways for water runoff so this process can accelerate the rate of soil erosion.

## **2) DEFORESTATION**

Clearing forest or plants and trees in the forests for human needs is called as deforestation. Deforestation reduces the amount of plants and trees in that area. Usually trees and plants in forests hold the soil during flood and also during storms; but if they are cleared out then the soil will get washed away. In this way deforestation affects the fertility of soil. Due to this only some areas will have good soil and the rivers carry these eroded soils downstream which causes significant problems. Thus crop yields decline and people have to import foreign fertilizers. Costa Rica loses about 860 million tons of valuable topsoil every year and Madagascar loses its 400 tons of soil due to erosion.

## **3) EXCESSIVE USE OF FERTILIZERS AND PESTICIDES**

Pesticides means any form of chemical which is used to control unwanted plants like woody plants, herbaceous plants and also used for eliminating insects which are harmful for the plants. Pesticides are also used for killing rodents, arachnids etc. the increase in the usage of pesticides was increased tremendously after the Second World War. Pesticides have been successful in controlling pests for a short duration of time but at the same time the effects of pesticides exists of a long period of time. Increasing concentration of pests happens in the top level of the food chain. Pesticides also create some serious problems. These points are to be noted:-

- a) Due to continuous usage of pesticides there is a chance of evolution of new breeds of pests which are immune to the pesticides.
- b) Excessive usage of pesticides increases the immunity of the pests to withstand the effect of pesticides and also the newly evolved pests kills the useful insects like earthworm which helps to maintain the fertility of soil.

## **4) OVERGRAZING**

Overgrazing occurs due to increase in livestock populations. This increase is also the result of human need. Cattles like cow and goat eats the grass, which leads to lack of vegetation cover and finally soil degradation. Grass and other types of vegetation are not able to survive due to over grazing. Millions of people in Africa and Asia raise animals on pastures that have low capacity because of poor rainfall. Pastoralists and their rangelands are threatened by overgrazing. Pastoral associations in Africa have tried with mixed success to improve the productivity of common pasture lands. In India the Agra khan rural



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support programme has been successful in improving management of grazing lands.

## **5) SALINIZATION**

Salinization means increase in the amount of soluble salts in the soil. India consists of about 6 million hectares of saline land. Salinity depends on the following they are as follows. In some regions the water naturally is itself rich in soluble salts. Excessive use of alkaline fertilizers also increases the salinity of the soil. Salts from the deep rise up in the summer season and reaches the top layer of the soil due to difference in pressure and concentration and accumulates in the top layer of the soil. Salts that are dissolved in irrigation water accumulate on the soil surface because of inadequate drainage especially during flood. This tends to be a major problem as most of the waste land in India falls under this category. This makes the land unfit for agriculture and some other uses.

## **6) WATER LOGGING**

Water logging is caused due to excessive irrigation in the land, improper water management systems, low penetration on land, etc. Water logging for a long time completely degrades the fertility of soil and makes it a complete wasteland. Water logging keeps the pH of the soil critically imbalanced. Thus, this is also a major cause of soil as well as land degradation. This is one of the reasons why environmentalists as well as common people does not encourage the construction of dams as it makes the whole land under it as wasteland.

## **7) DESERTIFICATION**

Desertification is caused due to land degradation in semi-arid and dry regions. Most of the desertification process occurs due to manmade activities such as mismanagement of forests, overgrazing by cattle's raised by humans, and also due to mining and quarrying. Reducing the vegetation cover in a particular area is also a cause for desertification. Change in climatic conditions over a large period of time can lead to permanent desertification which is a serious threat to the human population in that particular area.



## 8) LANDSLIDES

Landslide means movement of huge lumps of rocks and sand usually in sloppy areas. Landslides often occurs in hilly regions like Ooty, Kodaikanal, and Darjeeling etc. since hilly regions contain many slopes they are often prone to landslides. But mostly humans are the cause for these landslides in hilly regions because humans build roads, cut trees and make soil loose in hilly regions. Roads are built in hilly region by drilling the mountains when these roads are built the slopes that are cut for making roads are left as it is so during rainy season these slopes cannot hold water and they are so weak so landslides occurs. During landslides the useful soil gets washed away due to rain and the soil which is less in nutrition content settles ate the slope but this soil cannot be used by the plants for their growth because they lack in nutrition. In this way soil degradation occurs due to landslides and it is one of the major contributors towards soil degradation.

## WHY DOES LAND POLLUTION AND SOIL DEGRADATION MATTER?

Only about a third of Earth's surface is covered in land, and there are now over seven billion people living in this place. Most of our energy still comes from fossil fuels buried under the ground and since we don't know any place to extract from or at least sufficient technology is not developed still to excavate from other planets, we are heavily dependent on our land for minerals.

Much of our food is grown on the surface of our planet; the water we need comes from the planet's surface too or from the aquifer which is underground (This will be discussed in the next chapter). In short, our lives are as intimately tied to the surface of the earth as the plants that grow from the ground. Anything that damages, degrades or destroys the land ultimately has an impact on life of Earth and will threaten its ability to survive on Earth. That's why we search in need of solutions to the problem.

## WHAT HAPPENS IF THE CURRENT TREND CONTINUES?

Land is something which is very important. If such a thing is going to be degraded and polluted; agriculture, which is the backbone of permanent settlement, will be one of the first things to go down. Constant pressurizing of agricultural lands only makes it to deteriorate. We are slowly killing agriculture for satisfying our needs for time being. One day, we will enter the stage of crisis in the field of agriculture. If we reach this stage, then everything will start to collapse by itself. We will commit the worst genocide in history. Without sufficient agricultural lands, we would not be able to sustain the overwhelming population.

These tensions will only lead to disputes, and later chaos which will only lead to an ultimate war between humans. All this happens just only because Agriculture is hit, which is only a part of the problem. Large scale deforestation is another major problem which should not be left lightly. Trees are something which plays an important role in sustaining the balance of nature. If they vanish, so does nature itself.

Deforestation leads to various problems such as soil erosion, erratic rainfall, decimating wild habitats, etc... (This will be discussed throughout the thesis)

If we continue the current trend of deforestation, pressurizing agricultural land, making irrational use of land expecting more results without knowing that these results are short-lived , In long run it makes the existence of life on planet earth a good question.

## **UNIT 2 – THE DOMAINS OF EARTH**

### **CHAPTER 2 – WATER**

#### **INTRODUCTION**

Water is something which we use in our everyday life. It determines the pulse rate of nature. Water by its different forms go through a cycle around our planet and replenishes everything. Rain is the dominant form which we see commonly, that both physically and mentally brings about a positive change.

We see water at all its different forms – rivers, lakes, ponds, seas, oceans, glaciers, etc... and we admire its beauty. Water is one of the rarest resources in our universe. Not much water is found in our solar system other than our earth and predicted in few moons in a far distance into the darkness. Our earliest civilizations started near rivers and valleys. The Egyptian civilization developed along the River Nile, and the Indus valley Civilization says by its name where it has developed.

Water always had the configuration to replenish ‘life’ on earth. It quenches the thirst caused by natural droughts and washes away the dust caused by disasters. The music created by water in form of rain is beyond satisfaction. Water at all its natural forms supported life in one way or the other.

But what if this configuration change, in such a way that it can actually do the reverse of what it has done before? The domain of water is very important. It is where life started, and it is what all life depends upon. Let us see in this part of the thesis what the importance of water is and how we humans have decimated this domain.

To understand the problem, we must break some myths on the status of water. We will understand the natural cycle of water first. The concept of Water Paradigm shift will be discussed in this chapter throughout. Then we will move on to the exploitation of water and an example of a project which has the potential to threaten the water reserves. As a whole, in this chapter we will see about:-

- Natural working of Water system
- Water Paradigm
- Demand of Water and Water stress
- Qualitative and Quantitative exploitation of Water
- Cauvery delta Coal-bed Methane Project

## NATURAL SYSTEM OF WATER

Wasting water is arbitrarily seen as opening a tap and letting the water drain. Also today's image of water conservation involves a picture of closing the tap of water to 'save' it. These are certain myths we need to break. We must note that before humans got civilized, there were no artificial water conservation practices by any other species and we humans had enough water resource over a period of 60 millenniums. Mother Nature always had the ability to replenish the vital resources which replenished life and made it possible to exist. The water element is the most vital resource and nature always had a system to conserve it by itself. This makes water an inexhaustible resource and there is no need for conserving water by any artificial intervention (It is a known fact that water is a renewable resource).

We are also aware of the fact that despite water being a renewable resource, we experience water shortage and at times scarcity. Perhaps it is why we have stepped up to create the thesis in the first place. What kind of sorcery is this then?

In fact, after taking a lot of steps to conserve water we are still in shortage of water. This is because the natural system is not as efficient as before, since humans started to wreak havoc on it that the system collapsed and lost its efficiency greatly over these years, due to the exploitative nature of present day technology and humans.

Nature had certain permanent wind patterns that create monsoon winds that flow over almost every place in a particular period of time. There are several perennial rivers that are originated from high mountains due to melting of glaciers. There are even underground water systems which stores water between the gaps of two rock beds (mostly above parent rock bed). But these systems have been disturbed by human interactions with nature, which involves cutting down of trees in large scale, global warming, ozone layer depletion, pollution, destruction of various ecosystems and bio-diversities which acted as an important factor of maintaining the environmental conditions and nature's balance.



## THE NATURAL WATERSHED SYSTEM

The rainwater is stored by the nature to make it available for all life forms in the purest form. This system is created by nature to protect rainwater from mixing it with the saline seawater. Getting the water from rain is done by this watershed which creates deep channels or the storage hydraulic structures like lakes, ponds, streams, canals, natural cesspools, springs and inland seas or peninsular seas. These structures were also noticed by our ancestors from the ancient age of civilization and replicated a similar structure to add more water usable resources.

In this case, the 'bank' which stores water for a very long time is groundwater. The groundwater is space beneath or in between two rock layers and also found in gaps in rocks underground. The rainwater gradually drains into the ground to groundwater storage by getting through inter-particle spaces in between the sand and also through these hydraulic structures converts rainwater into groundwater on a large scale.

The main problem here is the technological advancement of the human race – construction of artificial settlements and structures such as roads, buildings, pavements, bridges, etc... block the surface and create a huge disturbance in the groundwater drainage system. There is a complete cut off of rainwater to ground in certain densely populated settlements. This led to a decrease in groundwater levels. Another aspect of the major change happened after the industrial age is the urbanization around natural hydraulic structures. This is not a new thing which happened, except people started to exploit water very badly, which caused a disturbance in the natural watershed system.

This forces us to make the myths discussed earlier a reality. Since there is a disruption to the supply of ground water, pouring water is actually considered a wastage of treated water.

**The watershed had a structure which goes on in following pathway:**

**RIVER-(hydraulic pressure due to monsoon belts) - lakes - streams - ponds - cesspools - human made water harvesting structures (After human intervention)**

The following watershed system has structure of reversible flow in both ways which change according to two different water sources:

- Ice caps
- Monsoon

In melting ice caps, the water flows from river to stream and ponds. There is no disturbance by the urbanization. But global warming is a serious threat to the melting of ice caps. It leads to release of large amount of water in short time which we can neither use now nor in the future when the source itself vanishes.

**In Monsoon, the rainwater move from ponds to rivers as the smaller streams join together to join the pond and rivers. These tributaries converge at a point forming a lake surrounding it and then into a river.** The major problem here is the growing population around these settlements and urbanization near the small water bodies. These water bodies which are formed in nature are occupied by humans for settlements and industries.

So the water supply from streams to the big rivers and lakes is blocked and there is very frequent flooding in cities due to building settlements in temporarily dried up water bodies and low lying areas which was once a small water body. This led to a huge decrease in water level in watersheds and the system is damaged completely. India is the biggest example for this scenario as most of the cities in shore like Mumbai, Chennai, Kolkata, Bhubaneswar (Odisha) experience frequent flooding in one part of the year and faces critical water shortages in summer season. This shows how drastically we have affected the natural water system.

## NATURAL SOURCES OF WATER

### RAIN

Rain is the easiest and main source of water as we know and it is the most widely used source of water. It also replenishes the ground water which is another source of water. Rain is formed in a natural process called water cycle. This starts with the evaporation of sea water and it



also involves vapors from respiration and transpiration (transpiration is the water vapor loss from plants respiration). The vapors rise up and condense into water droplets when large numbers of water droplets are formed which leads to the formation of rain clouds and falls or precipitate as rain.

The North East region receives about 1000 cm and Western Rajasthan gets less than 10 cm of annual precipitation (This is natural). Further, most of the rainfall occurs during the season of south-west monsoon in four months i.e. from June to September.

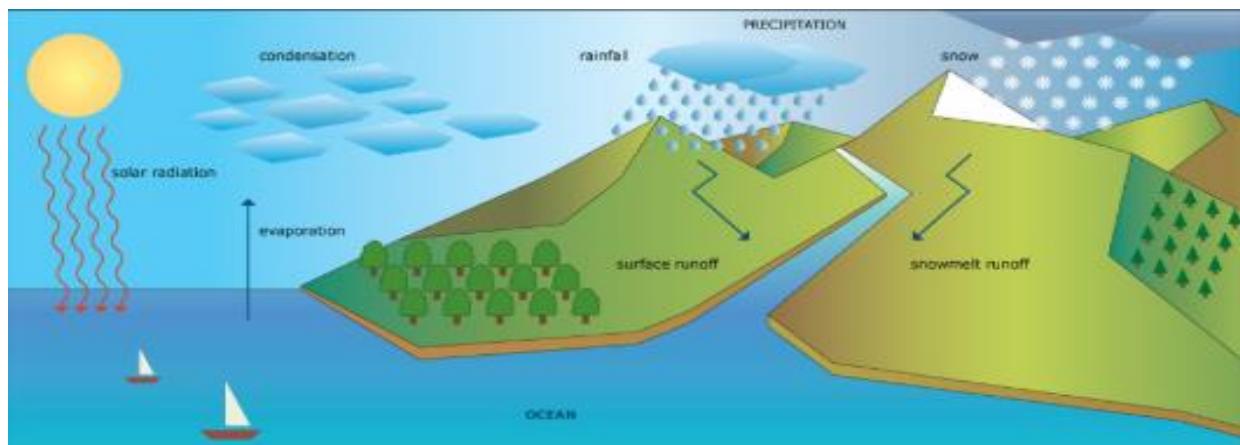


Image: The Natural Water Cycle

## **RIVER:**

It is a large natural stream of water flowing in a channel to the sea or lake. Small streams join to form river. Rivers are formed due to mountains or hills as discussed earlier and provide water to animals and plants on its way to the sea. Rivers are also considered as life line of a country.

Rivers are of two types –

- Natural
- Manmade or Artificial rivers

We need a lot of money to build a manmade river. The great manmade river is a huge system or network of pipes that provides water to the Sahara from the Nubian Sandstone Aquifer System it is also the world's largest irrigation project. This is one of the positive aspects of the present day technology.



## CONVENTIONAL SOURCES OF WATER:

### SEWAGE WATER TREATMENT:

The domestic waste water and some industrial wastewater are treated physically, chemically and biologically and turn them into safe water which won't cause any damage to the environment. It can be used for deistical purpose other than drinking. Australia, Canada, China, France, Egypt, Mexico, UK, Russia, USA are some countries having sewage water treatment plants with them.



### Composition of water all over the world:

The distribution of water on the Earth's surface is extremely uneven. Only 3% of water on the surface is fresh; the remaining 97% resides in the ocean. Of freshwater, 69% resides in glaciers, 30% underground, and less than 1% is located in lakes, rivers, and swamps.

Before getting into water scarcity, let us understand the concept of water stress first to understand how these sources of water are exploited by the human beings...

Now we have an idea of actual working of natural water system and its lost potential. We will now discuss about the present day mythical ideology of water – called 'Water Paradigm'

## WATER PARADIGM:

### A PARADIGM SHIFT ON WATER

Paradigm shift actually means an important and evolutionary change that happens when the usual way of thinking about or doing something is replaced by a new and rational one. In simple terms, paradigm shift is changing an existing ideology to a better one. The important thing we are going to change the way of looking or thinking about is how we see the domain of water. The water is an important element that we need for everyday use. Without water, even life might not be originated on earth. But there are a lot of things which are outdated on how we see, how we use water, how we exploit water, how we wastewater, how we pollute water, how water is marketed and how water must be conserved.

The idea of “Water is the elixir of life. Water is so precious” is wrong. First of all, water should never be seen as precious. It is a common commodity that is essential for every human to live and flourish. It was always available in nature. Since when did it become precious?

It is simply due to the exploitative nature of humans. We have abused the domain of water to such an extent that today we see it as “precious”. If present situation continues, it is a simple fact; in future we may call air or land as “Precious”

### A PARADIGM SHIFT ON WATER USAGE AND WASTAGE

Water wastage is always seen as people wasting water by overusing it and making it wastewater without utilizing it properly or letting unused water into the drainage. But in the view of nature, in general, there is no such thing called as ‘wasting up’ something. Nature had the ability to take up any form of water and recycle it then shower it down as rain.

What are the ways we ‘waste’ water? Pouring it down? No water gets wasted naturally when water spills down the ground as every drop of water gets seeped into the ground. This is the huge natural water storage tank that purifies any form of water which falls on the land. But does this mean we are not wasting any water? If the water does not get wasted by any means then, how does water gets exhausted? The answer is found in the very core of the question and the paradigm in which we search for the question. What if nature's cleansing system itself is in a poor state due to the human interaction with nature? The truth is we destroyed every aspect of cleansing and replenishing agents of nature. There is no required groundwater percolation on earth as the human race built many concrete and other artificial structures that act as a barrier for percolation of water into the ground. The increase in temperature due to global warming delayed monsoons and extended the summer season, hence the water cycle is disturbed. We will now move on to the present day problem indicators, starting with ‘Water Stress’

## WATER STRESS

Water stress occurs when the demand for water exceeds the available amount during a certain period or when poor quality restricts its use. It is very evident that there is an infrastructure between supply and usage. Supply demand increases when available water is quantitatively and qualitatively exploited.

How is water stress measured? An index of water stress is often calculated as “water resources vulnerability index”. It is a measure of pressure on existing water resources.

**Water stress Index = Annual Water Withdrawals/ Annual run off**

<b>WATER STRESS</b>	<b>WATER STRESS INDEX</b>
0.2	No water stress
0.2-0.4	Medium stress
>0.4	High stress

## WATER STRESS IN INDIA:

Water stress in India is more attributed to pollution viz qualitative exploitation. Though Ladakh and Rajasthan face a water stress of 0.35-0.46, even Allahabad faces a water stress of 0.6 which is of very high magnitude. It is evident that perennial rivers are polluted by heavy toxins, effluents and biodegradable refuse that defy the **BOD** and decrease rivers ability to flow. Hence bad water is stagnated and bad odor further increase.

Due to low dense emulsion atmospheric oxygen does not dissolve into water. And due to constant release of effluents **DO** content also gets decreased and gets diffused into the atmosphere and finally it becomes dead. Down in the south of peninsular India, distributaries of very big lakes are converted to drains and trickles. This led to huge decrease in water level.

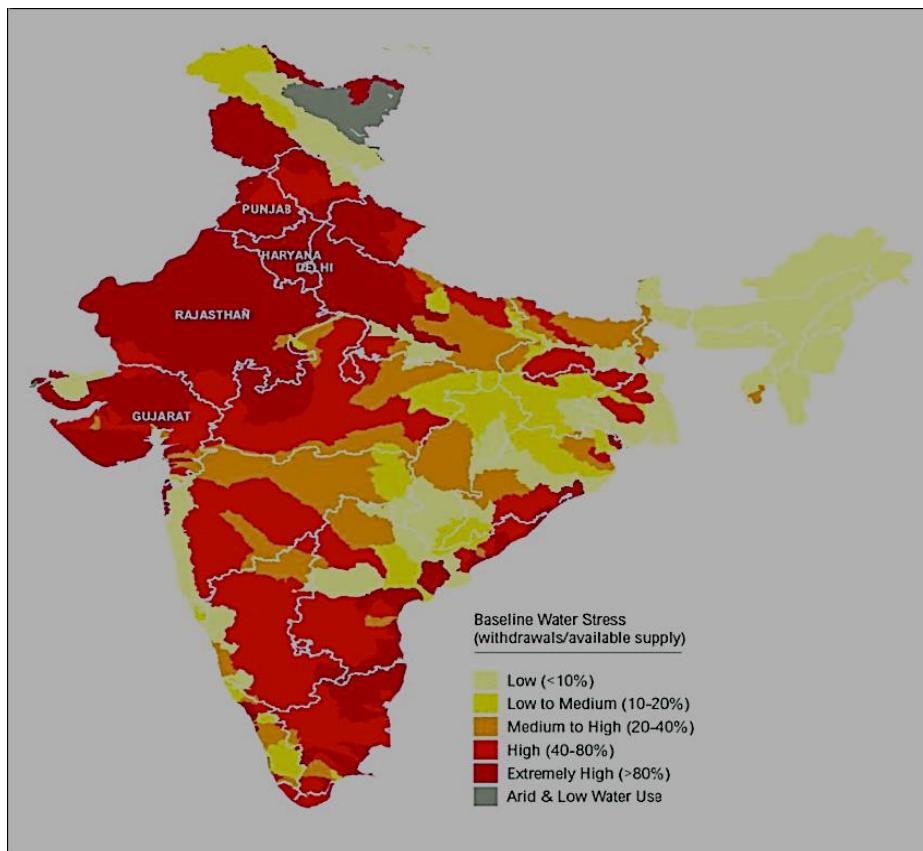


Image: Water stress in India

## **DEMAND FOR WATER – INSTIGATOR OF WATER STRESS**

### **VARIOUS TYPES OF WATER DEMAND**

1. Domestic water demand
2. Agricultural water demand
3. Industrial water demand

### **DOMESTIC WATER DEMAND:**

Domestic water demand includes all the day to day water needs and requirements for daily life. For ex: private buildings for drinking, cooking, bathing, lawn sprinkling, Gardening, sanitary purposes etc. The water demand in domestic level varies according to the lifestyle and living requirements of an individual or of the consumers, on an average this domestic consumption under normal conditions in a Indian city is expected to be around 135 litres /day/person as per Indian RTI reports. The total domestic consumption generally amounts to 50-60% of the total water consumption.

### **AGRICULTURAL WATER DEMAND:**

Water is needed for food production for the increasing population. There are various important crops which must have irrigation to have a regular water supply for its growth. Even though only 15% of total harvested lands are irrigated, they produce about 50% of crop production, making it clear that we depend extensively on irrigation for food production. Irrigation projects boomed during the 60's and 70's and started to slow down because of their high costs and environmental damages. Water demand for irrigation varies according to different regions because of differences in climate, water availability, land fertility, and water management. For example, in an arid region such as Africa, we need as much as 25,000 cubic meters to irrigate 1 hectare of land, where in northern Europe we need only as much as 5,000 cubic meters. This fact together with the high population growth in Africa has already put some countries in that region in a situation where water scarcity has become a major obstacle in development.

## INDUSTRIAL WATER DEMAND:

The industries that produce metals, wood and paper products, chemicals, gasoline and oils, and those invaluable grabber utensils you used for getting your ring (which also require water to manufacture) from the garbage disposal pits are major users of water. Industrial water demand includes water which are used for certain processes like dyeing, fabricating, processing, washing, diluting, cooling, or transporting a product; incorporating water into a product; or for sanitation needs within the manufacturing facility. The industries which use large amounts of water manufacturer such commodities as food, paper, chemicals, refined petroleum, or primary metals.

According to Ministry of Water Resources, about 40 billion cubic metre water is used in industrial areas of the country, which is about 6 percent of total availability of water. Out of this, about 10 billion cubic metres of water is used by processing industries and 30 billion cubic metres is used for refrigeration purposes. This table is taken from Indian government website which shows the Industrial use of water resources.

**Table 12.3**  
*Indian Scenario of Water Pollution by Industries*

<i>Industrial Sector</i>	<i>Annual Waste Water Discharge</i>	<i>Annual Water Consumption (million cubic metres)</i>	<i>Proportion of Water Consumed in Industry</i>
Thermal Power Plants	27,000.9	35,157.4	87.87
Engineering	1,551.3	2019.9	5.05
Paper and Pulp	695.7	905.8	2.26
Textile	637.3	829.8	2.07
Steel	396.8	516.6	1.29
Sugar	149.7	194.9	0.49
Fertilizer	56.4	73.5	0.18
Others	241.3	314.2	0.78
<b>Total</b>	<b>30,729.2</b>	<b>40,012.0</b>	<b>100.0</b>

Now let us understand how water is brutally exploited by humans. Both qualitative exploitation and quantitative exploitation must be considered while discussing this topic. Hence we will start with quantitative exploitation. To understand how water is exploited quantitatively, we must understand what water scarcity is.

## **QUANTITATIVE EXPLOITATION OF WATER**

### **WHAT IS WATER SCARCITY?**

Water scarcity is the lack of sufficient water resources or inability to access safe water supplies to meet all the demands of water usage within a region. According to United Nations, Water scarcity means scarcity in availability due to physical shortage, or scarcity in access due to the failure of institutions to provide a regular supply or due to a lack of appropriate infrastructure. Water scarcity has almost already affected most parts of the world. It already affects 2.8 billion people around the world, at least one month out of every year. More than 1.2 billion people lack access to clean drinking water.

In India, water scarcity is the worst scenario. Now, we are going to see a complex water scarcity scenario due to urbanization, heavy water stress and complex population situations. Let us see how the water scarcity in rural areas created due to cities in that region.

Most cities in India are facing severe water scarcity. Other problems and concerns pertaining to quantity and quality include equity across different segments and different sections of population, poor sanitation, ineffective and obsolete wastewater management practices and lack of long-term vision, planning and motivation. Cities expand at a rapid rate and consume resources available in suburban areas too.

**While land in suburban villages is taken by urban housing, industrial factories and companies and for dumping urban wastes very little is ploughed back by way of developing these areas.**

Urbanization process cannot be blind. It should ensure sustainable use of natural resources (To understand what sustainable development is, refer Unit 4 Chapter 2) but very little attention is paid to investigate the role of groundwater in the process of urban development. Available groundwater's exploitation is unplanned and unregulated, resulting in ecological degradation. In India, not only that water is never a part of the urban planning, the suburban issues are completely ignored and given the least importance in the overall planning process. This has resulted in serious livelihood problems in these areas.

Resource scarcity is certainly one of the reasons for the conflicts between urban and sub urban regions; but it is a note that resource scarcity is not caused majorly by the hydro-geological factors: most often it is man-made. Regardless of the causes, the consequences imply that water supply are very much part of the concerns such as urban water environment, water supply and sanitation. Secondly, as indicated

earlier, the looming threat of serious conflicts in resource sharing between cities and their suburban and rural areas is something which needs due attention. This question is of growing importance in the ongoing context of Indian urbanization.

Keeping these two elements, we will highlight the resource dimension in urban water conflicts in the process of service provision in cities in India with private sector involvement.

### **MNCs and private sector involved in water scarcity**

One of the new millennium goals for the coming decades is the priority given to access to safe drinking water and its financing.

Two opposing viewpoints emerged:

- Advocates of the private sector are trying to work out ways of reducing the risks for operators.
- Challengers of water multinationals stress the growing disparity of water access in cities of developing countries.

In India, this did not correspond to observed reality; until recently due to very controversial Delhi water sector project. Indeed, with the exception of short duration contracts for the construction of water treatment plants, attempts to initiate large-scale projects with the international private sector have failed. Private operators are not fully absent, but they are small in size; they undertake local contracts, involving a limited number of operations and no investment on their part. There are two main institutional arrangements for water services. Specific urban water bodies are in charge of water supply and drainage.

### **Conflicts due to private mechanism**

Urban water supply is thus largely dominated by the public sector, yet restrictions on access (complete or partial) are no less real, mostly because of the inefficiency of the public service.

First we are going to see about urban water conflict; then we are going to study the situations of Delhi and Chennai to understand better about water scarcity. The case of Delhi addresses conflicts linked to water access and compensatory strategies associated with it. The water scarcity of Chennai is in a most critical situation, opposing the city to the suburban regions and villages. The continuous water transport is arranged, in order to supplement the city's drinking water needs, this has drained water resources in suburban areas and villages. So the solution of distribution of water to solve water scarcity in the city region by taking it from a rural area creates water scarcity in rural areas.

## **How to identify water scarcity in urban or suburban areas?**

Now we understood what is the situation faced by Indian cities but we must know how exactly to spot out that a city or a country experiences water scarcity. When the total water demand is higher than the total water availability, we can identify that water scarcity is prevailing. In technical terms, the difference in the availability and demand show how much water is scarce in the region.

### **DIFFERENCE IN WATER AVAILABILITY AND DEMAND**

Before getting into actual statistical data on availability and demand, we shall know how much water is at demand in each sector. We already know how much availability of water from which of the sources we get similarly, there are different water demand according to different uses.

### **Calculation of water scarcity in India:**

The annual precipitation including snowfall, which is the main source of water in India, is about 4000 billion cubic meters (BCM). However, the average annual rainfall varies considerably from one region of the country to another. About 53.3 percent of total precipitation is lost due to evapotranspiration which leaves a balance of 1869 BCM water in the country. Further, about 40 per cent of the potential available can't be put to beneficial use due to topographical constraints and uneven distribution of water resources over space and time.

Almost half of the surface water is depleted without using as flood waters, or mixed into the drainage to clear water from the cities or dried up as it stands as stagnant water and doesn't get drained into groundwater. So, the available water is around 770 - 800 bcm.

The water demand is much higher than the availability of water. The available water is around 770 to 800 but in 2018 it was about 800 BCM water required. As there is no water democracy in India, the water is privatized and sold at cost to certain people who could afford. They use twice or even thrice the water as of the people who can't afford and depend on public water distribution.

*Table: Water requirements for various sources*

Sector	Water Demand in Km <sup>3</sup> (or bcm)		
	2010	2025	2050
Irrigation	557	611	807
Drinking	43	62	111
Industrial	37	67	81
Energy	19	33	70
Others	54	70	111
Total	710	843	1180

## **QUALITATIVE EXPLOITATION OF WATER**

Now let us see how humans exploit water resources qualitatively – Water pollution and Water degradation.

### **WATER POLLUTION**

Whenever undesirable chemical substances such as toxins, dyes and other waste such as detergents and factory dispenses gets mixed with water, the water gets ‘polluted’.

Pollution domain of water is of serious concern. When pollution in certain region is caused, then the aquatic animals which live there become the victim of this pollution. They may die on large scale. Examples include oil spillage, discharging waste chemicals from factories into water bodies, and use of fertilizers on soil. When water washes away the used fertilizers, they mix with rivers causing its pollution. This water mixed with fertilizers can also percolate to ground water table and then pollute the ground water too.

Water pollution is one of the biggest challenges India is facing right now in water domain. The untreated sewage is the biggest source of such form of pollution in India. The other sources of water pollution are runoff from the agricultural sector as well as unregulated units that belong to the small-scale industry. The situation is so critical that there is no water body in India that is not polluted to some extent or the other.

In fact, some reports say almost 80% of the water bodies in India are highly polluted. This is especially applicable to ones that some form or the other of human habitation in their immediate vicinity.

### **TYPES OF WATER POLLUTION:**

Water pollution can come from a number of different causes and sources. If the pollution comes from a huge single cause or source, such as an oil spill, it is called point-source pollution. If the pollution comes from many causes or sources, it is called non-point-source pollution. Most types of pollution affect the immediate area surrounding the source or cause. Sometimes the pollution may affect the environment hundreds of miles away from the source, such as nuclear waste, this type is known as Trans-boundary pollution.

## **CHEMICAL WATER POLLUTION**

Industrial and agricultural work uses many of the different chemicals that can run-off into water and pollute it. As discussed earlier, this can lead to serious pollution of different domains of water.

Metals and solvents released from industrial work will pollute rivers and lakes. These are poisonous to many aquatic life forms and it may slow their development, make them infertile or even result in death.

Pesticides and weedicides are used in farming to control weeds, insects and fungi. Run-offs of these pesticides and weedicides can cause water pollution and poison aquatic life. Due to this, birds, humans and other animals may be poisoned if they eat any of the infected fish.

Petroleum is another chemical pollutant that usually contaminates water through oil spills when a ship ruptures. Oil spills usually have only a localized effect on wildlife but it can spread for miles. The oil contaminated water will cause the death of many fish and stick to the feathers of seabirds causing them to lose the ability to fly. Oil spills have the potential to massacre life in the particular region.

## **WATER POLLUTION BY SUSPENDED MATTER**

Some pollutants do not dissolve in water as their particles of the matter are too big to mix between the water molecules. Such material is called suspended particulate matter and can often be a cause of water pollution. The suspended particulate matter eventually settles to form thick silt at the bottom. This is harmful to marine life that lives on the riverbeds or rock bed on lakes.

Biodegradable substances can become suspended in water and it can cause problems by increasing the number of anaerobic microorganisms present underwater. Toxic chemicals contaminated water is harmful to the development and survival of aquatic life.

### **MICROBIOLOGICAL WATER POLLUTION:**

Microbiological water pollution is usually a natural form of water pollution caused by microorganisms but it can lead to dangerous levels by human activities too. Many types of microorganisms live underwater and cause fish, land animals and humans to become ill. These microorganisms include:

- Bacteria
- Viruses
- Protozoa

Serious diseases such as cholera can be caused by these microorganisms that live in water. These diseases usually affect the health of inhabitants of poorer countries, as they do not have the facilities to treat polluted water.

### **GROUNDWATER POLLUTION**

When rain falls and drains deep into the earth, filling the cracks, crevices, and porous spaces of an aquifer (basically an underground storehouse of water), it becomes groundwater—one of our least visible but most efficient natural water resources. Nearly 40 percent of Americans rely on groundwater, pumped to the earth's surface, for drinking water. For some people in rural areas, it's their only freshwater source.

Groundwater gets polluted when contaminants—from pesticides and fertilizers to waste leachate from landfills and septic tank systems—make their way into an aquifer, rendering it unsafe for human use. Ridding groundwater of contaminants can be very difficult or even impossible in some locations. This makes the process costly. Once polluted, an aquifer may be unusable for decades, or even for thousands of years.

We can see the one which has the highest potential to satisfy the overwhelming demands is easily vulnerable. This puts us in a position to manage our resources.

We will now see what the main reasons of water pollution are.

## **CAUSES OF WATER POLLUTION:**

### **Urbanization**

As more and more people migrate into cities and towns, a number of factors cause pollution. This includes nuclear construction of buildings that obstructs the natural flow of water into oceans – which causes flooding of low lying areas. Moreover due to unplanned construction of buildings, we have reduced the rate of water percolation into the soil.

### **Destruction of Wetlands**

Wetlands are nature's way of cleaning water as well as damming water (they hold back water in summer and release it in winter). They are considered as the most bio-diverse ecosystems.

Destruction of wetlands:

- Destroys the habitat of many birds and fish;
- Removes the natural filters capable of storing and degrading many pollutants, such as phosphorus and heavy metals;
- Destroys these 'natural dams' and causes flooding further downstream.

### **Industries**

Industries produce waste that can affect the pH of the water. The pH measure of water determines whether the water is alkaline or acidic or neutral. The Temperature of the water is also changed when water used for cooling purposes is released directly into water bodies. It is also termed as "Thermal pollution of water" (drastic increase or decrease in temperature can have an impact on temperature sensitive organisms living in the water).



### **Mining**

While mining, there will be lot pollutants mixed directly to ground water and nearby water bodies.

It causes change in pH, nutrient contents of water and can also cause murkiness of water. The same problems will occur here as listed above.



## **Modern Agriculture**

Modern methods of ploughing, overgrazing, water logging and road building increases soil erosion due to the physical disturbance of soil and vegetation. Due to this effect, the murkiness and the amount of salts and minerals in water increase. The green revolution brought in the concept of using artificial fertilizers rather than harmless natural manure, which also causes critical imbalance in the nutrients dissolved in soil and thence water.

## **SEWAGE AND WASTEWATER MANAGEMENT**

Sewage and Wastewater released from Domestic households, industrial and agricultural practices produce wastewater that can cause pollution of many lakes and rivers. Sewage is the term used for wastewater that often contains faeces, urine and laundry waste. Sewage disposal is a major problem in developing countries as many people in these areas don't have access to sanitary conditions and clean water and also proper well planned management systems are absent. Untreated sewage water in such areas can contaminate the environment and cause diseases such as diarrhea.



Sewage in developed countries is carried away from the home quickly and hygienically through sewage pipes. It is treated in water treatment plants and the waste is often disposed into the sea.

In under-developed countries, sewage often causes problems when people flush chemical and pharmaceutical substances down the toilet. When people are ill, sewage often carries harmful viruses and bacteria into the environment causing health problems.

## EFFECTS OF POLLUTION OF WATER

**Diseases:** In humans, drinking or consuming polluted water in any way has many disastrous effects on our health. It causes typhoid, cholera, hepatitis and various other diseases.

**Destruction of Ecosystems:** Ecosystems are extremely dynamic and respond to even small changes in the environment (Butterfly effect). Water pollution can cause an entire ecosystem to collapse if left unchecked.

**Eutrophication:** Chemicals in a water body encourage the growth of algae. These algae form a layer on top of the pond or lake. Bacteria feed on this algae and this decreases the amount of oxygen in the water body, severely affecting the aquatic life there. This phenomenon is also called as 'Algal-Bloom'.

**Affects the food chain:** Disruption in food chains happens when toxins and pollutants in the water are consumed by aquatic animals (fish, shellfish etc), which are then consumed by humans. Through this way contaminants enter the food chain. This leads to Bio-Magnification.

### **Overall effect:-**

The pollution factors we have discussed about create an imbalance in nutrients of water. This can also kill aquatic animals and make the water unfit for consumption. The amount of minerals and salts in the water is affected. This altered water if consumed can cause health problems;

Murkiness of water can block fish gills and the bottom dwelling plants cannot photosynthesize as the sun's rays cannot reach them. Water is supposed to be neutral to be fit for drinking and for living organisms to live. When the pH is altered, it becomes unfit for use as well kills the aquatic animals living within the water's stake.

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## DESERTIZATION OF TAMIL NADU BY METHANE PROJECT

Methane project was introduced by the central government in Cauvery delta region for obtaining natural gas in that region for national power resource development. But this will initiate a disaster which will turn the whole Tamil Nadu into a desert. Complete water scarcity will prevail and half of the Tamilians are estimated to die out of without getting water.

The methane is pumped out by oil or gas wells which are used to take methane and oil by sending fluids in high pressure containing 70% water and sand through huge horizontal and vertical protection pipes drilled under hundreds of metres underground. This high pressure movement develops cracks and sends the methane and other hydrocarbon fluids out of land by contaminating the groundwater.

To do this huge process for just one time, It is necessary to use water and sand that require to build 100 apartments. This is for one such dig well but central government planned to have 2000 such dig wells around Tamilnadu. The water is provided from local water bodies and groundwater to reduce transport cost. This requires 4 TMC of water. This is the requirement of water to provide for 40 Lakh Indian people's yearly water needs!

Radioactive fluids will get mixed up with groundwater along with the pressure fluids. This emits radiation into groundwater and bedrock. So, the nearby regions (the full Cauvery delta) will be under complete destruction of vegetation and fertility of soil. When the people surrounding that region open they're taps, the water will catch fire!!!! Lot of new diseases might form along with cancer, abnormalities in pregnancies and humans who us this groundwater. The whole region will be turned into waterless, No food producing deserted land.

This is why the people of Tamil Nadu forced the central government and state government to drop this project.

## WHAT IF THE CURRENT SITUATION CONTINUES?

We are exploiting water quantitatively and degrading it qualitatively. If the present trend continues for few more years, the damage done to domain of water will be irreversible. Already few places on earth such as Cape Town of South Africa ran out of water.

Water is something nature granted to the species living on earth as an infinite resource, which we have confined to bottles and started selling it for a price. How more can the situation become worse?

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## **UNIT 2 – THE DOMAINS OF EARTH**

### **CHAPTER 3 – AIR**

#### **INTRODUCTION:**

Air is a unique and important essential component of nature which is responsible for sustaining life on a planet. By the term ‘Component of air’, we can relate it to the atmosphere. Earth’s atmosphere is a mixture of gases. The composition is primarily nitrogen (78%), with oxygen (21%), water vapour, argon (0.9%), carbon dioxide (0.04%) and many trace gases. Air also typically contains dust, pollen, and spores. Air in form of wind is also important in various power plants since we have developed techniques for utilizing the potential of wind for generating electricity, which is important for us today. For a layman, air is the clear gas which living beings breathe to live.

People take air lightly, as something which is easy on us and is weak. Air seems light, but there is a way lot of it pushing down on Earth’s surface. That is something called air pressure. The pressure is so huge, but your body applies equally opposite pressure to withstand it. In higher altitude, the pressure decreases. Hence you either feel a deep pain or bleeding through your nose or ears. This is all due to air pressure difference (Officially called atmospheric pressure). That is why you should not underestimate air!

#### **AIR’S IMPORTANCE:**

On Earth, we’re pretty lucky to have dense atmosphere filled with suitable gases which sustain life. Planets in our solar system such as mars does not have a good dense atmosphere, other planets like Venus have an atmosphere with 96% of CO<sub>2</sub> gas, leading to tremendous amount of greenhouse effect (This is the reason why Venus is hotter than mercury despite being away from the sun). The air in our atmosphere acts as a ‘winter sweater’ (Venus’s atmosphere is a furnace), keeping the Earth’s surface temperature from getting too cold or too hot.

Ozone, another type of gas in the air, also protects us from the harmful effects of Ultra Violet (UV) rays of sunlight. Ozone gas (O<sub>3</sub>) is as evil as friendly. It is a deadly poisonous gas that is lethal if inhaled beyond the safety limit. Luckily, nature decided that the composition of Ozone in our lower atmosphere is very low, and down here its composition is 1/5000th. However at the higher levels, this gas forms a protective layer that absorbs the UV radiations of sunlight, before reaching the surface of the Earth.

The Atmosphere also protects us from meteoroids. They cannot crash into Earth’s surface that easily, since when they enter the atmosphere of the earth, the force by which gravity pulls the meteoroid produces a friction between itself and the atmosphere, causing it to burn. A layer of atmosphere called mesosphere does this

function. This is where the outer space particles like meteoroids either burns down completely or breaks into smaller pieces before reaching the surface of earth, reducing – nullifying the effect of crash. This burning of meteoroids also gives us a chance to witness the spectacular phenomenon of ‘shooting stars’

## THE BALANCE OF AIR

People need to breathe, and so do the other animals—and plants! Breathing is part of a process called respiration. During a typical respiration process, a living thing (like a human) takes in oxygen from the air and gives out carbon dioxide. This process gives animals and plants the energy to eat, grow, and live! However it is not necessary that living things shall take in only oxygen to perform respiration and live. There are these organisms called anaerobic organisms which breathe in CO<sub>2</sub> itself directly to sustain their life!

When humans and animals breathe and exhale, we give off an odourless gas called carbon dioxide, or CO<sub>2</sub>. Plants use this gas, along with sunlight, to make food—and oxygen too! This process is called photosynthesis. Hence Plants and Animals are in a strong relationship. Both of them need each other. One man’s trash is another man’s treasure. Nature was balanced until this process on both sides were equal

However today, due to over usage of resources and technological advancements, large amounts of CO<sub>2</sub> are produced when cars and power plants burn coal, oil, and gasoline, drastically increasing the amount of CO<sub>2</sub> in air. This is bad because CO<sub>2</sub> is the most important contributor to human-caused global warming. This is caused by ‘The greenhouse effect’. We will see what it is in this chapter.

## THE QUALITY OF AIR THROUGH TIME:-

Talking about the quality of air over these years, we can split the time before and after the advent of industrialization. Before Industrialization, The balance of air so specified above was maintained perfectly by nature itself. Industrialization is mainly about the use of coal. Burning of coal produced huge amount of gases such as CO<sub>2</sub> and SO<sub>2</sub> into the air. Another dangerous substance produced is Suspended Particulate Matter (SPM) – Which when inhaled causes breathing problems, leading to choking. This was simultaneously accompanied by the removal of forest cover (As discussed in the earlier part of the thesis, Domain of Land). This critically affected the balance of exchange of gases between plants and animals. We have increased CO<sub>2</sub> content and at the same time reduced the No. of trees. Hence there is a huge CO<sub>2</sub> content which is to be handled by now reduced amount of trees. This also produces less oxygen since lower amount of CO<sub>2</sub> is processed by the world’s remaining forests.

This ultimately led to the drastic increase of CO<sub>2</sub> in the atmosphere, leading to the aggravation in the ‘Greenhouse effect’. Moreover the smoke emitted by burning of coal and those emitted from industries led to a condition called ‘smog’ in industrial

cities like London and Paris in 18<sup>th</sup> century, and now live examples include New Delhi of India and Beijing of China. All these disturbances in the domain of air is collectively called as ‘air pollution’ Before seeing about the factors contributing to air pollution, let us see what is the greenhouse effect.

### GREENHOUSE EFFECT:-

You might have come across this term somewhere else, and at most places, it is only viewed as something problematic. However, this effect is essential for a planet to sustain life. Remember that atmosphere of earth keeps earth from neither getting too cold nor too hot? All thanks to greenhouse effect!

Greenhouse effect is caused by gases such as carbon-di-oxide, methane, water vapour, etc... which are responsible for the heat retention ability of the atmosphere. They trap the sun’s heat which enter the atmosphere and circulates it within the atmosphere, warming down the temperature of earth. However, due to excessive production of CO<sub>2</sub>, we have aggravated the greenhouse effect. This in turn resulted in global increase of temperature.

Light is a compound of reactive power and magnetic fields. The spectrum extends from low power microwave ovens and infrared light to the visible part of the spectrum (red, orange, yellow, green, blue, purple) and then to more vibrant forms of light, such as UV and X-rays. These rays when strike the accumulated gases at the ozone layer, they tend to heat up. This is a basic requirement for life on earth otherwise it would have been just too cold. This is similar to the man-made greenhouse glass that absorbs and maintains an artificial and hot temperature inside the glass building, or at times by transparent plastic insulation. Hence, it is called as greenhouse effect.



*Image: A greenhouse made of glass*

However, due to the increase in CO<sub>2</sub> content in the atmosphere, the retention of heat also increased. This increased the global temperature by 0.8 degree Celsius to

1.4 degree Celsius. Do not let the numbers deceive you. However small it maybe, it has devastating effects. One of the effects is the average increase in the number of forest fires. A more detailed issue on a forest fire is given in Unit 3, chapter 4. This is the reason for global warming as the strong electromagnetic radiation has higher energy and is stored in the thick blanket of gases. In the recent years the earth has been heating up too much due to the production of these gases by various industries, factories and vehicular particulate emission. The UV and IR rays keep heating the gases at the verge of the atmosphere but the amount of gases is now higher. The main reason is CFC – Chloro Flouro Carbons that was initially used in refrigerants and in ACs.

A relatively small change in temperature, as the butterfly effect suggests, has caused global catastrophe today.

## **FACTORS CONTRIBUTING TO AIR POLLUTION**

Over the recent years, the amount of air pollution increased. In our current day situation, we are facing many problems due to air pollution. In some Indian states, the level of pollution is so high that we breathe in only the polluted air which in turn causes many diseases. Haryana is one of the most polluted states of India. Delhi is also included in the list. Air pollutants such as sulphur oxides, carbon monoxides, and many others have caused air pollution. A major effect of air pollution is Acid rain. Acid rain, first discovered (More precisely, one of the wonderful invention of mankind) in 1850's, was another problem resulting from coal powered plants.

Along with amazing technological advances, the industrial revolution of the mid- 19<sup>th</sup> century introduced new sources of air (As well as water) Pollution. By the middle of the 20<sup>th</sup> century, the effects of these changes were beginning to be felt in most of the countries around the world.

We have seen Industrialization is the main reason for the pollution of air. Let us see now the different divisions of this development which contribute to air pollution.

### **VEHICLE EMISSIONS**

Vehicle emissions are the source of fossil fuel emissions and air pollution. Private transportation accounts for about 10 % of carbon footprint.

Note: Carbon footprint, as the name suggests, is simply the amount of greenhouse gas released in the atmosphere by some human activities. More specifically, it talks about CO<sub>2</sub> gas.

Air pollutants emitted from vehicle are believed to cause cancer and contribute to problems such as asthma, heart disease, birth defects and eye irritation. Emission from vehicles increases the levels of carbon dioxide and other greenhouse gases in the atmosphere.

Greenhouse effect is also aggravated. In India, transportation sector emits an estimated 261 tonnes of CO<sub>2</sub>. 94.5% of this is contributed by road transport. The transport sector in India consumes about 17% of total energy and responsible for a 60% production of the greenhouse gases from various activities.

The pollution from vehicles is due to release of gases like CO, Partially burnt Hydrocarbons, Lead particles, NO<sub>2</sub>, SO<sub>2</sub> and SPM (Suspended Particulate Matter) mainly from tailpipes. Vehicles in major metropolitan cities are estimated to account for 70% of CO, 50% of HC (Hydro Carbons), 30- 40% of NO, 30% of SPM and 10% of SO<sub>2</sub> of the total pollution load of these cities. Two-third of this is contributed by two-wheelers alone.



These high levels of pollutants are mainly responsible for respiratory and other air pollution-related ailments including lung cancer, asthma, etc., which is significantly higher than the national average. Poor regulations on restrictions of use of old vehicles also contribute greatly to air pollution. We would find it easily true that older vehicles emit a greater amount of smoke.

## **INDUSTRIES**

Industries are the major contributor to air pollution. Industrial processes release pollutants such as nitrous oxide and hydro fluorocarbons into the air. Agricultural practices, livestock rearing and landfills also contribute to atmospheric methane concentrations. Smokestacks of thermal power plants, smelters and other industries release particulate and gaseous air pollutants which are known to cause greatest harm to human health. These pollutants combine with water vapour in presence of

sun light and oxygen and form dilute sulphuric and nitric acids.



When this mixture of gases contaminates rain clouds, it causes acid rain. This has killed more than 70% of corals in Lakshadweep and Andaman islands. Most of the harmful gases such as sulphur dioxide come from power plants that use coal as their fuel. These gases released

from factories causes a smoky dark atmosphere, especially over cities called as smog.

Smog creates harmful health hazards like lung failure and pneumonia. Major industrial producers of smog include oil production, industrial solutions, paints and coatings. This is not only a city problem, it may also harm rural areas and hence agriculture is affected. Thus industrial development, though needed, have a wider range of ill-effects on environment and dangerous to life.

The effects of smog have been felt in industrial cities like 18<sup>th</sup> century London and Paris. However some live examples can also be considered today, which we will be talking about in the later part of the chapter.

Power plants also contribute significantly to air pollution apart from industries. Most of the sulphur oxide comes from power plants that use coal as their fuel. The U.S. Department of Energy estimates that fossil-fuel burning power plants supply almost two-thirds of the nation's electricity needs. Natural gas and coal make up over 90% of this amount, according to the U.S. Energy Information Administration. Fossil fuel emissions contain the major greenhouse gases, including carbon dioxide, methane, nitrous oxide and fluorinated gases.

## **WOODFIRES**

Wood fires cause air pollution by releasing particulate matter into the air. These particles can become lodged in your respiratory system, causing irritation to tissues. The particles can also aggravate existing health conditions such as asthma, warns the Environmental Protection Agency. The aggravation results are commonly just a step before lethality, or even lethal at times. Not only wood fires but burning of other waste substances also leads to a similar effect. All of us would have experienced suffocation while crossing a burning zone one day or the other. It would not be too hard to imagine the effects if these are practiced on a large scale or frequently enough.

## **HOW FAR ARE WE AFFECTED BY THIS?**

We could already see the devastating effects of this today. The World Health Organisation established certain guidelines for a clean, non-air polluted city. Almost 64% of the total cities of the word surpass these limits defined by W.H.O (World Health Organisation). We will talk about two such urbanised cities here – Beijing of China, and Delhi of India.

China is a developed country, a superpower. Its capital is Beijing, one of the largest cities in the world – and one of the most polluted one. It is reported over 1.1 million premature deaths occur each year in China due to air pollution. There is also a significant dying of crops due to increase in ozone concentration in ground levels.

The atmosphere in Beijing can be visualised as during when we celebrate *bhoghi* festival here in Tamil Nadu, except in Beijing it is a daily case, not only on the event of *bhoghi*, with intensity over 10 times than what we would see here. People could hardly see through the air. Breathing is a nightmare.

So intense is the smog in China that when we get a glimpse of Beijing from aerial view, it is like a mysterious city of only skyscrapers penetrating above the clouds. It's a misty winter of smoke in daily Beijing all the time. One can hardly see through the smog to actually drive in a highway. No surprise that accidents are caused by this.



The situation is so worse that people started buying bottled air! A Canadian company called "Vitality Air" has established its market in China. "We wanted to do something fun and disruptive so we decided to see if we could sell air" The co – founder of Vitality air, Moses Lam said. Now they actually are selling air!

On the other hand, Delhi, the capital city of India has its own place in this hall of shame. Its place is named "Most polluted city of India". Delhi stands first according to the amount of air pollution. What is the major contribution for this air pollution? Since Delhi is one of the most densely populated cities of India, most of them use their own vehicle to move from one place to other. This has caused the amount of air pollution

to be raised by twice or thrice the old amount of air pollution. Due to increase in air pollution, people wear masks to protect themselves. Air chokes people instead of enabling them to breathe now.

Many factories are also present in this capital city. They also contribute significantly to air pollution in Delhi.



*Image: Gateway of India under heavy smog. Source – [indiawest.com](http://indiawest.com), this picture is actually used as a warning about travelling to India.*

We divided borders on land first, sealed water in a bottle and sold it for a price second, and now we have come up with another innovation. It is 14\$ for bottled air and 21\$ for bottled pure oxygen - by the company Vitality Air. Oh! Just in case if you are interested in this new oxygen, there are also premium oxygen versions and strawberry flavoured oxygen versions – Does oxygen even taste? (Please note - no attack intended, it is only to create an awareness in which path we are going). We have all right to laugh over the condition. But we must realise that the condition is as worse as funny it is. It is absurd to think that we will actually accept the use of bottled air right? Well, think again. Bottled water was first an absurd concept which we got used to today. Bottled air might be an absurd concept today, but, who knows what will happen? Certainly we humans will never bother about repeating the same mistake again...

## WHAT HAPPENS IF THE PRESENT TREND CONTINUES?

The domain of air is underestimated. Constant degradation of air causes a lot of problems such as acid rain, smog and other things as we have seen earlier in this chapter. Acid rains increase the acidity of the soil, which interferes with agriculture, which interferes with the domain of land! Now we can get the idea of the butterfly effect – one domain's disturbance interfering with another domain itself. It does not end here. Acid rain also pollutes water bodies, killing the aquatic animals contained in it – interference with domain of water. The nightmare of bottled air will come true. Sure no one wants to live their whole life by inhaling air from a bottle!



Global warming, another catastrophic global phenomenon which we experience today will also contribute greatly to the ailing of earth. We will discuss about this phenomenon in the later part of the thesis.

We ate strawberries; we drank strawberry juice or milkshake. But we don't find it good to breathe in strawberry. When we pollute much air, we are paving way to create a business out of this mess for companies. Breathing by a bottle is never a good idea. However if we are going to proceed in the same path as we do now, no one can save us from such a condition.



## UNIT 3 – HUMAN INTERVENTION– TECHNOLOGICAL ADVANCEMENT (1)

Till date, it is not so clear how to classify technology – a boon or a curse? This is a topic of debate. However, we are not going to debate on this topic here. Instead, we will see the roots of technological advancements and its view from different sides in this thesis. To understand its root, one must understand its history of development. This chapter talks about how we humans are using technology in a wrong way today.

### HISTORY OF TECHNOLOGICAL ADVANCEMENT

The Renaissance is the period of Europe from 14<sup>th</sup> century to 17<sup>th</sup> century when certain advancements in science was done. This is also the period when many great thinkers such as Leonardo da Vinci, Galileo Galilei, Newton, Johannes Kepler, etc. lived. This is the period when modern ideas of physics were established. Some of these ideas are used till date despite their limitations. This was the final period in human history when development took place with very little damage to nature itself.

The Industrialization, period of Europe from 18<sup>th</sup> century was when modern advancement of science and technology started. This is where we started to screw things up. In the excitement of advancement, we have forgotten the ways of our ancestors as well as the environment. Our eyes were blinded with greed and over-satisfaction. We must also realize that this is the colonial period – a period based on exploitation of resources, and the period of spike in population levels too.

Where it all started? With the use of fossil fuels of course! The world saw its first acid rain due to excessive emission of poisonous gases such as SO<sub>2</sub> and CO<sub>2</sub>. The world saw its first air polluted cities such as Industrial London, Manchester, Leeds and Paris. The world saw its first poverty division. Even though poverty is something which existed from olden ages, it is during this period when it appeared very clearly (Due to the increase in population levels). The border was darkened between the poor and the rich.

Why population increased? Due to the advent of medicine! But in precise terms, you will understand how medicine caused increase in population in the next chapter. Note that population levels also play a major role with the current global crisis we face today.

Until industrialization, Technological advancement was something which was small yet useful without much of side effects. But now due to narrow sighted and selfish development, we have created as much as new problems as we have created solutions to problems which did not even exist (Such as technologies which claim to make our life ‘easier’ and ‘comfortable’. That is not even naturally a problem!). Everything was alright. Nature is designed to sustain the life living within it on its own. It does not need any alteration by mere humans (As discussed in Domain of

Water). Shortage and scarcity are something which WE created ourselves. To understand the growth of this tree namely global crisis, we must start from its root.

## **ARTIFICIAL INTERVENTION**

Artificial Intervention is the root cause for all of these problems. We humans did not and still do not understand the functioning of nature and act accordingly, and we take its elements for granted. Little did we know that affecting its elements will result in a major change and would even start chain reactions. Today we know all these, yet we fail to stop our rate of intervention in the functioning of nature. We will take a look at the interventions of humans in each domain.

### **IN DOMAIN OF LAND**

One of the most absurd artificial intervention concepts is “Scientific forestry”. This concept involves destroying natural forest covers and creating a kind of artificial forest which would consist of only commercial trees such as oak and timber. The practice of plantations are also a kind of artificial Intervention and since only a specific type of tree is grown in each situation; it leads to usage of certain nutrients of the soil only, affecting the balance of types of nutrients in the soil. When all these are done, natural habitats of the poor wild animals will be ultimately destroyed.

Deforestation as mentioned in previous topics causes a lot of disturbance in the natural system. We will encounter a separate chapter regarding a major crisis involving deforestation.

### **IN DOMAIN OF WATER**

Even when we find dams amusing, it has its own set of problems. Over construction of dams obstruct the natural flow of rivers. It also contributes significantly to land degradation since we create a huge artificial water logging system instead of a water storage system. It also interferes with natural migration of fishes, which affect their population.

Inter-linking of rivers is one of many artificial intervention ideas. In this method, we shall change the path of the flow of rivers to satisfy human needs. Many claim these would solve frequent flooding near Ganga and Brahmaputra basins. However this is only creates a problem on the existing problem. At the first place it is our fault of capturing the territories of these rivers and building structures there – a flood occurring there is not surprising. This was also the problem which led to the Tamil Nadu floods of 2015. To inter-link rivers, we need to construct a lot of dams – which leads to another problem in finding a solution to existing problem. These dams will make the surrounding areas swampy – hence these areas will be unfit for agriculture. Moreover a large amount of people living in these areas must be displaced and satisfactory rehabilitation facilities must be given – which are both politically and economically a problem.

## IN DOMAIN OF AIR

Our technology has not grown to an extent that it severely intervenes in the working of domain of air itself. Hence for now the domain of air remains safe from artificial intervention.

## SELFISHNESS OF HUMANS

Today's technological development of 20<sup>th</sup> century is fascinating in one aspect. It provides new opportunities which make human's life easier. However on the other side, it turns out to be most frightening and most mysterious, most awful. Technology has developed to such an extent that we humans now have the potential to end life on earth within hours!

## NUCLEAR THREAT

How? We have a thing called nuclear power. The advancement in this field is claimed to be one of the reasons why we have attained world peace, but BEWARE!

We have attained 'world peace' today (did we?) by threatening. Most of us know Hiroshima atom bomb incident. What if we say you that today's nuclear powers are over 1000 times more powerful than that?



Scary? Yes! You must be scared! If we detonate all these bombs one by one (We have like 10 thousand of them, in a world filled with hunger and poverty. It is something we must be ashamed of), it will cause catastrophic destruction in a global level. Not millions, **billions will die within seconds**. Oh by the way, we are talking only about immediate effects. The after effects – The "Nuclear Winter" is far more frightening. The mushroom clouds created by these bombs will rise up to an altitude and will start to block out sunlight! We will repeat a mass extinction event except that WE have created it this time. Without a trace we will absolutely destroy life on earth. The plants will die out without sunlight, and other animals will die out without plants.

## The end of world war 2 and establishment of 'world peace'

The atom bombs dropped in Hiroshima and Nagasaki killed approximately over 200000 people. There is no exact count on this. Several sources claims the number of deaths range from 130000 to 240000 (Remember, there will be no accurate record of casualties if the event is catastrophic, like the Black Death or this one). Instant kills are unknown. However this incident till date left a deep permanent scar on the society of Japanese. They continue to suffer from increased cancer rates from

the region. The after effects are more shocking. People got frequent cancers, mothers bore disabled babies, and even if the new born children had no disability, they had increased chances of getting a cancer in future.

The counter measures (Hospitalisation) was frozen. 43 of the 45 hospitals in Hiroshima went down after the droppings. They became non-functional. Doctors and nurses, who entered the city from outside to treat the injured also died due to radiation.

Please remember, if these were the effects of a **mere Atom bomb** nearly 70 years ago, Think about today's advancement. We have 1000 times more powerful nuclear bombs today. What would happen if we decide to repeat the course of history?

## **BIOLOGICAL HAZARDS**

Bio-Hazards are another of the dangerous inventions. The world will drown in disease. Maybe one day, zombie apocalypse which we admire and enjoy seeing in movies and TV shows would become real.

Who would certainly say not when we are literally proceeding in a perfectly wrong direction with technology? It is capable of destroying societies in the most ruthless and brutal way possible. We can now create artificial plagues more powerful than the Black Death and create a deeper impact created by Black Death itself. It has the potential to wipe out half of the world's population (and more)



The concept of Bio War is a result of dirty strategy and technological advancement. It can be used to wipe out civilian population, destroy enemy's agricultural crops and at times can also be targeted at fisheries to reduce food available and spread diseases. This strategy has high potential to be used due to its relatively low cost and its silently killing abilities – known for its stealth.

We get horrific vibes on getting this information. That is how technology is being actually used today – no wonder why our planet is ailing.

Due to our advancement, we have ruined all the three domains of earth. We have polluted air, water and land. We have destroyed half of the forest cover in the name of advancing and we have butchered the innocent birds and animals without warning. Today, for most of the people, the chirruping of birds and the voices of other animals are vanishing out of sight, and they only hear artificial sounds like drilling or construction. The rest hear the haunting voices of the passed away souls.

Air is no more a clear one. It does not astonish us anymore. It makes us afraid, it makes us choke! The domain of air once made us to breathe now makes us to choke. The domain of water which was once pure and replenishing everything is now destroying everything with its mutation. The domain of land once gave us the ability to stand now crumbles us down. All the three domains stayed united, and still remain united. The difference is, it was supporting us. Now, it is against us...

When half the world's population is below poverty line, when people literally eat sand and clay for survival in parts of the world, when people are surviving hunger without flesh and with only bones and skins, our lust for power and greed for resources only makes us use technology in furthermore destroying available food by the use of bio hazards and wiping out population using nuclear war heads. What have we become? Senseless and heartless creatures? Humanity's symbol is about its moral values. Today we are losing our moral values. This is something which we all must be ashamed of, of what we have become today and what we are doing today and how we are responding to them.

Significant technological development is done in weaponry compared to medicine (We did not make this up. Best proof is that we do not have vaccines to cure all types of diseases yet we have all kinds of weapons to kill and mess up population in a particular area. Think again in which direction we are advancing) Why? We are now more interested in wiping out population than saving it!

### **ANIMAL EXPERIMENTATION – A MORAL OF SHARING GETTING DESTROYED**

In many countries, human experimentation is banned while animal experimentation is not even bothered about. Why? We have become heartless. There is no equality among different life forms of earth, then how are we even going to save nature? The countries which banned animal experimentation individually can be counted with fingers – India, Canada, Taiwan, New Zealand, Norway and Israel. Only Union in the world which banned animal experimentation is the European Union, which includes 28 countries. In total doing some addition we get the count of 34. Hence it is only 34 countries in the world out of total 195 recognized countries. Not even the superpowers such as the USA and Russia have any idea or interest on banning animal experimentation. This shows the relationship between humans and other animals. What is the use of the concern on animal extinction if this is not going stopped first?

We destroy nature and then demand the same nature to give resources for the overwhelming population. Our moral values are almost gone. In a world created on the basis of sharing and caring, we have established ourselves superior and started to destroy the natural ways of the working of everything. In a world where we must share our resources to fellow individuals as well as to other life forms, we have drawn borders to split resources and adopted ways to commit genocide on fellow life forms (as well as on our own life form). We shall remember that nature will not be kind to us at times, especially if we are going to wage war and invade it...

## **UNIT 3 – HUMAN INTERVENTION – HUMANS AS A CURSE OF NATURE (2)**

### **INTRODUCTION**

Why are humans interesting? Why are humans some ‘thing’ important first of all? Since we are dominant? Humans are clearly the dominant species on the planet today, so were the Trilobites of the Permian period and the Dinosaurs of the Jurassic period. But naturally they were just one among the many species on the planet. Therefore from the vision of nature, they were not that interesting at all, except that they are cool! Yet why are we interesting? It is simply because we consider ourselves interesting, ourselves superior to everything. But it is not true at any case. We are merely a part of nature and we are supposed to live within the system defined by it. However, we have decided to betray our mother nature and take whatever we want, define whatever we want. But since when did we become so overwhelmingly dominant?

The answer is our population. The growth of human population over the years is interesting to analyze. It was not something which was gradual. It took its twists and turns to become what it is today. Humankind existed since 200000 years ago. From the advent of farming, the population of humans increased at a steady rate. It was not disturbed until the 14th century (1350 A.D to be precise), when the event ‘black death’ occurred. This event wiped out over 40% - 60% of the population of the continent of Europe. The reason why such uncertainty exists in the count is due to the fact that situation was so worse that people were not interested in keeping the count of the dead while they themselves had a good chance of dying. This is but one of the events which proved that humanity is not inevitable. The bubonic plague swept through Europe for years. The population dent was so drastic that it could not recover to normal levels until 17th century (It took almost 300 years for complete recovery).

The advent of medicine in the 18th century at first was encouraging (and is encouraged), since now humans are able to save themselves from certain causes of death itself. However, this only made the management problem of our planet, worse. Population spiked to a tremendous extent that the world will now hold 7 times more humans than how much it did just before 200 years. It took 200000 years for humankind to reach 1 billion mark, but just 200 years to reach 7 billion mark (For the graph of human population over the years, refer page 65)

In the past, the birth rate and death rate have always been able to balance each other and maintain a population growth rate that is sustainable. There was a state of balance maintained at the population level, when the no of people who were born was approximately equal to the no. of people died. Now due to the advent of medicine and the advancement in technology with each year at the present rate,

there is a tremendous increase in birth rate and tremendous decrease in the death rate, widening the gap between these two critical weights that govern the balance of population. Hence we made the population levels unstable, leading to lots of problems today. This resulted in the skyrocketing of human population. The more precise term to use is “Over population”.

Our rate of increase in population is immune to any further dent (The last one being the Black Death). The world wars (Which lead to the deaths of over 50 million), present day diseases etc... merely did, and does nothing to stop the spike in the population. It is today, ever increasing with its uncertainty of future...

Our growth in population can be considered as a rushed up building construction, with no proper planning and with no proper management; its foundation laid on a weak basement. The building looks great and all but it will one day fall apart with its weak basement. That day, will be the day of human extinction.

Humans now inhabit literally every corner of the world. Wherever we go, we can spot a human (Hence, overwhelmingly dominant). We inhabit 6 of the 7 total continents (Except Antarctica, only since it has unfavorable climatic conditions. This continent has escaped human invasion until now. But due to the rise in temperatures and increasing technological advancement, one day we should be able to establish our colonies in Antarctica). Another approach to expand human settlement is about colonizing other planets! Terraforming process is one of the interesting artificial processes proposed by humankind.

## CAUSES OF SPIKE IN POPULATION LEVELS

### **Agriculture settlements – The temporary and contemporary reason:-**

This is not a very significant reason, yet is still a significant reason. This is when we started to get dominant. Our population has forever steadily increased from this point of 10000 BCE, when humans started practicing agriculture and started to have settlements. This was also the starting point of civilizations.



Today, agriculture combined with science is able to produce better means of producing food, which now allows feeding more population. But we must realize this is not still enough. Food supply today has become a mere business. The rich flourish and the poor perish. Also it is to note that half the world's population (3.5 billion) falls under below poverty line.



### **Better Medical Facilities – The permanent reason:-**

Technological advancement brought better medical treatment, saving lots of lives which were prone to dying. However, this led our population levels being permanently disturbed. Medical science made many discoveries thanks to which they were able to defeat a range

of diseases. Diseases that had claimed millions of lives until recently, is now cured because of the invention of vaccines. Combining the increase in food supply with fewer means of dying destroyed the balance and became the starting point of overpopulation.

### **The imbalance in birth rate and death rate:-**

At the root of overpopulation lies the difference between the overall birth rate and death rate in populations, caused by advent of medicine. If the number of children born each year approximately equals the number of adults that die, then the population will stabilize. Talking about overpopulation shows that while there are many factors that can increase the death rate only for short period of time (such as an epidemic or pandemic), the ones that increase the birth rate do so over a long period of time (such as improved medical facilities). Epidemics cost lives in a shorter period compared to current technology saving lives for longer span of time. The discovery of agriculture by our ancestors was one factor that provided them with the ability to sustain their nutrition without hunting. This created the first imbalance between birth rate and death rate. Population in the world is currently growing at a rate of around 1.07% per year. The current average population increases by estimated 82 million people per year.

### **Poverty shift:-**

While talking about overpopulation, we should understand that there is a psychological component as well. For thousands of years, only a very small part of the population was rich and lived a luxurious life. The rest faced poverty and would give birth to large families to make up for the high infant mortality rate. Moreover, 8 out of 10 children did not reach adolescence. They died due to natural causes (Such as disease). After advent of medicine, most of these 'extra children survive' and consume resources that nature cannot provide efficiently.

### **Lack of Family Planning:-**

Most developing nations (and under developed nations) have huge number of people who are illiterate, living below the poverty line and have little or no knowledge about family planning. Those people are unable to understand the harmful effects of overpopulation and lack of quality education prompts them to ignore family planning measures. This is not the case with developed countries such as Japan, where they pay attention to population control.

But another important factor we must consider apart from overpopulation is one of its elements – Population density. Population density is more of a problem than overpopulation itself. It is right to say that overpopulation increases population density. But few factors other than that also contribute to over population density. We will see about immigration now

### **Immigration:**

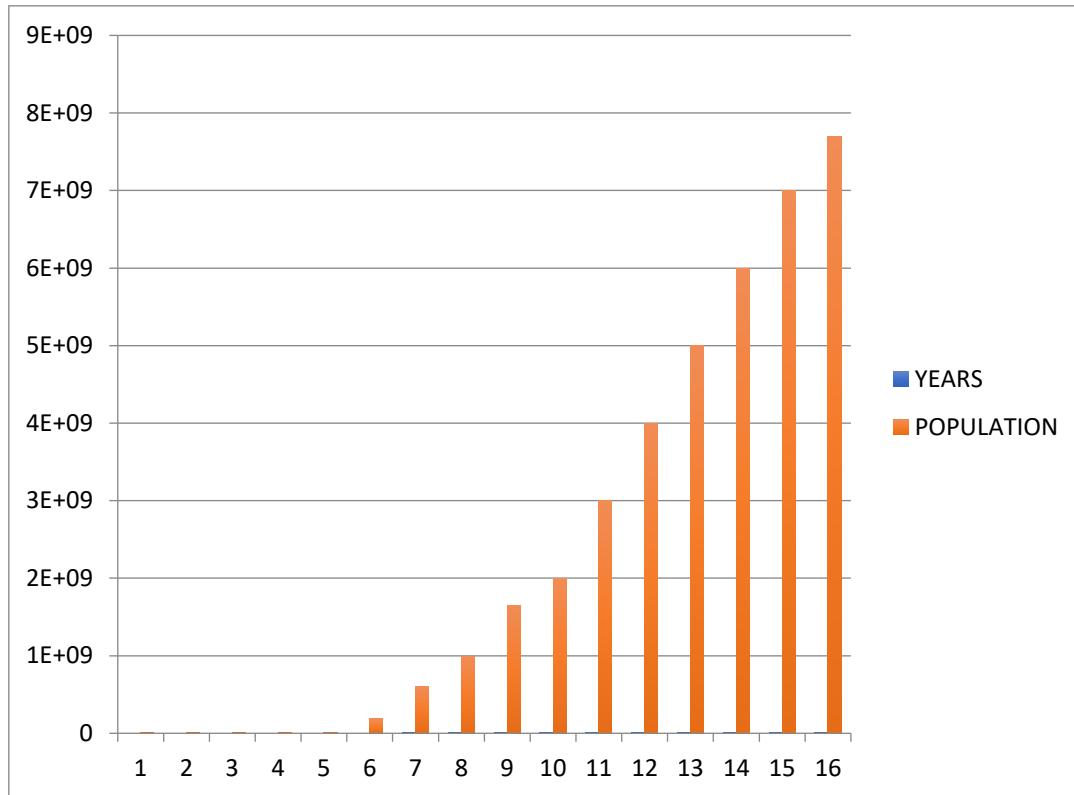
Many people prefer to move to places where they can live better. History teaches us a good lesson regarding this. The financial capitals of countries (Such as London of then Great Britain and Bombay (Now Mumbai) of then Colonial India) were central magnets of pulling population, having a scope of employment opportunities. Due to this sudden immigration of people into these cities, they failed to manage the overwhelming population. More population was concentrated in a small area, leading to a tremendous population density. This resulted in poor sanitation, inefficient water supply and poor living conditions.

People also prefer to move to developed countries like US, UK, Canada and Australia where best facilities are available in terms of medical, education, security and employment. The result is the migration of people over there and those places become overcrowded. The difference between the number of people who are leaving the country and the number of people who enter narrows down which leads to more demand for food, clothes, energy and homes. This gives rise to shortage of resources in that particular area.



Though the overall population remains the same, it just affects the density of population making that place simply overcrowded. For an instance, Japan's population itself is dropping very gradually because they don't encourage immigration and rate of No. of people who are born is almost equal to rate of No. of people who die, maintaining a balance. They maintain the population density under ideal levels.

## POPULATION LEVEL ALONG THE YEARS



The E represents the exponent, which is  $10^9$  years. The population has reached 7.7 billion in just 200 years since it took more than ten centuries to gain a population of 190 million. One can clearly look at the drastic change in the population levels over the course of just few decades.

## POPULATION GROWTH IN INDIA

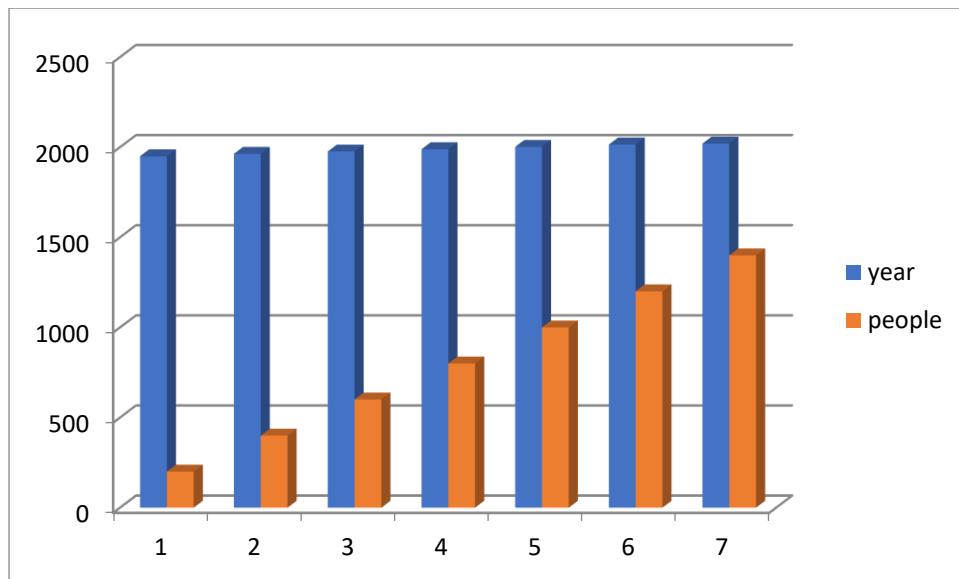
In 1990, India's population achieved a size of one billion. Predictions have been made that this number will increase to 1.63 million by 2050 at current growth rates (Surpassing China itself to become the most populous country). While some believe that increasing welfare and its additional measure such as birth control may solve the problems which is about to occur in future India, many state that only

aggressively reducing births by the action of government may make a difference; another alternative is natural population growth control – by mass starvation or disease, or control by crime and war. The population of India represents 17.99 percent of the world's total population which arguably



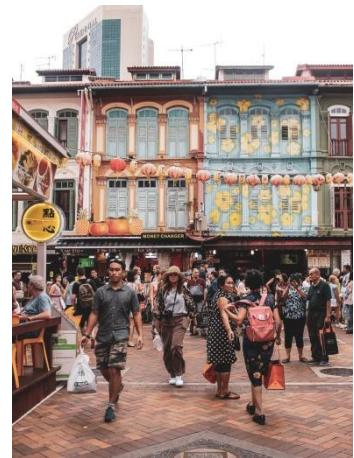
means that one person in every 6 people on the planet is a resident of India. Every nook and corner of India is a clear display of increasing population. Whenever we are in a metro station, airport, railway station, road, highway, bus stop, hospital, shopping mall, market, temple, or even in a social/ religious gathering, we see all these places are overcrowded at any time of the day. This is a clear indication of overpopulation in the country. The pictures you see in this page are clear proofs about how worse the situation is. We can see due to over population, there is poor management. Poor management means poor sanitation and poor health conditions. India by land area is only the 7<sup>th</sup> largest country. In terms of population however, it is 2<sup>nd</sup>. But in terms of population density, India ranks 19<sup>th</sup>





According to the Indian census carried out in 2011, the population of India was exactly 1,210,193,422. This makes India the second most populous country of the world after China and various studies have projected that India will be world's most populous country by 2025, surpassing China.

But when India is 19<sup>th</sup> in rank of population density, which countries have higher rank? Surprisingly, Singapore has the second highest population density, and Vatican City has the 3<sup>rd</sup> highest population density. Both of these are developed countries. They have proper management systems despite their overpopulation. Therefore these are the best examples from which we must understand that overpopulation itself is not a problem, but with improper management, it becomes a curse. Just in case if you are curious about the area with highest population density, it is the region of Macau, China – In just 32.9 sq.km of area, over 667,400 people live, as of December 31, 2018 (Please do not assume this ranks 1<sup>st</sup> in country wise population density index. Macau is not a country – a part of China. Actual 1<sup>st</sup> country which is placed first in the index is Monaco. However some sources suggest Macau having 1<sup>st</sup> rank, considering it as a country). Compare the images of this page as well as the previous one. What conclusion do you draw from this?



## BUT WHY HUMANS ARE A CURSE TO NATURE?

As mentioned earlier, Humans have evolved 200 thousand years ago. Until recently, their population was controlled under 1 billion. However, it just took a time of 2 centuries for human population to become seven billion from one billion. As the human population is increasing drastically, the earth's resources have been depleting as a vice versa. This is called as resource curse or plenty paradox. It states that the countries with rich natural resources, tend to have slow growth in economy, little democracy, and worst development outcomes than the countries with lesser natural resources. Many philosophers and logical thinkers explain that this resource curse is not inevitable or global, but it plays a major role in various countries and regions of the world.

The concept of resource curse began in the 1950's and 1960's only after people felt the importance of resources. The term 'resource curse' was first used in 1993 by Richard Auty to explain how countries with rich natural resources have to use them wisely to increase their economic growth than countries with lesser resources. A survey by two influential writers has shown how natural resources and economic growth are linked together. Several surveys and studies after that have brought a clear account on how natural resources play a major role in economy of a country and explains the reasons for how, when and why a resource curse is likely to occur.

Many scholars on this concept explain why some of the countries rich in resources are likely to succeed in economic stats while others with the same could not. Surveys suggests that the way in which the resource income is spent, the way the system of government is run, the quality of the institution, the various types of resources and the early versus the late industrializations all have been used to explain the failures and successes.

From 2018 onwards, a new debate has come out based on the topic – the potential for a resource curse related to critical materialism for renewable resources. Experts fear that the renewable resources will also be decreased in the upcoming years as a result of over utilization and over requirement. The global economy today is overwhelming the ability of the earth to maintain life's abundance. At this critical time in history, we need to reorient ourselves in how we relate to each other and to the earth's wonders through our economy. We require a new mass movement that bears a right way of living on our finite, life giving planet.

An elaborate reason is given as a previous chapter – How we humans have used technology to pollute the natural functioning of the environment and how we have butchered thousands of species out of existence.

## THE ANNIHILATION OF NATURE IN THE PROCESS OF SATISFYING OUR DEMANDS:-

We humans have evolved from the stage of wanting meagre survival to the stage of getting satisfaction, machines, technologies and all the resources on earth. But how can one change form a primitive stage to such developed stage without any future harm? Well, there might be a way but it is not the case of us. We devastated, obliterated and razed out nature in the quest of developing. Even then, nature is the source of all resources we get. It is the same even now. We must show gratitude towards nature. In the recent past without proper planning, we utilized most of the valuable resources we have on our earth. As our population is increasing at high rate, we must take some measures towards it.

Resource depletion is basically the consumption, usage or utilization of recourses at a higher rate than its replenishing rate. Natural resources are of two types, namely-renewable and non-renewable resources. We are mainly facing problems in managing non-renewable resources as they take millions of years to get replenished. We are not so much stressed about renewable resources like solar energy, wind, etc...



But some renewable resources like forests and water have also become a field in which we have to concentrate, as the rate of depletion is more than that of the rate of replenishing this resource.

Later, some decades earlier the spirit of helping nature started to develop in the view of humans. There were many reforms, plans and projects put forward and implemented by the governments of countries. But not all of them were successful. Due to some or the other political plays or institutional plans, these resource development projects were not implemented properly. Many companies, agencies, even some fields of government are not playing their role properly in managing the resources; in seek of profit, they try to extract and unearth resources more than the acceptable or permitted rate. Thus, we can see there are many places where these ideas are not put to work properly and effectively.

## THE REQUIREMENTS OF 7 BILLION HUMANS:-

Resources are depleted faster than the amount of resources produced. The industrial revolution led to the need of more raw materials to produce consumer goods and led to resource depletion.

### **What causes the depletion of our natural resources?**

- Overpopulation.
- Overconsumption and waste
- Deforestation and the Destruction of Ecosystems leading to loss of biodiversity.
- Mining of Minerals and Oil.
- Technological and Industrial Development.
- Erosion.
- Pollution and Contamination of resources.

And the short answer is improper management and exploitative nature of humans

### **What resources are in decline?**

**Water** – Even though you see water everywhere and our planet is 70% water, only 2.5% of that 70% is fresh water. The rest is salt water and not useful to humans at all. That small percentage of fresh water is mostly in the form of ice or permanent snow cover. So, we really have only a few percent available for use.

**Coal** – This is the most used fossil fuel and a non-renewable energy source. Peak coal extraction is predicted between 2025 and 2048.

**Oil** – Without oil, global transportation will be severely debilitated. If our current demand continues, this oil will only be enough to supply the world demands for the next 47 years.



**Natural Gas** – As of 2010, the available resources will be able to satisfy our needs for the next 50 years.

**Fisheries** – Fishermen from a lot of coastal provinces report a decline in their catch. Other marine species from which caviar is obtained are close to extinction. Caviar is today something which is too costly because of this reason. It is seen as a luxurious and prestigious dessert. But did you know that it was once freely available to eat in restaurants as a welcome dish a few decades back?



Hence it is clear that we can only enjoy the available resources to maximum potential only for over 50 more years. Hence the present generation would be the last generation to have a chance on using all these resources and live a comfortable life.

### **Natural Resources Depletion:**

Natural resource depletion refers to the decreasing amount of resources available on the Planet Earth. It occurs when we use the resources at a rate faster than their renewal.

We humans have evolved from the stage of wanting meagre survival to the stage of getting satisfaction, machines, technologies and all the resources on earth. But how can one change form a primitive stage to such developed stage without any future harm? Well, there might be a way but it is not the case of us. We devastated, obliterated and razed out nature in the quest of developing. Even then, nature is the source of all resources we get. It is the same even now. We must show gratitude towards nature. In the past, without proper planning we utilized most of the valuable resources we have on our earth. As our population is increasing at high rates, we must take some measures towards it.

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This problem came into existence thousands of years ago. Most of the natural resources were exhausted by kings to show their power, wealth, strengthen their empire, etc. Hundreds of years passed by as empires exhausted resources developing and capturing other countries. These resources were not even put to use in many cases, like during wars there comes huge expenses and even they get destroyed in the play. Then came the period where countries started to turn to republics and democracies. Not even this time there was caution about the depletion of the natural resources. They just concentrated on becoming a developed nation. Humans kept on depleting the resources not to fulfil their needs but to fulfil their greed.

### **Why is Natural Resource Depletion a Problem?**

With the help of science and technology, man has continuously abused natural resources to meet the increasing needs of population and violated the laws of nature. The over-exploitation of natural resources has posed a big threat to the

survival of mankind. As a result of large scale wastage production, we have managed to pollute air, water and land as well.

In the race for development, we have totally forgotten that the resources aren't unlimited. There is a need for conservation of natural resources which are becoming scarce with the passage of time. Their use exceeds the speed of their natural replenishment. Increasing pollution, global warming, industrialization and other processes have accentuated the depletion of natural resources.

There are basically two types of natural resources namely, renewable resources and non-renewable resources.

- A renewable resource is a resource which can be used again and again. These can renew themselves and are never depleted. For example, sunlight, wind energy, etc.
- A non-renewable resource is a resource which does not grow back, or a resource that usually takes a very long time to renew. These resources when exhausted once cannot be renewed. For example, coal.

Although renewable resources may seem like they will last forever, most of these natural resources are limited, meaning they will eventually be finished.

Whether the resource is able to be recycled, and whether there is availability of substitutes for the material are major factors affecting supply of resources. The problem of resource depletion arises here. When the resources are consumed at a rate faster than they can be replenished, it is termed as resource depletion. This includes the use of either of the renewable and non-renewable forms of resources. With increasing population and increasing demands of consumers, resources are being over-exploited and being depleted day by day. This is a serious problem as without these resources, humans cannot survive. We use natural resources on a daily basis and thus we need to conserve them too for future.

The main concept of the problem can be seen from the facts and figures which show that major resources like coal are being depleted at an alarming rate. Problems like food and water scarcity arise when resources aren't available much. Pollution and global warming are added consequences of this problem, which need to be taken care of for the harmony of human life on Earth. Some facts with regard to the depletion of resources:

#### **Natural Resource Depletion Statistics:**

First the extraction of minerals from the earth: From 40 billion tons in 1980 to 58 billion tons in 2005, global resource extraction grew more or less steadily over the past 25 years. This represents an aggregated growth rate of 45%. The extraction of metal ores particularly increased by more than 65%; indicates the continued importance of this resource category for industrial development. A person uses on

an average 16 kilos of resources extracted from the earth every day. It is assumed that the production of mined metal commodities will increase by 25% percent by 2030.

Now coming to the depletion of important natural resources, the statistics are enough to depict how serious the problem is. More than 700 million people in 43 countries suffer today from water scarcity. By 2025, 1.8 billion people will be living in regions with absolute water scarcity, and it is estimated that nearly two-thirds of the world's population could be living under water stressed conditions. Approximately one out of three people suffer from water scarcity every day.

The problem began from the time of Industrial Revolution. As our culture advanced and humans invented many things that make our day-to-day lives easier, the demand for raw materials increased at a substantial rate. The problem is, we're consuming a lot without caring about the depletion of these resources. If this trend continues, soon we will have to lead a life devoid of many substances which means resources like fossil fuels will longer be available. Moreover, problems like water scarcity and food shortage arise when there is colossal waste of resources available with us.

Also, if there is shortage of fossil fuels, there will be less transportation, smaller economies and higher prices of commodities. Deforestation or cutting down of forests; results in a major loss of resources like wood, paper etc. It also causes global warming and rise in pollution levels. In addition to this, many species become extinct.

### **Effects of Natural Resources Depletion:**

The depletion of natural resources has widespread consequences not only on the human life but the environment too. Some of these are as listed below:

- **Resource Scarcity:** Resources become scarce because of over-consumption and degradation, mostly in the areas of tremendous population growth.
- **Rising Prices:** When natural resources become scarce, food, fuel and energy prices rise. Even the price of renewable resources increases if they need to be shipped to reach areas where these have been depleted.
- **Water Shortages:** When infrastructure development and population growth increase, water shortages occur. As of today, almost 1 billion people lack access to clean water.

## **How do Human Activities Affect the Natural Resources?**

Natural resources are profitable to the mankind in various ways and thus humans take them for granted. The inconsiderate usage of resources has led to this scarcity of resources. The natural resource depletion starts from the human greed for more and luxuries of life. The deforestation leads to destruction of natural resources resulting in loss of green cover. Along with this, the wildlife suffers from habitat loss which causes them to migrate and eventually get extinct. Another activity affecting resources is the overuse of mines for the production of human luxuries.

The water changes its composition and gets toxic when humans settlements dispose waste to the water resources like river and in the beaches. The fact that natural resources can't remain pure also contributes to their depletion.

### **Natural Resource Depletion in India:**

India is facing an ecological crisis with degradation of its natural resources day by day. The nation is expected to surpass China as the world's most populous country by 2025. As the Indian population rises rapidly and over-exploitation of land and water resources continues, the natural resources are at stake. There is increasing deficiency of energy, metals, coal, and non-fuel and non-metallic materials. With regard to fuels, there is great concern over the increasing use to meet human desires.

Every year enough oil is purchased from countries in the Middle East which are major sources of petroleum. The developed nations of the world have access to abundant resources but the developing nations like India still have to import many of these from foreign countries. Another problem is the pollution of environment. In India, people in rural areas do not have access to clean water. As of today, 163 million Indians lack access to safe drinking water.

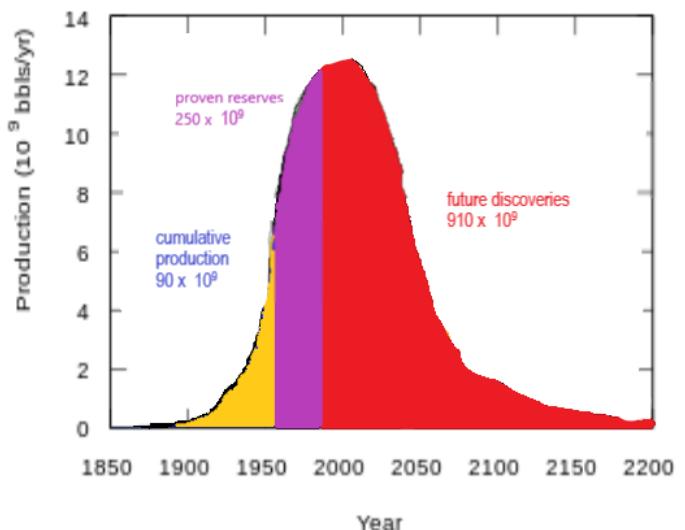
There is unequal distribution of natural resources in many areas of the country. Therefore, natural resources require very careful and optimum use and need to be protected. About 146.82 million hectares of land has been affected in India due to soil, water and air erosion and other complex problems such as alkalinity/salinity, and soil acidity.

In addition to it, the use of inappropriate chemical fertilizers has adversely affected soil fertility and nutrients. Many parts of our country are affected by drought and flood. The country's large terrain depends on rain for agriculture. Due to heavy deforestation and soil depletion, in many areas rainwater is not absorbed in the soil. Groundwater available for agricultural and other uses is also being exploited.

### **Impacts of overpopulation:-**

1. **Health problems:** high population density countries are available to many health problems. This is due to the increase in uses between many people in places of residences, the cause of spreading of viruses like Zika virus is likely to increase.
2. **Unhygienic environment:** the places where overpopulation occurs are likely to turn into an unhygienic place very soon. This is due to the human waste accumulate and activities at an increasing rate.
3. **Unemployment:** overpopulation is the one of the main reason for unemployment. People generally don't get the job due to a lot of competitions in the sectors they require. When the requirement for the jobs decrease, there will be an increase in the criminal activities which in turn leads to disturbance in the society.
4. **Poverty:** another main impact of overpopulation is poverty. India is one of the main countries that are poverty stricken. As there is an increase in population in India, there is also an increase in the poverty rate. This shows that poverty and population are directly proportional.
5. **Over utilization of natural resources:** increase in the population leads to increase in the needs of resources. This also leads to indiscriminate use. Due to larger demand, there will be more exploitation and greater usage.
6. **Pollution:** population in exceeding condition always causes pollution. The types of pollution caused are land, air, water, etc. High human activity leads to enhancement in pollution.

There are many problems which we may face if we continue with similar rate of extraction of resources even in the future. First thing that would affect us is energy crisis. We have been getting around three-fourth of our energy needs by burning coal and fossil fuels. Surveys have said that the fossil fuels would only last for around 200 years if we keep on extracting them. Then we will be pushed to the situation where we have to search for new sources of energy without having proper backup with us and with none left for future. Then, there is also a theory called Peak oil theory. Peak oil is the theorized point in time when the maximum rate of extraction is reached and these rates face a declination.



## **UNIT 3 – HUMAN INTERVENTION**

### **CHAPTER 3 – ENVISIONING FUTURE**

#### **INTRODUCTION**

Future is something about which we are all excited for. We always have the wish to know about our future. It makes us curious about the possibilities of what could actually happen, since there are a wide range of outcomes, which are mysterious. While some are excited, the others have chosen a side – To be happy or to be afraid. With the ongoing crisis, our future is uncertain. Let us now travel forth in time and witness what would happen if the current trend continues...

#### **OUR REAL FUTURE...**

Let us pick an arbitrary number, say, 2100. In this year we have reached the 22<sup>nd</sup> century. Human population would have already surpassed 11 billion mark of their population. Despite our desperate dreams of having a bright future, with attaining world peace – It is not going to happen. Poverty will only increase. The rich will get richer and the poor will suffer even more. Mass famines are common, and food and water are now reserved commodities worldwide. Oh wait! We have forgotten to mention about air! Air is also now a reserved commodity too; since our achievements have polluted the atmosphere to such an extent that now we need bottles to breathe. Water in a bottle; Air in a bottle; Business in a bottle; Development is a bottle neck and life is a bottleneck inside the broken bottle of nature.



The gap between rich and poor will widen to such an extent that the poor will quickly start to perish (Note that over 90% of the population will be poor). The once freely available resources which are supposed to be available for everyone is now suppressed and confined in a bottle, and are now only available to a few groups of individuals.

With the wrong advancement of technology, by this time, we would have wiped out even the common animals such as dogs and cats. With Bio hazards, we would have wiped out many people. We would have done mass genocides which would result in like 200 million deaths. It is not about mass killing or murdering individuals, it is now only about wiping and sweeping population. Common people are no more ‘humans’.

They will be treated like cattle – killing whenever and for whatever reason few people wish. It all connects with economy factor and resource availability.

Fossil fuels would become so rare that they can no more be used commercially. Without Oil, machines which function on the base of fossil fuels will be halted. Economies will crash, people will go unemployed, at the end it will be only few individuals enjoying the resources. These tensions will only lead to prolonged cold wars, further costing many lives. Countries will not refrain from using nukes. This would have permanently polluted land and air with nuclear fallout and radiation.

Will humanity lose its mind? Won't there be a single group of individuals having mercy and awareness on what's going on? Exactly! Our present day ideology and level of 'awareness' has guided the youth in such a way they will not care about all these. They will let it all go.

Improper usage of land degrades agricultural land. Hence food production will be halted, which in turn crashes economy and increases tremendously the prices of food. Due to global climatic change, few species of crops may even get extinct. Large scale Deforestation must have reduced rainfall and affected the balance of nature. Without rain, droughts will prevail. Without trees, soil erosion will be aggravated, creating more waste and barren lands fit for nothing. Due to deforestation, natural habitats of wild animals will be destroyed. This will result in Mass extinction of wildlife. Variety of life and the beauty of nature will be decimated.

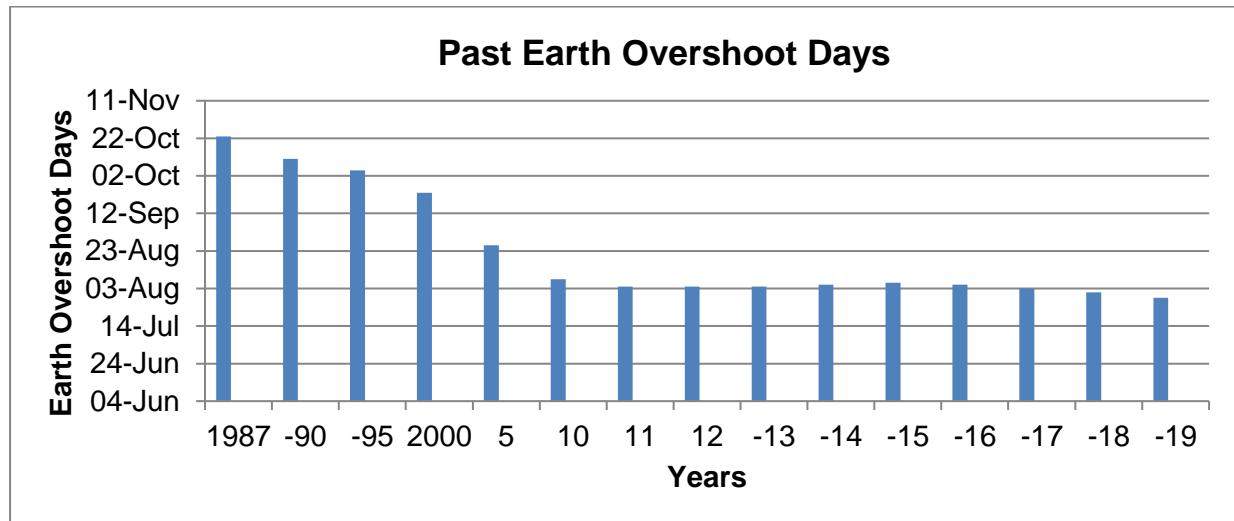
Overcrowding of population combined with bio hazards will introduce new diseases, which will further wipe out population.

Rivers are now drainages. Atmosphere is a nightmare, and land is a joke.

Hence this time period will be the peak of human population. After this there will be natural cleansing action which will wipe out population. Moreover due to economic and political reasons we will commit mass genocides. This will result in the breaking point of human population. We can witness drastic decrease in the population. In short we will make other species to be extinct, and then we will make ourselves extinct - an innovative way to end millions of years of life on earth within decades.

## EARTH OVERSHOOT DAYS – THE STATISTIC WHICH SHOWS OUR PATH TO ANNIHILATION

Earth Overshoot day is some day in a particular year. This day is the day when the demand of all ecological resources exceeds what the nature can regenerate at that particular year. Below is a graph which gives a glance of declining resource replenishment and increasing demands every year



This graph illustrates the overuse of Earth's resources which has to be used in a year.

You can observe the decline in the Earth overshoot days in the past 3 decades. This graph is going down at an alarming rate due to over exploitation of natural resources. This graph will decline in the near future. In 2019, this day was July 29<sup>th</sup>, compared to 22<sup>nd</sup> October of 1987

So now we will look at these issues at depth. Let's divide the topic into 2 main parts: Global level and Country level.

## **THE GLOBAL LEVEL**

In the current world, we are facing many problems. Some of these problems can be solved with existing mentality but, many problems cannot be solved at this rate of contribution from our side. These problems are created by humans themselves to fulfil their bottomless greed bottle.

There are some serious issues on which we must take immediate measures; else we will face global scale destruction. We must do something to counter these issues. The main challenges are global warming, deforestation, education awareness, over population combined with poor management, pollution, industrialization, etc. these challenges cannot be resolved immediately drastically, but can be reduced to some extent and thereafter slowly wiping it out. It is very difficult but it is possible. There are many reforms and movements but, they are not much effective.

We will visit the past to realize the gaps between each of the timelines – Past, present and the future.

## **EARTH IN PAST**

- In the past, the population in the global level was less when compared to now. The population was under a control before, but now after the invention of many new medical technologies there was an outbreak in population levels. Much of these is discussed in the previous chapter.
- As the No. of people was less with minimum to no interference with natural working, the pollution levels were not threatening.
- Land degradation levels were low, since people were engaged in natural farming. They did not use chemical fertilizers. Moreover there was not much pressure on the agricultural lands.
- To be more precise, humans never managed resources better than we do today. However since we did not have exploitative technology and there was lower need, our improper use of resources did not affect the environment that much.
- Global warming and greenhouse effect aggravation are not known in this timeline.
- Extensive deforestation was not practiced. It is discussed in domain of land that how it was before and after British intervention.



## **IN THE COUNTRY LEVEL**

It has been discussed earlier that India is the seventh largest country in the world and second most populous country in the world with a population of about 1.3 billion people. As we can notice that India has a larger population, resources are used in greater amounts by the people in an unplanned and improper manner and this over usage might lead to shortage of resources for the whole country. We can also notice that people face various kinds of issues regarding resource management for the past ten years. To know about the future of India, we must re visit our past and compare with the present, because our future depends upon our past as well as the present.

## **INDIA DURING THE PAST**

Any student of class 6<sup>th</sup> and higher can notice that India was filled with vast amount of natural resources for both humans and other animals alike and had sufficient amount of resources for every living organism. When we compare the population of current India with the population of ancient India, ancient India had a population of about half the population of the current India. It is also to note that India's population contribution to global population was never low. Our population levels always remained high relative to global population. However they had their own way with the nature. They did not destroy any kind of natural resources or they didn't harm nature to extreme events. They lived along the ways of natural working and always sought to conserve the resources in the natural way – which will be later pointed out by 'modern' colonizers as 'primitive' and 'out dated' ways.

Literacy in ancient India was low. But the people had the natural instinct to conserve nature in every possible way. It doesn't mean that they never harmed the environment or they did not practice large scale hunting, but all these interactions did not harm the natural working of the environment itself. Hunting and destruction of environment is a part of nature – provided it is under limit.

## CONSEQUENCES IN THE PRESENT

Since humans are responsible for their treachery committed towards nature, they are facing the consequences for their sins.

In 1999, Odisha faced a deadliest cyclone which caused almost 15,000 deaths of people. This Odisha cyclone was also known as Super Cyclone which was the most deadly storm in Indian history. This caused heavy damages to the environment of Odisha.

In 2001, Ironically on India's 51st Republic Day, A massive earthquake occurred at Bhachau Taluka of Kutch District of Gujarat massive which almost killed 20,000 people in Gujarat. The seismographic reading was between 7.6 to 7.7Nm

In 2004, a gigantic tsunami occurred in the India Ocean and this Tsunami hit the Southern part of India and caused almost deaths of 230,000 people. This tsunami also affected other neighbouring countries of the Indian Ocean.

In 2015, Tamil Nadu faced a catastrophic flood which caused almost deaths of 20,000 people. In 2017, Tamil Nadu faced a great cyclone, which led to severe loss of public property.

In 2018, the whole state of Kerala was filled with flood and the Kerala government was helpless at one point of time. They recovered from the monstrous flood with the help of other states and renovated their state. In the same year, some parts of North India suffered from water scarcity and resulted in drought.

In 2019, once again Kerala faced the monstrous flood. In the same year, Tamil Nadu faced another severe cyclone which destroyed crops and reduced crop yields. Due to these disasters, the development rate is haled. These are some major disasters in recent times in India which took lives of many people.

One may say that these are all just 'natural' happenings. However we must remember about the butterfly effect discussed earlier. Everything which hits us is our own doing. We must also observe that not only the intensity of these attacks of nature on us is increasing but their frequency of attacks is also increased over these years.

## ENVISIONING THE FUTURE OF INDIA

If we the citizens of India continue to deplete the natural resources without implementing proper measures to conserve the environment, then India does not have a chance in getting its development halted; but will actually fall. India is a country of many possibilities even till date, even after when our resources are stolen from us.

In future, India might become a developed country with high tech machineries, advanced technologies, skyscrapers etc. These are possible if India takes proper steps towards the nation's development by implementing stricter rules on environmental conservation, creating proper amendments, etc.

Through united co-operation and renewed awareness, it is actually possible to make India the next superpower. However below all these lies the basis of environmental conservation. Agriculture is the backbone of our country; it must be protected. Forest of India is the pulse of our Nation; it must be conserved. Population power of India is a golden gift; it must be respected.

Hence the future does not need to depend on our past or the present. An instantaneous force will drive anything in every possible direction. When we work on developing our nation, then definitely the result will look bright and colourful.

## **UNIT 3 – HUMAN INTERVENTION**

### **CHAPTER 4 - THE WORLD ON FIRE**

#### **INTRODUCTION**

Yes, as the title suggests, the world is literally on fire. We are committing mass genocide to the trees of the world – to the lungs of the world. This entire topic only talks about one specific issue. But why specifically this issue? You will know. There are lots of issues to talk about. But this is the issue from which at least now we can start to create awareness in people as well as to the future generations. This is the issue in which we have really crossed the limit in the already crossed limit. What is this issue? We will take a look at it now.

#### **THE AMAZON RAINFOREST**

This South American rainforest is the world's biggest forest cover – 5.5 million sq.km in area (India's area is only 3.28 million sq.km). It is majorly located in the country of Brazil (60%). Parts of it are also located at Columbia, Peru and other South American countries. The forest is the home to wildlife of our planet. While humans dominate the entire planet destroying all remaining forest covers, Amazon stands as the only major habitat for wild life to live freely without any human intervention. It is true that there are several tribes who live inside the forest, but they do not intervene in nature's matters like we do. They at least know to live along with nature.



There are certain species confined only to this part of the world. They cannot be found in any other part of the world. Such species which are confined to one single area are called endemic species. It is fascinating to know about endemic species but it is also a curse for them. If that particular area is altered in its natural components, they are very prone to extinction. Things like these happened in the past. One example includes dodo – an endemic species to the island of Mauritius. It is a cute, beautiful, small, flightless bird. When colonizers came to Mauritius, they butchered this innocent species and pushed it to extinction in just decades. It is classified extinct by the year 1662. Hence there is no actual photograph revealing its true appearance. However the details of its appearance were recovered from personal diaries and journals. All we know today is that it was cute... and innocent.

This region contains 2.5 million insect species, 2000 bird species , 2000 mammal species, ten thousands of tree species and so more. It has within its domain; cute, beautiful, small, huge, frightening, ugly as well as dangerous species. This rainforest has the largest bio diversity in the entire world and also has the world's second longest river – Amazon River. It is to note that by discharge volume of water, Amazon River is first at world level and it is a dispute that either Nile or Amazon River is the longest river. This thesis considers the widely accepted opinion – hence second largest river.

## THE CONDITION OF AMAZON FOREST OVER THESE YEARS

Amazon forest was under deforestation for over 3 decades. Due to increase in population and the greed to acquire more resources, large scale deforestation of Amazon forest was led by individual companies and governments supporting them. As a result as of 2018, 17% of Amazon rainforest was already destroyed. Researchers suggest that the destruction rate is very close to the 'tipping point'.

A tipping point in an ecosystem or in a climatic system (or both) is the threshold point after which the eco system's nature will change and can bring drastic changes to climatic conditions. The nature of the system itself will change as a result. The tipping point of Amazon rainforest deforestation is around 20% - 25%. Hence it is not too far until we screw things up. There are lots of systems suspected to pass the tipping point on the planet – classified as tipping elements (Amazon forest is one among them). If the tipping point is passed, the change we have caused will become irreversible since nature will collapse under itself from there on. The region would become a desert. Billions of individual animals and plants will lose their habitat and ultimately die

The forests faced 2 droughts – one at 2005 and another at 2010 like never in a hundred years. The latter was worse than the former in some aspects. What caused these sudden droughts is a matter of debate but is most likely due to human intervention. All these factors are only pushing the forest to its tipping point.

It is a fact to keep in mind that Amazon rainforest is the world's largest carbon sink. Carbon sink is a place which absorbs and disposes global carbon. This sink is under catastrophic destruction – which will lead to sudden spike in CO<sub>2</sub> content and in the greenhouse effect – ultimately leading to sudden increase in global warming

## THE PRESENT CONDITION

We are already seeing the consequences of the climatic change. The droughts have caused aggravation in drying effect of the dead trees. This accelerated the rate of forest fires in that region. Hence we can see that the system started to crumble upon its own by the initiation of deforestation to a large extent. Dry climate caused by drought which is a direct effect of deforestation has caused the 'natural' wild forest fire. Over these years parts of the forest were continuously lost to forest fires. However, in the year 2019, the fires reached a new height.



Deforestation resulted in erratic rainfall, which in turn caused drought. When drought occurs, the temperature in that particular area gets increased. This also leads to a dry climate without any humidity.

Dry climate is a natural instigator of Wild forest fire. Hence due to raising temperatures and dry climate, it resulted in great Amazon forest fire. A small spark is all that is needed to destroy a forest cover. Dry leaves are more prone to catch fire. This is sometimes termed as the 'Drying effect of dead trees'. Hence it is clear that one action causes a chain reaction which leads to a drastic outcome.



## 2019 AMAZON FOREST FIRE – MULTI ORGAN FAILURE OF OUR AILING PLANET

Since January 2019, there is a surge in the rate of forest fire in Amazon. The cause was initially unknown. People experienced unusual choking. The fire rate has been increased over 88% compared to last year – which is drastic and sudden. The situation is so worse that the smoke clouds can be seen easily from outer space above Brazil. NASA has warned the Brazilian government about this but they failed to give importance on this issue. Actually the situation now is apart from natural causes. Instead it is a result of dirty international politics. The media fails to report this to people since it is not an ‘International issue’ – But in reality it is an international issue now.



*Image by: NASA Earth Observatory*

Those are not clouds – Those are smokes.

The picture below shows the extent of deforestation of the great Amazonia.



*Image credits: CARL DE SOUZA/AFP/Getty Images – Taken from newscientist.com*

Apart from the destruction of the Carbon sink, the emission of carbon levels is devastating. The situation is so worse that the entire city of Sao Paulo once experienced a Morning-night. The picture was taken at 3:30 P.M. The skies look pleasing? Of course not! It is to note that this city is over 2700 km away from Amazon forest fire, but still experiences the block out. By 4:00 P.M the same day, the sky has become completely black. The seriousness of this issue must strike fear in us, awareness must be created, however neither is happening today.



The Brazilian government failed to respond to any request made by international organizations. This is because currently Brazilian government is trying to improve its economy by expanding land. Hence it is clear that it is not a natural cause – it is once again a great artificial intervention.

The Ego problem of few people led to such a catastrophic event today. If you are reading this in 2019 we can guarantee you that while you are reading this, the land size of 2 football grounds are being burnt. Imagine a rain at this situation – Carbon rain.

The Brazilian government was completely lax on this issue over these years and continues to be lax to the present day (2019). In fact the fire is initiated by the government. In the name of improving their economy, they are destroying the world's natural system. If Amazon forest gets destroyed completely, a global crisis will occur. We will experience a global climatic change.

## THE RESPONSE OF BRAZILIAN GOVERNMENT TOWARDS THE ISSUE

In fact the standing Prime minister of Brazil as of 2019 – Jair Bolsonaro won the elections by a good majority. One of his promises was to fully ‘utilize’ the resources of Amazon forest to improve Brazilian economy – and then he proceeded to destroy it. The Brazilian government refused to accept any international help regarding the matter. The president made many mocking statements which outraged the world as well as his own people.

At first he was too stubborn, egoistic to accept any foreign help. Under continuous international pressure, after refusing every help, he claimed that his country does not have enough power to deal with the situation, since the forest is larger than Europe itself. It is not possible to control the criminal fires. It is a matter of debate that whether the fires are criminal or instigated.

What is it like when two world leaders fight like children personally in international media? When the G7 summit offered 20 million dollar help plus additional 13 million dollar help from UK alone and 11 million dollar help from Canada, he refused to accept any of them since the President of France has insulted him – by calling him a ‘liar’. Look at the present day condition – People are more interested in solving their personal problems in international level rather than accepting a help to clear a global crisis.

This issue is a great example for the lack of awareness in today’s world. It is also a good example how large scale deforestation has naturally accelerated another effect which makes nature crumble on its own weight. Keeping these points in mind we must change our ideology on viewing the environment and must actually take steps to conserve it.

## **UNIT 4 – SOLUTION**

### **CHAPTER 1 – A COMMON SOLUTION**

We have deeply analyzed the current problem of our planet. We have examined all the three domains of our planet, about how and what it was and is now. During our journey you might have observed that there are certain common problems in all the domains. Hence we will first aim at solving the major (common) problems we face today.

#### **AGAINST DEFORESTATION - AFFORESTATION**

We have seen that deforestation initiates a domino effect in various domains. It causes erratic rainfall, as well as soil erosion. It also causes critical imbalance in oxygen – carbon di oxide levels. Without forest cover, wildlife will perish without their natural habitat. Hence conserving forests are very important. Measures must be taken to plant trees at large scale. Technological way of doing this will be explained in third chapter of this unit.

Simply chopping down trees will be comfortable at short run but at the long run it will not be good. For each tree chopped down, considerable amount of saplings must be planted. The regulation of this must be maintained at all times.

#### **AGAINST BURNING OF FOSSIL FUELS – MOVING TO ALTERNATE SOURCES OF ENERGY**

Burning of fossil fuels also contribute to air pollution. Overexploitation of fossil fuels drains it while destroying the environment. Again this interferes with all three domains. It causes acid rain which degrades land as well as water. In today's modern world, energy is a must. We simply cannot live without energy. But that does not mean we cannot live without fossil fuels. There are several alternate sources of energy to be exploited which are both eco-friendly and powerful.

Hydropower, Solar power, Geo thermal power, Tidal power are some of the alternate sources of energy which can be exploited to meet the world's energy needs. Hydro power plants have multi purposes – which includes production of electricity and conservation of water.

Sources such as solar are completely eco – friendly. It causes very less to no harm to the environment. Fossil fuels at first were most widely used in trains – Steam engines, and in factories. We have shown that we can make a shift from this source in the field of railways. Today we have electric trains, and plans are made for implementing magnetic railways, which function by the principle of electro-magnetic induction.

## THE REAL SOLUTION

'Saving' water domestically, afforestation or changing to alternate sources of energy is not much useful in conserving nature as it is not a permanent solution. The saved energy will be used in one way or the other but a system is needed to replenish everything by itself. No other system could be more efficient than the former natural system. Only way to conserve our resources is by fixing up the natural system of renewing and cleansing cycle. But this requires a reversion process, a process which will cost our present day advancement.

The solution to the problem is to cut down all existing technologies which damage this system. In case of water, there is another problem – we destroyed the natural system that renews water and created a new system which only uses up the water. Bore-wells are technological up rooters of water resources. It acts like syringe which sucks up water from the ground in less time to use. The water is sucked in less time and water is renewed after a long time, so it causes an imbalance in ground water replenishment.

What is the actual solution for this? Are we supposed to go back to the ancient age where there are no industries or cities? Are we supposed to use the technology again to solve this? Both must be done simultaneously to solve this problem. The modern technology which supports the traditional concepts and natural processes is a better solution for our nature. Eco friendliness in technology in the world is the solution to revive and stop the ailing of earth.

## SOLUTIONS TO PREVENT/REDUCE NATURAL RESOURCE DEPLETION

We have seen that the problem of natural resource depletion is indeed a very serious one. The increase in population and excessive human desire for all amenities of life are some of the major reasons behind it. Activities like deforestation, over-consumption and wastage of resources further lead to depletion. If we do not do any defense for it then surely our planet will face extinction in all the resources soon. This will have major impacts on human existence and also the environment.

Among the proposed solutions are switching to alternate energy such as solar power and wind power and responsible use of resources. We must start to follow the concept of sustainable development. We should use resources in such a way that the needs of the present are met and also suitable amount is left for the future generations to use. The goals of economic and social development can be achieved by ensuring terms of sustainability in both countries – either developed or developing. If our attitudes towards natural resources remain uncared, then the day is not far when our very existence on the earth will be threatened. It's time we realize that our actions are harming the planet and its resources, and we need to conserve,

not destroy them by irresponsible activities. Only then the world can survive and maintain its equilibrium.

As Margaret Thatcher has said, "no generation has freehold on this earth. All we have is a life tenancy with a full repairing lease".

The likely solutions to reduce the resource depletion are as follows:

**Reduced Use of Fossil Fuels:** We can conserve fossil fuels by using less gasoline and electricity. Driving less and saying yes to carpooling are simple ways to conserve gasoline. Buying a vehicle having high fuel mileage and purchasing Energy Star appliances can also contribute to conservation of fossil fuels.

**Keep Water Clean:** Water may seem like a never-ending resource which is found everywhere, but due to population growth, the access to clean water for large populations' decreases. Water can be saved by taking small steps in and around your home. Some of these include checking for water leaks and replacing or fixing leaky faucets. Domestic Rainwater Harvesting is a very effective way to save water.

**Preserve Trees and Forests:** To satisfy the world's need for paper alone, approximately 4 billion trees are going to be cut down per year. Thus, preventing the deforestation is very necessary. During a visit to a local forest, one should act responsibly and make sure that campfires are safely maintained.

**Protect Coastal Ecosystems:** Coastal ecosystems are very important for maintaining biodiversity, but they are also extremely valuable for industries like fishing and tourism industries. Seafood consumers should keep in mind how their purchasing decisions can affect the environment.

## PROPER MANAGEMENT OF RESOURCES

This is the most powerful solution. Management of resources is very important. In this world of human population over 8 billion, and other fellow animals, efficient use of resources is a must. Each domain must be managed properly.

### Conservation of Land

The chapter "Domain of Land" started with the way to conserve land. With the efficient land use pattern, this can be easily achieved. There is no great method to conserve land rather than implementation of policies. It all depends on Proper management alone.

Ideally, we'd look at every aspect of land pollution in turn and try to find a way of either stopping it or reducing it. For problems like waste disposal, solutions are relatively simple. We know that recycling can dramatically reduce the need for sending waste to landfills; it also reduces the need for incineration, which can produce "fly ash" that blows many miles until it falls back to land or water. In some countries the filled up landfills are covered up with earth and then parks, some public

facilities are built over it; these kinds of methods are very innovative and are steps to the welfare of environment. We'll always need mines but, again, recycling of old materials can reduce our need for new ones. In some countries, it's now commonplace to require mine operators to clean-up mines and restore the landscape after they've finished working on them; sometimes mine owners even have to file financial bonds to ensure they have the money in place to do this. Greater interest in organic food and farming might, one day, lead to a reduction in the use of harmful agricultural chemicals, but that's unlikely to happen anytime soon. Even so, public concerns over food and chemical safety have led to the withdrawal of those highly harmful pesticides—in some countries, at least. New technologies will almost certainly make it easier to "recycle" polluted land and allow us to use it again in future. For example, the relatively new form of waste disposal called plasma gasification makes it possible to "mine" former landfills, converting the old waste into an energy-rich gas and a relatively safer solid waste that can possibly be used as a building material. Bioremediation is yet another very promising land-cleaning technology, in which microbes of various kinds eat and digest waste and turn it into safer end-products; phytoremediation is also a similar concept but involves using plants, such as willow trees, to pull contaminants from the soil.

## **STEPS TO REDUCE LAND DEGRADATION**

We have discussed about soil degradation and its causes in Unit 1 – Chapter 1. Soil degradation is one of the most concerned issues because it can affect us in many ways like falling of buildings, increase in the number of barren lands etc... so it is our duty to find some solution to this problem. We are going to discuss some of the solutions.

- a) Farmers should plant crops which increase the fertility of the soil like leguminous plants (such as pulses, Cereals) these plants have the capacity to store nitrogen from the soil. This requires well planning.
- b) Before construction of any buildings soil testing should be done.
- c) Industries should be set up in remote places (the places where human habitation is less) so that it reduces the amount of useful soil degradation.
- d) Farmers should be encouraged to use natural fertilizers instead of artificial fertilizers.
- e) Area under forests should be increased by proper policies and planning.
- f) Many trees should be planted in areas which are often prone to landslides. This does afforestation and also at the same time reduces soil degradation.
- g) Many artificial lakes and ponds should be created in places which have poor nutrient content in soil. It is to note that human intervention can now only be countered with human intervention.
- h) Cropping should be done in a particular interval of time because this can increase the soil nutrient content.
- i) People should not plant crops which require excess water for their growth in places which have less amount of water.
- j) Factories should not just throw their harmful chemical waste in soil because this can lead to soil degradation. The configuration of soil changes because of this.

- k) Many mines and manmade holes are left as it is. This affects the condition of soil and brings more dust in that are so man made holes and mines should be closed after their use. Of course it costs money but since we opened it, we must close it.
- l) Forests should not be cleared. This conclusion is drawn from both Unit 1 – Chapter 1 and Unit 3 – Chapter 4.

## Conservation of Water

There are several water conservation techniques which can be employed for better efficient use of water without affecting the environment. Some of the methods include rainwater harvesting and other water innovation methods. Few of them are listed below:-

### TANKAS

Tankas are used in the traditional rainwater harvesting technique commonly practiced in the Thar Desert of Rajasthan. A Tanka is a cylindrical paved underground pit into which rainwater from rooftops, courtyards or artificially prepared catchments flows. Once completely filled, the water stored in a tanka can last throughout the dry season and is sufficient for a family of 5-6 members. An important element of water security in these arid regions is to collect water easily at their own rooftops or at their own underground tanks, rather than going for distant sources...

### JOHADS

Johads, one of the oldest systems used to conserve and recharge ground water, are small check dams that capture and store rainwater. Sometimes, several johads are interconnected through deep channels, with a single outlet opening into a river or stream nearby.

### ZABO

The Zabo system combines water conservation with forestry and agriculture. It is practiced in Nagaland. Zabo is also known as the Ruza system. Rainwater which falls on forested hilltops is collected by channels that deposit the run-off water structures created on the hillsides. The channels also passes through cropping field, collecting the dung and excretory of animals, before reaching the paddy fields at the foot of the hill. Ponds created in the paddy field are used to grow medicinal plants.

## BAMBOO DRIP IRRIGATION

Bamboo Drip irrigation System is a system that has been practiced for over two centuries in northeast India. The tribes of the region have developed this system for irrigation in which water from perennial springs is diverted to the terrace fields using varying sizes of bamboo pipes. This method works based on the principle of gravity. This ancient system is used by the farmers of Khasi and Jaintia hills.

## KHADINS

Khadins are constructions that are designed to harvest surface runoff water for agriculture. The main feature of a khadin, is a long earthen embankment that is built across the hill slopes of gravelly uplands. Khadin allows the excess water to drain off and the water-saturated land is then used for crop production. It was first designed by the Paliwal Brahmins of Jaisalmer in the 15th century. This system is very similar to the irrigation methods found by the people of ancient Ur.

There are several other ancient systems such as Eri system in Tamil nadu

## ADOPTION OF DRIP SPRINKLER IRRIGATION

Surface irrigation methods, which are traditionally used in India, are unsuitable in water scarce areas, as large amount of water is lost through evaporation and percolation. Drip irrigation is an efficient way of irrigation in which a limited area near the plant is irrigated by dripping water. It is the suitable way for any area and especially for water scarce areas. .About 80% water usage can be reduced by implementation of this method

## Conservation of Air

Again, there is no specific efficient method to conserve air as a whole. It all depends on Implementation of policies to regulate the emission of gases. However here is something which would contribute to less emission of CO<sub>2</sub> from vehicles. For this we shall analyze the main contributors to air pollution – Individual vehicles and industrial emissions.

Vehicles operate on the use of fossil fuels. Burning fossil fuels will certainly release toxic oxides such as NO<sub>2</sub> AND SO<sub>2</sub> along with CO<sub>2</sub> which contribute to air pollution. In today's world of urbanization, it is impossible to live without vehicles, without the chief mode of transport. However, what if we reduce the use of vehicles to some extent as well change the mode of which these vehicles operate?

In France lies the effort of providing bicycles for rent. In Paris, the capital city of France, the government has enabled its citizens to rent a cycle from any metro station. This helps to reduce the use of vehicles and increase the use of environmental friendly cycles. There is a cycle stand at every metro station in Paris. Again this is a government initiative.

The other alternative is the use of electric cars. A company called ‘Tesla’ has made significant advancement regarding this. These cars completely function on electricity. Instead of petrol stations, there exist electric stations provided by tesla in different parts of developed countries such as the USA. Solar powered cars are another innovation which is under the works. These changes will bring about a significant change to our world. However their cost stands as a barrier to their quick implementation.

## **GOVERNMENT IMPLEMENTATION OF POLICIES**

We have a lot of policies and plans laid down. They are innovative and has high potential, but the question is – Are they implemented properly? We will see some few cases in our own country.

### **In domain of Land**

In India, the government has laid down ‘National Forest Policy’ in 1952, which specified the area under forest shall be at least 33% (Over 1/3<sup>rd</sup> of the area of India itself). However due to lower awareness and exploitative nature of the Industries, we have failed to keep up with the laid down policy. Today, with slight improvement we stand at 23% of forest area, but the present condition is uncertain. We are standing on thin ice even today.

### **In domain of Water**

#### **Ganga action plan (GAP) 1:**

The First River Action Plan i.e. the Ganga Action Plan was taken up by the Ministry of Environment & Forests in 1985. Since then its scope has increased to all the major rivers of the country and the program was further extended to other major rivers of the country in 1995 under the National River Conservation Plan-NRCP. Presently, the centrally sponsored scheme of National River Conservation Plan-NRCP is under implementation in 160 towns along polluted stretches of 34 rivers spread over 20 States at an approved cost of Rs.4736 crore. The major rivers being Ganga, Yamuna, Gomati, Damodar, Sutlej, Krishna, Cauvery, Godavari etc. among others, the objective of NRCP is to check pollution in rivers through implementation of the following pollution abatement schemes to bring the river to bathing quality standards. The first experiment under this scheme was GAP phases 1 and 2. It involved both draining and treatment. Therefore a comprehensive solution was attained.

**GAP1:** Ganga Action Plan Phase I (GAP I) plan was formulated on the basis of a comprehensive survey of the Ganga basin carried out by the CPCB in 1984. According to the CPCB survey, the total sewage generated from 25 Class I towns in 1985 was estimated as 1340 million liters per day (MLD). At this point bod was improved to a high level. Out of this, due to resource crunch, pollution

abatement works corresponding to 882 MLD only (65% at that time) were taken up under GAP Phase I. To accomplish this task, a total of 261 projects of pollution abatement covering these 25 towns in three States were sanctioned at a cost of Rs. 462 crore. Under this plan, a sewage treatment capacity of 865 MLD has been created.

**GAP2:** Since GAP Phase I did not cover the pollution load of Ganga fully, GAP Phase II, which includes plans for Yamuna, Gomati and Damodar besides Ganga, was approved in stages between 1993 and 1996. The present approved cost of Ganga river under GAP Phase II is Rs.652.89 crore against which an amount of Rs. 240.72 crore has been released to implementing agencies. Out of a total of 268 sanctioned schemes, 79 schemes have been completed so far and the balance schemes are in progress. This plan is being implemented in 60 towns covering five States and 780 MLD of pollution load is proposed to be tackled under this plan out of which a sewage treatment capacity of about 26 MLD has already been created.

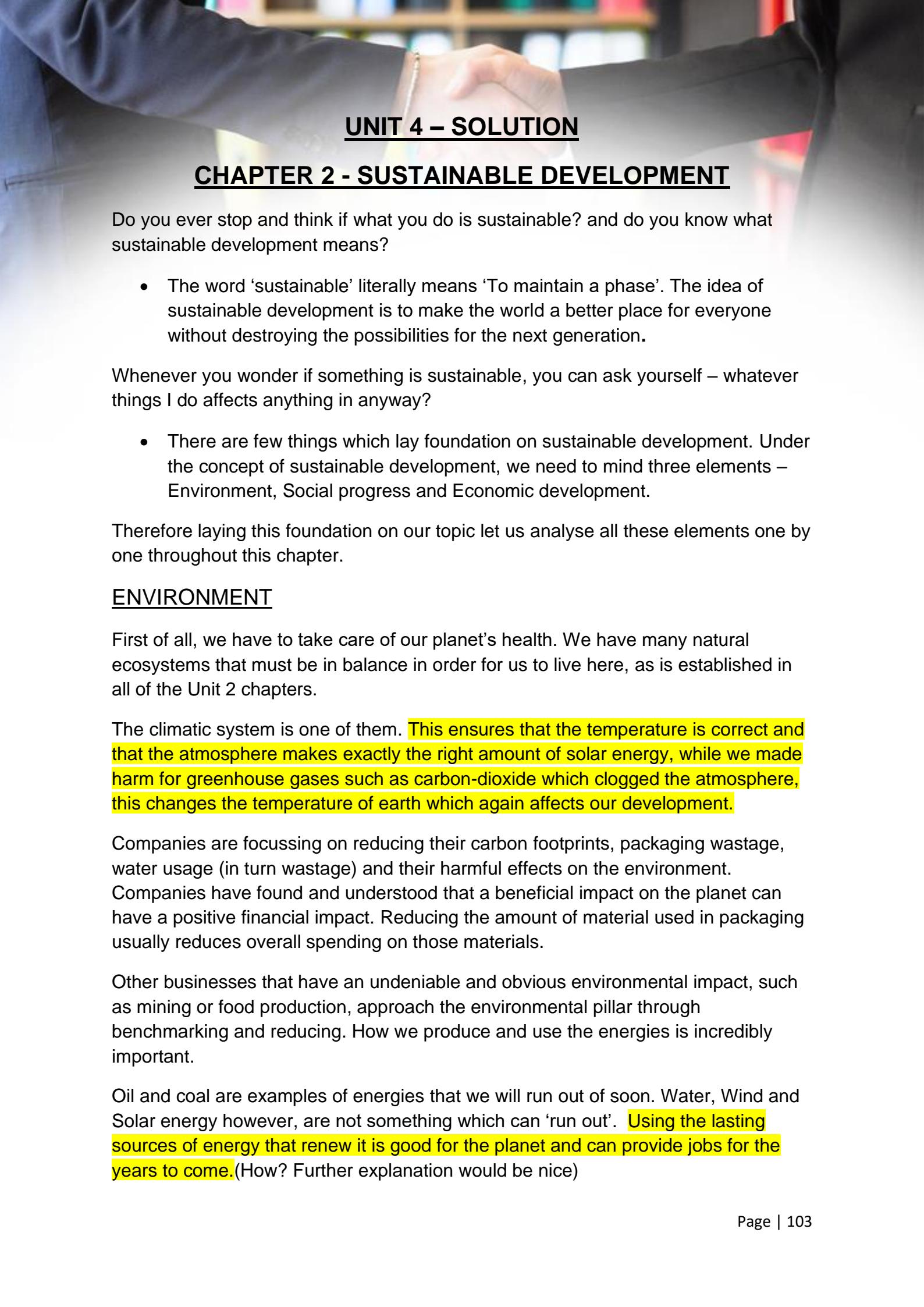
### In domain of Air

Even with the current policies and regulations by India, it is predicted that over 674 million Indians (about 40% of total population of India) will breathe highly polluted air by 2030 – According to a study by IIASA (International Institute for Applied Systems Analysis) and CEEW (Council on Energy, Environment and Water). This clearly shows the poor implementation of policies and the failure of present day awareness.

### SO WHAT MUST BE DONE?

Hence these are the lessons we must learn – The innovative creation of Policies are not and never enough. We shall implement these policies in the right way to bring a change. Even with proper implementation, the people must be in the state to accept the policies and follow them. It is like creating a perfect seed which is to be sown in a good soil at the right season, with required supply of water and manure.

The next chapter gives an account on our positive progress towards saving our ailing planet.



## UNIT 4 – SOLUTION

### CHAPTER 2 - SUSTAINABLE DEVELOPMENT

Do you ever stop and think if what you do is sustainable? and do you know what sustainable development means?

- The word ‘sustainable’ literally means ‘To maintain a phase’. The idea of sustainable development is to make the world a better place for everyone without destroying the possibilities for the next generation.

Whenever you wonder if something is sustainable, you can ask yourself – whatever things I do affects anything in anyway?

- There are few things which lay foundation on sustainable development. Under the concept of sustainable development, we need to mind three elements – Environment, Social progress and Economic development.

Therefore laying this foundation on our topic let us analyse all these elements one by one throughout this chapter.

#### ENVIRONMENT

First of all, we have to take care of our planet’s health. We have many natural ecosystems that must be in balance in order for us to live here, as is established in all of the Unit 2 chapters.

The climatic system is one of them. This ensures that the temperature is correct and that the atmosphere makes exactly the right amount of solar energy, while we made harm for greenhouse gases such as carbon-dioxide which clogged the atmosphere, this changes the temperature of earth which again affects our development.

Companies are focussing on reducing their carbon footprints, packaging wastage, water usage (in turn wastage) and their harmful effects on the environment.

Companies have found and understood that a beneficial impact on the planet can have a positive financial impact. Reducing the amount of material used in packaging usually reduces overall spending on those materials.

Other businesses that have an undeniable and obvious environmental impact, such as mining or food production, approach the environmental pillar through benchmarking and reducing. How we produce and use the energies is incredibly important.

Oil and coal are examples of energies that we will run out of soon. Water, Wind and Solar energy however, are not something which can ‘run out’. Using the lasting sources of energy that renew it is good for the planet and can provide jobs for the years to come. (How? Further explanation would be nice)

## ECONOMIC DEVELOPMENT

Almost everything we develop, buy and trade starts with nature. The smarter we use our natural resources and better we create for fair distribution, the more sustainable we are. One way to contribute to a more and even distribution is to be more aware of what we buy and how it is produced.

If we are to win the battle for sustainable future, we have to follow fair rules that apply to everyone. **To be sustainable, a business must be profitable** (??). At the same time, Profit cannot trump the other two pillars.

In fact, ‘profit at any cost’ is not at all what the economic pillar is about. Sometimes, this pillar is also referred to as government pillar, referring to good corporate governance. This means that boards of directors and management align with shareholders’ interests as well as that of the company’s community, value chains, and end-users customers. With regard to governance, investors may want to know that a company uses accurate and transparent methods.

It is the inclusion of the economic pillar and profit that makes it possible for corporations to come on board with sustainability strategies. The economic pillar provides a counterweight to extreme measures that corporations are sometimes pushed to adopt, such as abandoning fossil fuels or chemical fertilizers instantly rather than phasing in changes. This is an effective way to reduce the usage of these polluting fuels at a faster rate.

## SOCIAL PROGRESS

We humans are part of nature. We have minds that create the strangest and most creative things – that can be constructive or destructive. For us to be at the best versions of ourselves, everyone must have guaranteed equal opportunities, dedication, safety, food and medicine. This not only provides greater opportunities for us as human beings but also for the planet.

The approaches to securing and maintaining this support are various, but it comes down to treating employees fairly and being a good neighbour and community member, both locally and globally. On the employee side, businesses refocus on retention and engagement strategies, including more responsive benefits such as better maternity and paternity benefits, flexible scheduling, and learning and development opportunities. Treating others fairly contributes to the environment in a way. It works this way – the more social we get; the more united we are. The more united we are, more sustainable and more manageable we will become.

For community engagement, companies have come up with many ways to give back, including fund raising, sponsorship, scholarships and investment in local public projects. We just have to think in new ways, these three must work together – that is sustainable development. And there is actually a plan for this; all the countries of United Nations have agreed on a joint plan for sustainable development. But for the plan to work, we need to co-operate and we need to be on board.

There is also a way in which people as an institute can contribute to sustainable development.

## WOMEN IN SUSTAINABILITY

Women play an important role in sustainable development. In order to make advancement in sustainable development, women and men around the world have committed themselves to politics laws, field works, etc. Even as women globally make strides towards advancing the ideals of sustainability in various forms, they continue to face gender based challenges.

The CEEW (Council on Energy, Environment and Water) is committed to promote gender diversity in sustainability public policy. Our women in sustainability (WI's) are committed to change the states within the institutions and the sector as whole. WI's, a network of individuals and institutions seeks to promote gender equality.

## INSTITUTIONAL SUSTAINABILITY

Institutional growth towards sustainability cannot be managed or improved unless it is measured. The CMM (Coordinate and Management Meetings) provides an approach to evaluating the sustainability of the processes an organization uses to achieve its goals. Plans and programmes without action represent futile exercise. Strict implementation and monitoring of relevant environmental policies, plans, laws, regulations and standards is indispensable to attain the goal of sustainable development. There should be adequate skilled and motivated manpower and strong institutional capacity to address environmental and social sustainability.

## EDUCATION FOR SUSTAINABLE DEVELOPMENT (ESD) – FOUNDATION FOR A STIPENDIARY MILLENIUM

With the world population approaching 8 billion people and having limited natural resources, we as individuals and societies need to live together sustainably.

Education for sustainable development empowers people to change the way they think and work towards a sustainable future.

Under this concept, children get to learn the ways in which they can supplement a progressive and productive future life. The children who make our future generations are compulsively made to face a life where they are responsible for the planet's recovery.

Earlier there were movements to save poor and innocent people from powerful people. But in today's condition the people- including children- have a great responsibility of saving planet from exploitative natured people. To make this movement progressive there are certain fundamental requirements, those are equal and combined participation.

UNESCO aims to improve access of quality education on sustainable development at all levels and in all social context to transform society by reorienting education and help people develop knowledge, skills for sustainable development.

Sustainable education is extremely important because it teaches younger generations the value of living a sustainable lifestyle and it encourages society to reduce consumption, recycle more and reuse items as often as possible before discarding them – Hence reducing overall demand of people despite overpopulation.

Education provides a foundation; the groundwork on which of our economic and social wellbeing is built it is the key to increasing economic efficiency and social consistency. By increasing the value and efficiency of labour it helps to raise poor from poverty.

There is growing international recognition of ESD as an integral element of quality education and a key enabler for sustainable development. This serves as a tool for young minds to live a sustainable life. They are the ones who could make future planet earth, possible.

UNESCO focuses its support to member states and stakeholders in addressing sustainable development challenges through education on the following areas:

- Climate change
- Disaster risk reduction
- Biodiversity education
- Poverty reduction
- Sustainable consumption

Education for sustainable development is the education for future. It helps in building a better and fairer world for the 21<sup>st</sup> century. This requires participatory teaching and learning methods that motivate and empowers learners to change their behaviour and take action for sustainable development.

This would make learners to take informed decisions and responsible actions for environmental integrity, economic viability and a just society for present and future generation. All classes of people, in all domains should inculcate the quality of caressing the nature and planet by not causing harm to them.

The primary goal of this movement will be eliminating poverty, empowering people, their voices and interests. A revolutionary change has to come in the perception of human beings bringing in a holistic and ecological view of the world the first step for that would be limiting the rising population and stopping perpetuation of poverty. Creating awareness in children would make them yearning for their turn to participate in this movement actively.

## UNITED NATIONS CONFERENCE FOR SUSTAINABLE DEVELOPMENT

The United Nations is an inter-governmental organization which helps in maintaining international peace and security, developing friendly relation among nations, achieving international co-operation, and being a centre – harmonizing the actions of nations.

The United Nations Conference on Sustainable Development (UNCSD) is also called as earth summit 2012

The UNCSD was hosted by Brazil in Rio de Janeiro on 20-22 June 2012. The UNCSD was the third international conference on sustainable development. The UNCSD is aimed at reconciling the economic and environmental goals for sustainable development.

The UNCSD includes 57 heads of state and 31 heads of government, private sector companies, NGO and other groups. The UNCSD intended to be a high level conference, including heads of states and government or other representatives focused on shaping environmental policy.

The leaders of the conference are the member countries of the G20. The leaders, heads of states and governments and its representatives discussed about the theme, objectives, goals and result. There are seventeen sustainable development goals discussed in the conference.

The conference had two main THEMES:

- To achieve sustainable development, to support developing countries that will help them to find path for development.
- To improve international coordination for sustainable development by building an institutional framework.

The UNCSD has three main OBJECTIVES they are:

- Securing renewed political commitment for sustainable development
- Assessing the progress and implementation gaps in meeting previous commitments.
- Addressing new and emerging challenges.

## METHODS implemented by UNCSD:

### Data source:

The source used in the analysis includes academic literature and newspapers. It also includes abstraction of the articles from database as RIS files Data collection starting to fall of 2011 and continued until May 2013

### Keyword Strategy and Article Selection:

Keyword search of the various data sources was conducted like “United Nations Conference on Sustainable development” and “Rio +20”.

The articles choose many individually to share knowledge by their research and merge it into an article. The newspaper mutually checked conducting the search so that they can reduce duplicates.

### Coding:

After all the checking they release the article as PDF files. The coding is taken by reading, using initial codes, adding the list as other topic. This method is called pattern coding.

### RESULT of the conference:

The primary result of the conference was the- "The Future We Want," The heads of state of the 192 governments in attendance renewed their political commitment to the promotion of sustainable future. The document largely reaffirms previous action plans like Agenda 21.

## GLOBAL SUSTAINABLE GOALS

Sustainable goals are the goals to achieve a better and brighter future for all. There are 17 such goals. United Nations addresses the universal issues that countries face related to poverty, inequality, climate, environmental degradation, prosperity, peace and most importantly, justice. All these goals are built upon trust and equality. It is targeted to achieve all these goals by 2030.

### **1) NO POVERTY:**

The ultimate aim of the goal is to attain zero poverty by 2030. Poverty remains one of the greatest challenges of development. There are 122 women aged 25 to 34 living in extreme poverty for every 100 men of same age group in the world. Poverty affects age groups differently with the most devastating effects experienced by children. Achieving goal 1 is hampered by lack of economic growth in the poorest countries of the world.

### **2) ZERO HUNGER:**

In present world, 15% of the people in South Asia still faces greatest hunger burden. The target of this goal is to ensure that food is accessed by all people, especially the poor and vulnerable people. This ensures the end of all forms of malnutrition and hunger. This could be accomplished by doubling agricultural productivity. Doubling agricultural productivity is a huge task and it requires co-ordination and well planned implementation of management.

### **3) GOOD HEALTH AND WELL-BEING:**

This goal is implemented for ensuring health safety and promoting better life for all living beings irrespective of any differentiating factor. People can create awareness in their community about the importance of good health and lifestyle. Significant strides have been made increasing life expectancy.

### **4) QUALITY EDUCATION:**

By 2030 all the girls and boys should get good and complete education and also should ensure that they have good skills in all aspects. Despite variation by any factor, all should get equal primary & secondary education. It is to note that today 103 million youth worldwide still lack basic literacy skills. We have already spoken about the importance of education for sustainable development.

## 5) GENDER EQUALITY:

Women plays important role for the success of every man's life. By 2030, this goal aims at achieving no discrimination of gender and violence and other things on women will be subdued. This requires enforceable legislation that promotes empowerment of all women and girls and requires secondary education for girls. Despite gender difference, everyone must be considered 'Human'.

## 6) CLEAN WATER AND SANITATION:

Water is a basic commodity for everyone. For many years most of the people died especially children due to lack of adequate water supply and sanitation. To rectify this problem Government should implement many water supply scheme and sanitary scheme to avoid death. Ending open defecation will require provision of toilets and sanitation for 2.7 billion people.

## 7) AFFORDABLE AND CLEAN ENERGY:

The world energy demands are ever increasing and our resources which we depend on present day is getting used up. We have to find new access to afford for modern energy services. Along with the cooperation of international countries we should find many modern technologies and promote investment to get clean energy technology. Only 57 % of global population relies primarily on clean fuels. Moving on to alternate sources of energy is talked on Unit 4 – Chapter 3 – Technological Re advancement

## 8) DECENT WORK AND ECONOMIC GROWTH:

Population is the least respected factor in our country. Overpopulation is not even a problem if they are managed properly as spoken in the previous chapters. To achieve higher economic productivity we should utilise new technologies along with hard work of the population. The aim of this goal is to attain employment and decent work by 2030. People especially from rural areas are the ones who suffer in unemployment disaster. If we manage to employ the majority, it will bring about a planning and co-ordination which will help us reach greater heights.

## 9) INDUSTRY, INNOVATION, AND INFRASTRUCTURE:

To get equal access for all, modern economic development of infrastructure must be implemented. Build resilient infrastructure, promote inclusive and sustainable industrialisation and foster innovation. This must be done causing no harm to the environment.

## 10) REDUCED INEQUALITIES:

This goal aims to empower and promote the social, economic, and political overall of all, irrespective of age, origin, religion or economic or other status .The main target of this goal is to ensure equal opportunity and reduce inequalities including eliminating

discriminatory laws, policies and practices. An ideal condition is never possible. However we can get one step closer to it.

#### **11) SUSTAINABLE CITIES AND COMMUNITIES:**

The ultimate aim of this goal is to ensure access for all adequate, safe and affordable housing and basic services and upgrade slum and reduce the number of death and the number of people affected and substantially decrease the economic loss. This aim has to be done before 2030.

#### **12) RESPONSIBLE CONSUMPTION AND PRODUCTION:**

Promote public procurement practices that are sustainable, in accordance with national policies priorities. To achieve sustainable management and efficient use of natural resources and also to reduce waste generation through reduce, reuse and recycle by 2030.

#### **13) CLIMATE ACTION:**

Climate change is intensifying because of extreme weather events such as heat waves, drought, flood, etc... Global emissions of carbon dioxide have increased. Improve education and create awareness among people on climate change mitigation, adaptation and early warning. Students must be educated regarding this issue so that they take action on it in future.

#### **14) LIFE BELOW WATER:**

Over three billion people depend on marine and coastal biodiversity for their livelihood. 40% of world's oceans suffer from overfishing, poor fishing, and poor waste management. The main aim of this goal is to reduce the marine pollution. Oceans absorb about 30% of CO<sub>2</sub>, so that life of aquatic animal's life get damaged.

#### **15) LIFE ON LAND:**

Every year we lose 13 million hectares of forest that are home to more than 80% of all land based species. This has happened since we forgot that we are supposed to share the planet with fellow life forms too. The world is losing its own biodiversity at an alarming rate. We must take an action to end poaching and deforestation. By 2030 this goal aims to ensure the conservation, restoration in forest, wetland, mountains and dry land.

#### **16) PEACE JUSTICE AND STRONG INSTITUTIONS:**

Justice is the foundation of trust. Trust is the foundation of sustainable development. This goal promotes peaceful and inclusive societies for sustainable development in providing access to justice for all. It aims to develop successful, responsible and inclusive institutions at all levels. The International Community values peace and

justice and it calls for stronger judicial systems that will enforce laws and work towards a more peaceful and just society. The objective of this goal is to reduce all forms of violence, conflict and insecurity.

### **17) PARTNERSHIPS FOR THE GOALS:**

Stronger partnership will contribute to environmental protection, sustainable development, by mobilizing resources, sharing knowledge among people. Mobilize additional financial resources for developing countries from multiple sources. Strengthen the means of implementation and revitalize the global partnership for sustainable development. Adopt and Implement some steps for promotions for least developed countries.

### **AGENDA 2030**

This agenda is planned to eradicate poverty from the world. This is to bring a better economic development in 2030. It seeks universal peace at larger freedom. We all recognise that the eradication of extreme poverty is the most difficult challenge in the world, however, is the most indispensable thing. The countries that are acting in collaborative partnership will definitely implement this plan.

There is a great tyranny of poverty and it is this generation, and future generation's responsibility to secure and heal our planet.

The 17 sustainable development goals discussed earlier and other 169 targets which are announced demonstrate the scale and ambition of this new universal agenda. They seek to build on millennium development goals..

This agenda is implemented in about **706 countries** which includes India. However due to lack of awareness, some countries do not take this agenda seriously and this leads to hampering of both sustainable and economic development globally.

The Agenda 2030 has 4 sections of specific characters:

- A political declaration to initiate the targets and goals
- The 17 sustainable goals and 169 targets
- The ways in which the goals can implemented
- The structural design for the future goals and the reviews of the agenda can be determined.

Targets: (Are these few of the 169 targets, or some other main targets?)

- By 2030, eradicate extreme poverty of all people below poverty line especially people who are getting 1.25 USD everyday as salary.
- Reduce at least by half the population of poverty
- Implement nationally appropriate social protection systems and measures for all.
- Ensure that all men and women in poor state have equal access to public property and basic life features.
- Build a permanent place or house for poor to avoid them from the exposure of extreme climatic conditions.

Moreover, to ensure progress and long term accountability, the 2030 Agenda includes a strong follow-up and review mechanism which will allow all partners to assess the impact of their actions. At global level, this is overseen by the High level Political Forum on sustainable development, which meets at UNHQ (united nations headquarters) every year to track progress. The UN 2030 Agenda envisages “a world of universal respect for human rights and human dignity, the rule of law, justice, equality and non-discrimination”. We have finally understood that mere creation of laws and goals are not enough – they must be implemented.

It is grounded in the universal declaration on human rights and international human rights treaties and emphasises the responsibilities of all states to respect, protect and promote human rights. There is a strong emphasis on the empowerment of women and of vulnerable groups such as children, young people, and persons with disabilities, older persons, refugees, internally displaced persons and migrants.

The council of Europe contributes to achieving these goals through most of its sectors through work funded by the ordinary budget as well as with extra-budgetary contributions. The sustainable development agenda is particularly important for the organisation’s development co-operation programmes.

The council of Europe’s new Project Management Methodology is also there to ensure that methods as well as substance of these programmes contribute to achieving the agenda, including through a human rights approach. Overall, the cooperation programmes carried out via the office of the Directorate General of Programmes are currently worth 200 million.

Agenda 2030 needs bright minds and relentless dedication from all society – governments and the UN cannot do it alone. Harnessing the know-how, expertise, technology and financial resources from businesses, academia, civil society and individuals, is necessary to reach the ambitious targets in every context. The Agenda’s 17 Sustainable Development Goals (SDG), and their 169 targets, aim at eradicating poverty in all forms and “seek to realize the human rights of all and achieve gender equality”.

## GLOBAL SURVEY

The Global survey of sustainable development brings together the overall causes and effects of sustainable developments in the last few decades and also an assumption for future. It picks up expectations and opinions from various angles.

Its main aim is to give importance to the environment, social issues and economy in the countries. After that, the performance of each country will be assessed. This survey targets individuals and political representatives, business, media and civil society both on a national and international level.

For mass campaign, the Global Survey is distributed as “multipliers”, which means networks from all areas. They support the Global Survey and initiate all to participate.

Government of the Federal Republic of Germany (Federal Ministry for the Environment, Nature Conservation and Nuclear Safety) will finance the project. Hamburg, and Yale University, New Haven is responsible for planning and implementation.

On September 2018, the survey started. It will be under access until June 2019. The outcomes are expected to be in the month of August/September 2019. All this to be done only to create awareness, initiate and accelerate the decisions mandatory for sustainable development.

### Some key conclusions

- Young people want local options that they can include in their daily lives: Asked to react to sustainability scenarios -mobility (car sharing, bicycle centre, carpooling), food (urban gardens, vegetable bag subscription, family take-away) and housekeeping (collective laundry, urban composting, energy management) - most young people choose the bicycle enter, urban gardens and urban composting. This shows the need to have initiatives that are involving but not intrusive, where they can interact and participate at the local level.
- There is a need to build trust and participation: Trust was an issue for many young people; only 30 per cent of those surveyed think their neighbours trust each other. Despite this, many young people actively participate in activities involving others. For instance, in countries like Australia, New Zealand, the Philippines and South Africa, more than 80 % of participants have been part of an association in the last 12 months, with the least involved young people living in Egypt, Japan and India.

- For sustainable lifestyles solutions at the local and community level to be successful, more trust and social links among young people are needed. This will allow cooperation, solidarity and collective creativity to develop, creating the essential environment for sustainable solutions to flourish. Associations, non-governmental organizations and youth groups need to build partnerships with young people to inform them about and engage them in sustainable lifestyles practices.
- Promoting research and education for sustainable lifestyles: For a better understanding of sustainable lifestyles and consumption patterns, more research and education is needed to help in the shift towards sustainable lifestyles. Schools, professional training and awareness raising have an important role to play in building capacities for sustainable lifestyles.

Existing initiatives and networks that focus on research and education for sustainable lifestyles should be improved and replicated. This will help advance sustainable lifestyles and create new visions for sustainable lifestyles.

This report is aimed at policy makers and relevant stakeholders, to assist them on how to help support the shift to sustainable lifestyles through effective policies and initiatives, including communication and awareness-raising campaigns.

It consists of cross-country conclusions and recommendations as well as 16 country papers, which provide insight into country-specific conditions, culture, economic development and other factors affecting lifestyles.

The 20 countries in the GSSL are Argentina, Australia, Brazil, Canada, Colombia, Egypt, Ethiopia, India, Japan, Lebanon, Mexico, New Zealand, Philippines, Portugal, South Africa, Sweden, Turkey, the United Kingdom, the United States of America and Vietnam.

Some countries involved in the GSSL presented their respective national survey results in 2011 through a variety of events including press conferences and workshops.

## ECO-RESTRUCTURING

Eco-restructuring is the implication for an ecologically sustainable economy. Government officials implement environmental policies to establish the industrial-ecological progressions that enable the motions of economic modernization. When establishing economic growth, policy makers focus on the progression towards sustainable environment by establishing a framework of ecological engineering. Government funding is necessary when investing in efficient technologies to stimulate technological development. Economic dimensions are been sorted out by the idea of sustainability.

Whenever we talk about the idea of Eco-restructuring, the only thing should be focused is the importance of the socio-technical transitions. Bringing a change among the industrial sector would increase the efficiency of the sustainable world. To have a smooth transition between socio – technical categories, social agreement is important when introducing Eco-restructuring methods. When forming new ecological policies, policy maker's focus on the movement that sustainable environments have in regards to the social expectations.

Economic production is an example of the existing relationship between eco-restructuring and sustainability. Cleaner production with minimal impact on the environment is the main idea behind the correlation of the two subjects. Since industrial ecology contributes to the direction of sustainability, eco-restructuring is perceived as a benefit for the environment and natural adaptation.

Critics of the eco-restructuring and sustainability policies argue that a clear balance between a self-preserving ecological system and mass production is difficult to maintain. However, ecological engineering has been a major component used when applying eco-restructuring methods in the production of resources.

## ORIGIN

In 1998, the book Eco-restructuring: Implications for Sustainable Development was published by Robert Ayres. The book provided a significant contribution to the research of industrial- ecological progressions. Robert Ayres introduced a new prototype of eco-restructuring for sustainable development of technologies, economic movement and social lifestyles. The implication for cleaner and more efficient technologies contributes to the research of ecological construction.

## TECHNOLOGIES

It helps in increasing the production rate by bringing out efficient technologies that reduces the usage of non-renewable resources. Renewable energy is a form of energy obtained from clean and natural resources. Solar and wind power technologies are examples of clean energy forms that would eliminate pollution produced from the coal and diesel energy sectors.

## ECONOMIC MOVEMENT

This type of economy structure looks at ways to reduce the environmental impacts. Nations focus on steering their policy agenda to allow the implementation of ecological strategies. This will accelerate the transformation of the economy sectors towards a clean and effective ecological state.

## SOCIAL LIFESTYLES

Human economic activities can influence the type of issues that ecological systems face. These social lifestyles are subject to the changes in the production of goods and services. An example of this idea would be the collection of raw materials and disposing them in a proper efficient manner that will have little impact on the environment. If the whole cycle is restructured to meet the principles of ecological regulation, then experts would have to analyse the effects of human activities and determine a possible alternative to the removal of biomedical waste and other raw materials.

Certain factors can influence the regulations that the policies cover such as the need for sustainable development. Legislative measures are also developed based on the propositions of ecological and Economical advantages. The principle of sustainable development applies to the restructuring of technologies, economic movement and social lifestyles. These principles have helped to determine an evolution of the ecological system

## ENVIRONMENTAL FACTORS

The application of eco-restructuring seeks to improve the environmental stability in relation to manufacturing and waste management. However, ecological effects can occur by following improper procedures. Despite the precautions that must be considered, there are environmental benefits of ecological modernization such as renewable energy.

The use of renewable energy would eliminate the threat of ecological dangers such as pollution. Modern technologies also have a role in the impact of the environment. When new technologies are developed, sustainability is achieved through improving the environmental dimensions.

## ECO RESTRUCTURING AND SUSTAINABILITY

Socio-technical transitions correlate to the need for social change in the study of sustainable resources. Sustainability plays vital role in several sectors of managements such as health care, education, ecology, economics and technology. As the Government is not more concerned about this idea the productions is been carried out efficiently through the idea of self-preserving system which should be creating awareness throughout the world to bring a change gradually.

Despite the research supporting the reformation of the ecological system, natural resources can suffer depletion and will need the support of sustainability to preserve its existence. New policies are required to move towards equality and sustainability since the social expectations reflect the relationship between the two concepts. The public perception for an alternative solution to sustainable development is reflected through the ecological policies enacted by government officials. Eco-restructuring offers a positive aspect to the principles of ecological modernization. It is an alternative to the motion of technological progressions within the global economic regime.

## THE GARDENING CONCEPT

This is the concept where the agriculture is done through gardening like cultivation system with a high input of labor. This concept actually decreases the capital investment as we use human sources more. This is done with a great advantage of bringing out nutritious food as output by planning a balanced pattern of mixed cropping structure. This is a wise strategy to decrease unemployment and to meet future food shortages. It also promotes people to do agriculture for living. This is especially important to halt the shift of people from agriculture sector to other sectors. Agriculture and farmers must be respected.

But the intelligent intermediate step would be to preserve the skills needed to manage highly productive mixed agricultural system that later can be more easily intensified towards a gardening like pattern of cultivation. In this light, small-scale mixed agriculture can be seen as the starting block for stepping up agricultural productivity in the future in a sustainable way.

## INDUSTRIAL METABOLISM

Industrial metabolism is a concept to describe the material and energy turnover of industrial systems. It was proposed by Robert Ayres in analogy to the biological metabolism as "the whole integrated collection of physical processes that convert raw materials and energy, plus labor, into finished products and wastes".

## IMPLICATIONS FOR SUSTAINABLE DEVELOPMENT

Following on from the critically acclaimed Industrial Metabolism, this study provides a significant contribution to the literature on sustainability by identifying, on a sectorial basis, the critical issues facing the world as a whole, and the technical feasibility of addressing them. A new paradigm of eco-restricting for sustainable development is introduced, involving shifts in technology, economic activities and lifestyles needed to harmonize human activities with natural systems.

This volume analyses several sectors and technological fields that are involved in the search for sustainable patterns of industrialization. Comprehensive coverage is given on the fields of material, various energy technological and futures, tropical land use, transport and industrial space use, ecological process engineering, and agro-engineering. The volume also contains chapters on systems views of the broader eco-restructuring concept, including its biophysical basis, global eco-restructuring and technological change, and national and international policy instruments and institutions.

## URBAN METABOLISM

Urban metabolism is a model to facilitate the description and analysis of the flows of the materials and energy within cities, such as undertaken in a material flow analysis of a city. It provides researchers with a metaphorical framework to study the interactions of natural and human systems in specific regions.

## SUSTAINABILITY INDICATORS

With the issue of sustainability at the core of many environmental issues today, one of the main uses of Urban Metabolism in the modern era is to track and record levels of sustainability in cities and regions around the world. Urban metabolism collects important and very useful information about energy efficiency, material cycling, waste management and infrastructure in urban environments.

The urban metabolism model records and analyzes environmental conditions and trends which are easily understood for policy makers and consequently comparable over time making it easier to find unhealthy patterns and develop a plan of action to better the level of sustainability.

## GREENHOUSE GAS ACCOUNTING

Urban metabolism is even helpful in tracking the greenhouse gasses emitted in a city. The production of greenhouse gases has increased exponentially since the birth and mass production of the automobile causing a problem for our atmosphere.

Urban metabolism has been proven to be a necessary tool for measuring levels of greenhouse gas because it is an out-put or waste product that is produced through human consumption. The model provides quantifiable parameters which allow officials to mark unhealthy levels of GHG (greenhouse gas) emissions and again, develop a plan of action to lower them.

## MATHEMATICAL MODELS

Aside from the two accounting applications above, urban metabolism has begun to develop mathematical models to quantify and predict levels of particles and nutrients within the urban metabolism model. Such models have mostly been created and used by MFA (master of fine arts) scholars and are helpful in determining present and future sub-processes and material stocks and flows within the urban environment. With the ability to predict future levels, these mathematical models allow progress to be made and possible pollution prevention programs to be instated rather than end-of-the-pipe solutions which have been favoured in the past.

## DESIGN TOOLS

Through the utilization of the 3 applications above, scholars and professionals can use urban metabolism as a design tool to create a greener and more sustainable infrastructure from the beginning. By tracing flows of energy, materials and waste through urban systems as a whole, changes and alterations can be made to close the loops to create circular metabolisms where resources are recycled and almost no waste is produced. Such initiatives are being made around the world with technology and inventions which make building green that much easier and accessible.

Uses of the model are however not restricted to strictly functional analysis, as the model has been adapted to examine the relational aspects of urban relationships between infrastructure and citizens.

## SUSTAINABLE DEVELOPMENT IN INDIA

The United Nations defines sustainable development as “development that meets the needs of the present without compromising the ability of future generations to meet their own needs”. Previous dialogues on sustainability have more or less focused on climatic change and environmental issues, but the new paradigm (a typical example) of sustainability, as negotiated over the last three years for this summit includes all efforts towards an inclusive, sustainable and resilient future for people and the planet. There is a significant departure from the previous framework to now include a “Harmonising” of three elements: economic growth, social inclusion and environmental protection. “Eradicating poverty in all its forms and dimensions is an indispensable requirement for sustainable development,” the UN has said.

## SUSTAINABLE DEVELOPMENT GOALS IN INDIA

From India’s point of view, sustainable development goals need to bring together development and environmental into a single set of targets. The fault line, as ever in global conferences, is the inappropriate balance between environment and development...we could also view the SDGs and the post 2015 agenda as an opportunity for revisiting and fine-tuning the MDG framework and sustainably regaining focus on developmental issues.

## NEED FOR SUSTAINABLE DEVELOPMENT IN INDIA

This admission is, of course, an understatement. All available indicators point to the ecological situation being nothing short of disastrous. Natural ecosystems are under stress and decline across most of the country; some 10 per cent of the country’s wildlife is threatened with extinction; agricultural biodiversity has declined by over 90 per cent in many regions; well over half of the available water bodies are polluted beyond drinking and often beyond drinking and often beyond even agricultural use; two-thirds of the land is degraded to various levels of sub-optimal productivity; air pollution in several cities is amongst the worst; ‘modern’ wastes including electronic and chemical wastes are being produced at rates far exceeding our capacity to recycle or manage. There is a limit for everything.

A 2008 report by the global footprint network and confederation of Indian industries suggests that India has the world’s third biggest ecological footprint, that its resource use is already twice of its bio-capacity, and that this bio-capacity itself has declined by half in the last few decades.

## STEPS TAKEN BY THE GOVERNMENT TO VERIFY SUSTAINABLE DEVELOPMENT

### 1. CONFORMATION OF PARIS AGREEMENT.

The 21<sup>st</sup> conference of parties was called “cop 21” under the United Nations framework provides a framework for all countries to take action against climate change. This international agreement aims to reduce carbon di oxide emissions and greenhouse emissions and will succeed to Kyoto protocol.

This agreement gives importance to concepts like climate justice and sustainable lifestyles. For the first time brings together all nations under UNFCCC. The main motto is to monitor the global average temperature which is below 2 degrees above pre-industrial level and driving efforts to limit it even further to 1.5 degrees.

### 2. THE CLEAN DEVELOPMENT MECHANISM PROJECTS IN INDIA:

It is one of the flexible mechanisms defined in the Kyoto protocol. It provides for emission reduction projects. The clean development mechanism was designed to meet the following objectives:

1. To help developed countries fulfil their commitments to reduce emissions.
2. To assist developing countries towards sustainable development

### 3. STATE ACTION PLANS ON CLIMATE CHANGE

The state action plans on climate change (SAPCC) focused on adaptation with mitigation as co-benefit in sectors such as water, agriculture, tourism, forestry, transport, habitat and energy. It aims to

1. Create institutional capacities
2. Implement sector activities to address the climate change

These plans are implemented by 28 states and union territories. These states submitted their SAPCCs to the MOEF&CC (ministry of environment and climate change). India is one of the few countries around the world to have a carbon tax in the form of cess on coal. Not only India imposed such cess but it has also been progressively increasing it.

#### **4. NATIONAL ADAPTATION FUND FOR CLIMATE CHANGE**

It was established in August 2015 to meet out the adaptation cost of climate change with the budget provision of 1350 crores. The main objective of this fund is to prepare and update climate scenario, and assessing vulnerability and climate impact assessment.

### **CONCLUSION**

In spite of all those measures taken, achieving sustainable development is a big task. It requires a lot of involvement of every sector and each level of society. Experiences of the pilot countries can provide a platform for India to achieve sustainable development

### **BRUNDTLAND COMMISSION:**

The commission was brought to bring together several countries which were striving to stop the deterioration of planet earth .its chairperson was appointed by secretary-general in 1983. This was otherwise called as 'World commission on environment and development'. All rich and poor developed and developing countries in the north and the south were not ready to give up this chance of being a part of the united move. The common problems that these countries encounter were environmental threat like acid rain, uncontrollable deforestation (desertification) destruction of the ozone layer and pollution. The early signs of climatic change like rise in sea level, irregular rainfall and impending disaster were impossible to overlook and increasing unacceptable.

They all were seeking to step into a developmental concept that would reconcile economic development accompanied by environmental protection. The first report on the idea of sustainable development was realised in 1980 by world conservation strategy of international union for conservation of nature. That report concentrated on global structural changes. United Nations created an independent commission which initially had to analyse the existing problems and ideas for their solutions like independent commission on disarmament and security issues. The organisation aimed to create a united international community with sustainable sustainability goals by identifying sustainability problems worldwide, rising awareness about them and suggesting the implementation of a solution.

"Our common future" on the environment and development of earth was the first volume of main report published by Brundtland commission in 1987. This commission also aimed at other cumbersome tasks like international economy population and human resource, food securing, species and ecosystem, energy, industry, proposal of legal principles for environmental protection.

The United Nations general assembly figured out the deterioration of human environment and natural resources. To work and pursue sustainable development together Brundtland commission was established.

The principle focuses of Brundtland commission are:-

- Promotion of environmental stewardship of connection between governmental and non-governmental entities
- Government council and business dealers to come together and discuss ideas and strategies to encourage sustainable development

The conception framework for international ties between government and multinational corporations as agreeable to many nations are successfully constructed by Brundtland commission. The major problem encountered was global implementation of sustainable development. However, because of Brundtland commission's effort, progress has been acquired. The international meeting brings out concrete initiative and goals for healing the earth and nurturing it.

### **RESOLUTION ESTABLISHING THE COMMISSION:**

- (a) long-term environmental strategies should be proposed for achieving sustainable development to the year's 2000 beyond
- (b) To recommend ways in which concern for the environment may be translated into greater co-operation among developing countries and between countries at different stages of economic and social development and lead to the achievement of common and mutually supportive objectives which take account of the interrelationships between people, resources, environment and development;
- (c) To consider ways and means by which the international community can deal More effectively with environmental concerns, in the light of the other recommendations in its report;
- (d) To help to define shared perceptions of long-term environmental issues and of the appropriate efforts needed to deal successfully with the problems of protecting and enhancing the environment, a long-term agenda for action during the coming decades, and aspirational goals for the world community, taking into account the relevant resolutions of the session of a special character of the Governing Council in 1982

## **UNIT 4 – SOLUTION**

### **CHAPTER 3 – TECHNOLOGICAL READVANCEMENT**

So far we have seen that right implementation of policies and proper management with world co-ordination can help to heal our ailing planet to a great extent. But what must be done in the field of technology?

As discussed earlier, technology is very powerful and has a huge potential. However its potential is threatening, its power is devastating. But what if, we could actually use it in a right way? What about reverting everything back and make a new beginning? Why not approach the solution in a right way?

Failure is the greatest teacher. When we fail, there is always a next time. We know what exactly not to do. We have failed in clean development using current technology. Yet now we know where and why we went wrong. This provides us a lesson and experience on how to use technology. In fact technology itself is not bad at all. The way we used technology so far was wrong. If we use it right, we will put the power and potential to right use, for right way of advancement, for development, and for saving our planet.

Now since we have examined the root of the problem we face today, it is easy to summarize the solution. Now we know where the root is present and which place exactly to water. Right now we have already proposed variety of alternate models to derive energy. It need not be just burning fossil fuels to produce energy. It can be from renewable sources such as water or air. It need not be dams while talking about water. It could be simple water harvesting employed domestically. Simple windmills are good if not the best to derive energy. Solar energy is something which has the highest potential of all energy. We would like to lay special emphasis on solar energy in this chapter. Also technological advancement is not only about deriving energy efficiently. It is also about conserving it. Also it does not even need to be based on energy itself! It could be regarding proper management, and minimizing the flaws in existing creation. We will cover all of this in this chapter!

We will start with one of the controversial technological advancement – Artificial Intelligence.

## ARTIFICIAL INTELLIGENCE

Our present day world is based on technology. Technology plays a major role in our day to day life. Over these years, technology has advanced to a great extent. The main cause of the development of technology is to make the world a better place. The most amazing technology found until now is Artificial Intelligence (AI). Artificial Intelligence works based on their predefined algorithms programmed specifically to perform various jobs and save our time .An algorithm is a set of unambiguous instructions that a mechanical computer can execute.

The algorithms are of two types, the simple one and the complex one, the complex ones are often built over the simpler ones. Machines are more efficient and can perform any specific task in less time than the time taken by a human to complete it. As also we humans need the help of AI in order to have an accurate solution for specific problems. Modern AI has the capability to even recognize human speech and many other fields like military defence simulations, routings for content delivery networks, autonomously operating cars, etc...

### **TYPES OF AIs**

The idea of saving our planet with the Implementation of AI's can easily be done with the three types of AI.

The first type is the Analytical type AI. This analytical type AI uses cognitive intelligence and predicts the future by studying the past experiences .The second type is the Human inspired AI. This AI contains cognitive intelligence combined with emotional intelligence these help them in understanding human emotions, also these are mostly used for accurate decision making. The third type is the Humanized AI. These kinds of AI have all three types of intelligence cognitive, emotional, and social. This kind of AI can be self-conscious and also it is self-aware to interactions with others. AI plays a major role in Robotics and Machine science. Creating a Robot with artificial intelligence however can be very costly.

The twenty first century AI's are so much advanced in computer power, data storage, and also in theoretical understanding and these advancements is a major reason for the technological based industries using AI to solve many challenging problems in computer science, software engineering and operations research. Even though AI's are very much advanced, they lack in several features such as common sense, reasoning knowledge representation, planning, learning, natural language processing, perception, transportation of objects. Even though the modern AI's draw upon many fields like computer science , information engineering, mathematics, psychology, Linguistics , philosophy, and many other fields they cannot satisfy all our human needs.

Therefore the technology has to develop even better than how it is at the present.. Considering the current situation, China is observed to be the first expected AI super powered country.

According to some AI researchers, Artificial Intelligence (AI) is an area of computer science that emphasizes the creation of intelligent machines that work and reacts 'like' humans. Some of the activities computers with Artificial Intelligence are designed for include speech recognition.

## **AI AND THE AILING PLANET**

Some countries like India are not interested in implementing such technology because they claim that these kinds of technologies may result in Mass Unemployment. But that won't be the case if we limit the implementation of AI to only the fields where human labour is insufficient, or it does not interfere with current employment.

But think of, how can we save our ailing planet with AIs? We can use AI's to protect our ailing planet and conserve the resource wastage to make our world a better place. Using AI to protect our Earth from its destruction can be very convenient and also it is very much useful in conserving our resources. By this method the resource wastage can be controlled and hence these resources can be saved for our future needs.

More or less we need to depend on technology. When compared to human beings, AI's are more productive and require less energy. Likewise if Power Generation and Distribution jobs are given to one particular Artificially Intelligent Robot, it would convert the given resource into energy and also produces less wastage when compared to Human operated power generation jobs. Therefore AI's can conserve nature in a more efficient way than human beings. Also AI's can help us a lot in making the country more developed and also it can help in remote areas and illiterate people in their daily life.

Analytical type AI can be used to control the pollution by predicting the pollution level using the amount of cars present in the particular area and alerting the pollution control if there is an increase in the pollution level. This alert will thus change the path for other cars and hence will decrease the pollution level and also this alert can help the government in taking action against over pollution in a particular region. This can hence decrease the pollution levels and also help us to breathe fresh air.

Humans can forget but AI's don't, so these AI's can be deployed for saving information, as the information can never be forgotten. AI's can also be deployed in many other fields too! Using AI's in the medical field is a very innovative and effective idea as these AI's can also be programmed to treat patients and also these AI's can be used in research field, as they have accurate knowledge according to their programmed algorithms.

This can help researchers in a very effective way too. AI's can work on research on behalf of humans. This will help scientists and researchers in bio hazardous research or other harmful researches (For finding antidote to existing diseases). AI's present in India are not much advanced than that of China or US. Encouragement of AI's in our country is low.

Implementation of AI's in military and other defence forces to fight against other countries and to withstand wars can save many human lives. War using technology is depreciated; however, a wise leader shall try to avoid wars but always must be ready for one. Implementation of AI's can also result in the country's technological growth and advancement. AI's can be deployed for Traffic Maintenance and also to find and warn the Law Violations all around the city or country.

To create an AI with language programs to interact with humans is very costly and also in some countries like India these technological hardware need to be imported from other countries, and also there are less number of well-trained operators to maintain the modern and advanced AI's.

Machine learning, an early form of AI that has in recent years become mainstream, causing both delight and nervousness among AI experts and technological companies AI involves building computers capable of taking smart decisions by themselves, the way humans do. Machine learning and other various sub fields such as deep learning are the means to achieve AI. The revival of interest in machine learning has been driven by a confluence of factors, such as the massive increase in computing power, emergence of neural networks and the easy availability of vast amounts of data, saving things on the internet can be very easy and more convenient as the information we are saving are saved in the cloud drive and it is very easy to retrieve information in case of urgency.

Compared to AI leaders in the Silicon Valley and China, India is a laggard but even here, nearly 300 start-ups are using some or the other form of AI. According to Tracxn, a start-up tracker, among all dedicated AI Only Indian start-ups, 23% are working on providing solutions to multiple industries, 15% are in e-commerce, 12% in healthcare , 11% in education, 10% in financial services , and the rest in fields such as retail and logistics, according to a 2017 report by kalaari capital, a venture capital firm. How does this work? Traditional code writing entailed programming computers, essentially telling computers what to do. With machine learning, computers are taught to do things themselves.

As mentioned earlier, we shall not blame the development of technology itself. Everything depends on how we use technology. Artificial Intelligence combined with machine learning has a huge potential, to either reach new heights or destroy the height we have gained so far. Considering AI's vulnerability of being hacked and the ability to change their original protocol, Humans must learn how to control the power

they have created. AI is a great power. Hence the limits of AI must be defined; the border between humans and AI must be well defined.

## INTERNET OF THINGS

Technologies are developed a lot over these years .These technologies applied in electronic appliances is termed as Internet of Things, (“IoT”). This is enabled by Wireless Sensor Network (“WSN”), it’s a new technologies paradigm that can connect things from various fields through the internet. The IoT has ability to measure, infer and understand environmental indicators, from delicate ecologies and natural resources to urban environments.

This is enabled by Wireless Sensor Network (“WSN”), it’s a new technologies paradigm that can connect things from various fields through the internet. The IoT has ability to measure, infer and understand environmental indicators, from delicate ecologies and natural resources to urban environments. Now a day’s people almost forget to do every simple things. Some even don’t know that they did or didn’t turn off their light, fan, T.V, etc...to avoid these mistakes, software companies develop IoT ('Internet of Things').

In this modern world every person has their own mobile phone, the idea of the IoT is to connect internet with things. We can use our phone as a remote to control every single object to control from anywhere in our world using internet When a person forgotten to turn off light, then remembered whether he turned off the light or not. In this case the phone can be used as remote to turn it off, but we need internet to do that. If we have internet we can connect to the camera which is in our house, if the light is not turned off we can check from here and if not turned off we can off it.

### Implementation of IoT

The longitudinal learning system was able to provide a self-control mechanism for better operation of the devices in monitoring stage. This proposes a wearable sensor node with solar energy harvesting and Bluetooth low energy transmission that enables the implementation of an autonomous wireless body area network ('WBAN'). We can improve our agriculture by using IoT. Technology is changing different aspects of human life.

Agriculture is one of the most important paradigms which can use the advantages of IoT in optimizing the:-

- Production efficiency
- Quality of the crops

### Production efficiency:-

Production of crops can be depended on climatic condition and supply of water. The work of IoT is to tell the farmer that today the weather will be like this, this data is collected for the past days or weeks. So, the farmer can make measures to protect the crops before it gets damaged. We may think that how a farmer can afford to buy an android or ios phone, its government job to provide the phone to each farmer.

### Quality of crops:-

The crops given by the farmers don't that how much fertilizers have been used. But the IoT gives advices to the farmer to use certain amount of fertilizer to be used, so the produced crops will be of greater quality

## A RESOURCE TO QUENCH THE ENERGY THIRST OF THE WORLD – SOLAR ENERGY

Today we are running out of the existing sources of energy on which we depend so much, and we humans cannot tolerate the immediate impact when the energy is completely used up. The main source of energy getting depleted includes fossil fuels. The entire concept of industrialization is based on this source, but we do not have sufficient reserves of this energy anymore. Therefore through time we shall adapt to new changes. Hence we started to move into new concepts, such as eco-friendly ways of using energy. With the positive side of technological advancement, humans have efficiently found new ways of exploiting energy without damaging nature.

One such alternate source of energy is solar energy. There are different ways in which we can use solar energy. It is directly obtained from nature and it is something which we used since the origin of humankind. Solar energy contains both heat and light, and we have efficiently used the light energy for vision. Now we have found ways of using the full potential of using solar energy.

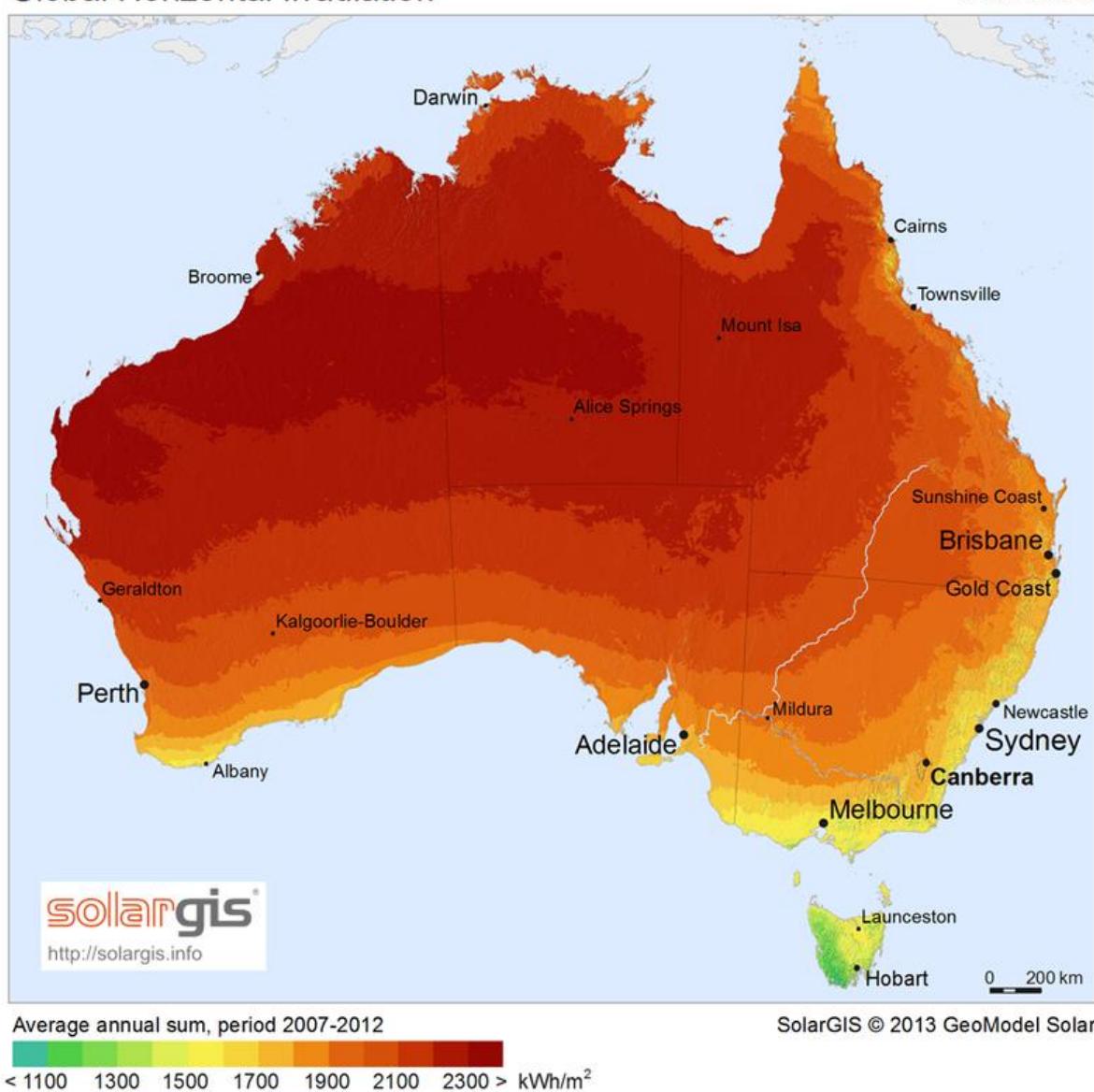
One way of using solar energy is by the use of solar panels. This technology is common now-a-days. You must have heard about this somewhere, since people are getting more consciousness about its true potential. The working of solar panels is very simple. Light ray can be considered as an electromagnetic radiation. This is directed towards the solar panel (Or the panel is kept in such a way it faces the sun). The solar panel is made of a material which has fixed electrons. This light radiation strikes the stationary electron to initiate an electron flow, which results in the

production of electricity. This effect is called the 'Photoelectric effect'. It is very useful in getting the most widely used form of energy from the dominant form of energy.

Hence if we implement solar panels everywhere, we must have no energy crisis! But why then didn't we do this till now? The simple answer is its cost as well as its implementation. The world cannot completely depend on solar panels alone since a simple climatic change like cloudy weather can interfere with the working of solar panel. A good supply of light is needed for its working. Also solar panels are so costly. A good solar cell (A panel consists of many solar cells) costs about ₹200. Only when a large amount of solar panels are used, good amount of electricity can be produced. Also using that much of solar panels require area. In a densely populated country like India, implementation of solar panels remains a big challenge due to this very reason. However, we shall look at the long term gains instead of short term ones. Investing in solar panels is like investing in a business. It takes time to get the money put in the panels to be derived back by energy. Did we forget to say that solar panels have high lifetime? In today's world of competition, solar panels come with a 1 year manufacturing defect warranty and a 25 year overall warranty! Hence once installed, it can function for like 25% of a century. Many countries have already implemented solar panels in large scale. Australia is a good example.

## Global Horizontal Irradiation

Australia



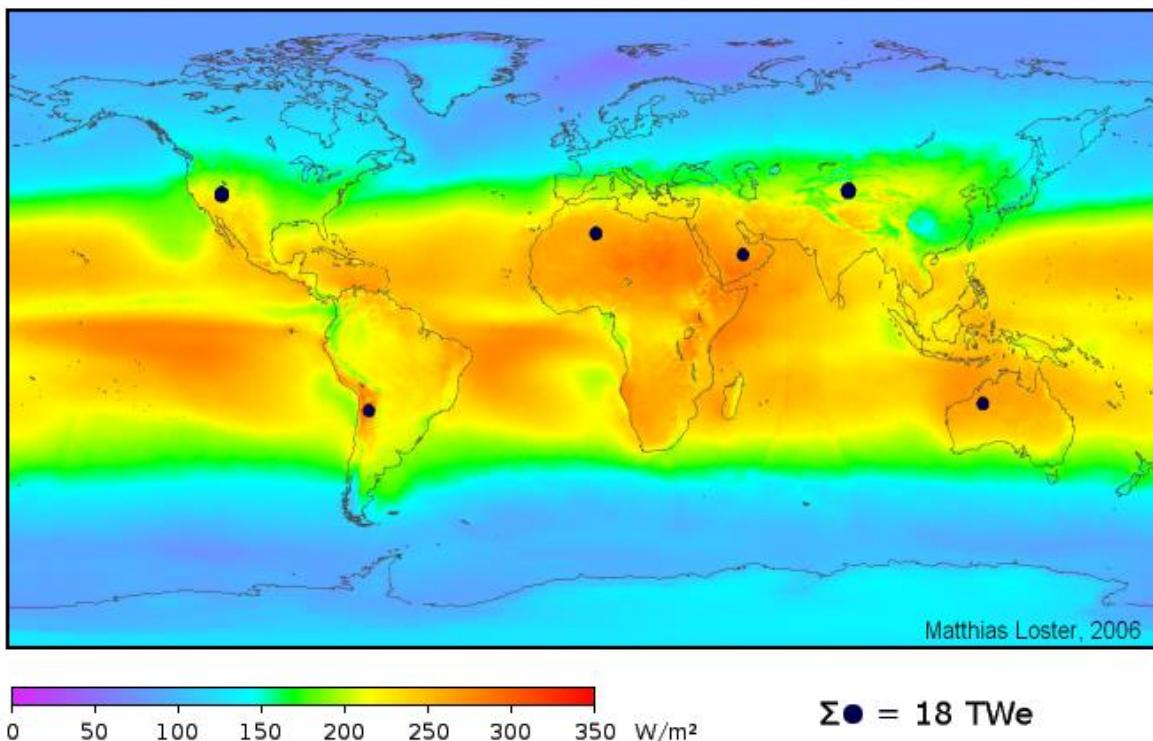
Source: <http://solargis.info> – Solar potential in Australia 2013

Looking at the potential of solar energy in Australia, its government has decided to fund many projects. Over 5% of its energy requirements of Australia came from solar energy as of 2018, which is over 11.7 TWh (Terra Watt Hour). Developed countries such as Australia can provide funds to solar projects. However there are many other natural places in the world where its energy is not utilized properly. This includes the Sahara Desert of Africa and the Thar Desert of India. There are many parts of the world under under-developed or developing countries, which hesitate to finance such projects. This is where the concept of Global Sustainable Development comes into handy. If the countries get developed, the people will get awareness as well as the satisfactory mind to actually fund these projects. Even if it is not feasible to cover the entire desert with solar panels, some considerable portion of the desert must be used.

To understand the potential which Sahara contains, here is a small hypothetical project. If we construct solar panels which cover over just 2% of total area of the Sahara desert, it is more than enough to meet the energy needs of the ENTIRE WORLD! (2% is 184,000 sq.km of area). But there are several factors which make this impossible (At least today). The primary factor is the opposition of the local people. The secondary factor is that it is not possible to transport energy from Sahara to all corners of the world. It will result in tremendous energy loss.

It is never a good idea to implement solar panels in one area then transport it. Instead solar panels have the capability to be installed in any remote location, ruling out the energy loss due to transportation from power plants. The certain area can directly derive electricity from the solar energy which it receives. There is a sharp fall in the price of solar panels over the decade, and new technology of solar cells have increased efficiency of 19% - the latest technology of mono chromatic solar cells (from existing 16% of poly chromatic solar cells). The former and the latter can be easily distinguished by its colour – Black and Blue respectively.

The potential of solar energy is provided by a map in the next page. The data is assumed by the use of solar cells only of 8% efficiency (Since the data is old as back as 2006), but we know that today we have over more than double the efficiency.



Source: [https://www.ez2c.de/ml/solar\\_land\\_area/](https://www.ez2c.de/ml/solar_land_area/)

Solar panels can be used in vehicles. This can greatly reduce air pollution. Battery vehicles are an old but a gold concept. Why not use solar energy to make its implementation widely possible?

Not only can solar panels be used to use solar energy. Solar heaters can be used instead of electrical heaters, which can greatly reduce the energy demand. Solar furnaces can be commercially used to melt steel or to produce much heat for any commercial requirement. The temperatures of solar furnaces can exceed 3000 degree Celsius – which is about half of the Sun's surface temperature itself!

### LIMITING CURRENT TECHNOLOGICAL ADVANCEMENT

We have specified the dark side of today's technology. Limiting current technology can only be done on the foundation of trust. Weapons which have the potential to commit mass genocides such as bio hazards and nuclear weapons must be limited. They possess a great threat to humanity as well as to the nature. Today's so called world peace is built up on the foundation of fear. There is a severe suppression based on nuclear superpowers and non-nuclear countries. Many countries also have restrictions on the creation of nukes and the number of nukes they have, while other countries do not have much of these restrictions. Only during the phase of cold war (1945 – 1991, until the collapse of Soviet Union), there were 2 events which narrowly prevented world-wide annihilation by use of nuclear war heads.

Only by world co-operation, implementing policies which limit the use as well as the production of these weapons can bring real peace to the world. Late is better than never. This is the right time to re-create a world based on trust rather than one which is built on the foundation of fear. Fear leads to anger and anger leads to destruction.

We have a lot of resources which have much potential other than solar energy such as tidal energy and geo thermal energy (However solar energy has the maximum potential). But they are either underrated or not properly utilized. Examples include the wind and solar energy available at Rajasthan. Right implementation of technology as well as government policies combined with management is the only possible solution to increase the efficiency in energy production, in the world of energy crisis. We can at least contribute in not harming the environment if we humans do not have much power to recover it.

## **UNIT 5 – CONCLUSION**

It is to note that apart from International implementation of policies, the Governments measures to be taken and proper management of resources also plays an important role in conserving our environment. We as the people who live on the mercy of our planet must struggle harder and stronger to make a change.

“I believe, One man can make a change” – Stan Lee

The power of individuals is under estimated. Little drops of water make a river. If each individual starts to talk about the present day crisis, a huge change will occur. It is all based on awareness, as is said in the topic of sustainable development. Everyone must know how nature works and must be aware that everything they do in their daily life can adversely affect the environment.

One must understand how rare life is, and how beautiful life is. Life is one thing which is priceless. We must stop considering everything selfishly and start considering everything with empathy of the future generation. We do not own anything here. We come in the world empty handed and leave the world empty handed. We merely use the resources for time being borrowed from our ancestors who in turn borrowed from nature. It is a moral value to return whatever we have borrowed. Hence we kind of return it by passing it down to the future generation.

There are several technologies which help in conserving environment. They are smart innovations by humans, to make the world a better place. One way of countering human intervention in nature is by human intervention in human intervention in nature. To put it simple, we have created the problem; hence it is our duty to solve the problem. We will create problem to the problem by right implementation of technology. Drones can be employed to plant trees, AIs can be used to regulate the use of resources and IoT can be used to minimize the wastage of these resources.

Like sustainable development which involves development at present without compromising the needs of future, development must also be in a way such that it does not interfere with the actual working of natural process. We humans created technology, the most powerful weapon. However we are still mastering the skill to control it completely. What good is a power if you do not know how to control it? We are learning from our failures to correct ourselves in every possible way.

But what about the hopeless Amazon forest issue? After continuous pressure by international media and protests in Brazil itself, the president has decided to accept help starting from 31<sup>st</sup> of August. He accepted help of 4 jet fire fighters from Chile and the 13 million dollar help from UK. We must start talking about these matters and we must show the world that we do actually care about the environment.

People are gaining awareness now-a-days, day by day. The process is slow. But it is happening. Simultaneous protests occurred in Rio de Janeiro and Porto Alegre throughout the last weeks of August 2019.

Humans are the most abundant species on the planet. There is no dangerous animal which we can find even in Amazon than ourselves. So far we have made nature regret about its greatest creation. We have waged an endless war against it and invaded its domains. However Nature is still generous enough to forgive all of us and give us all a second chance to fix everything. If we all try with maximum potential to bring about a change, the expected change should occur and will occur.

We shall find ourselves guilty for committing betrayal to our mother nature: we shall find ourselves guilty for committing high treason against queen nature! We shall move away from the idea of domination and get to the idea based on mutual understanding with nature. This is the perfect time to create a change, this is the perfect time to initiate a change, the time cannot be more perfect – or worse.

Being the leader of other species, it becomes our duty to manage the planet. Ailing Planet is neither an individual issue nor a human-only issue. When there is a problem in natural system itself, everything within it will get affected. We as humans shall defend other species instead of destroying them. We as humans shall take up the responsibility of saving the ailing planet, and we as humans shall stop suppressing everything and establish a trustworthy relationship with nature.

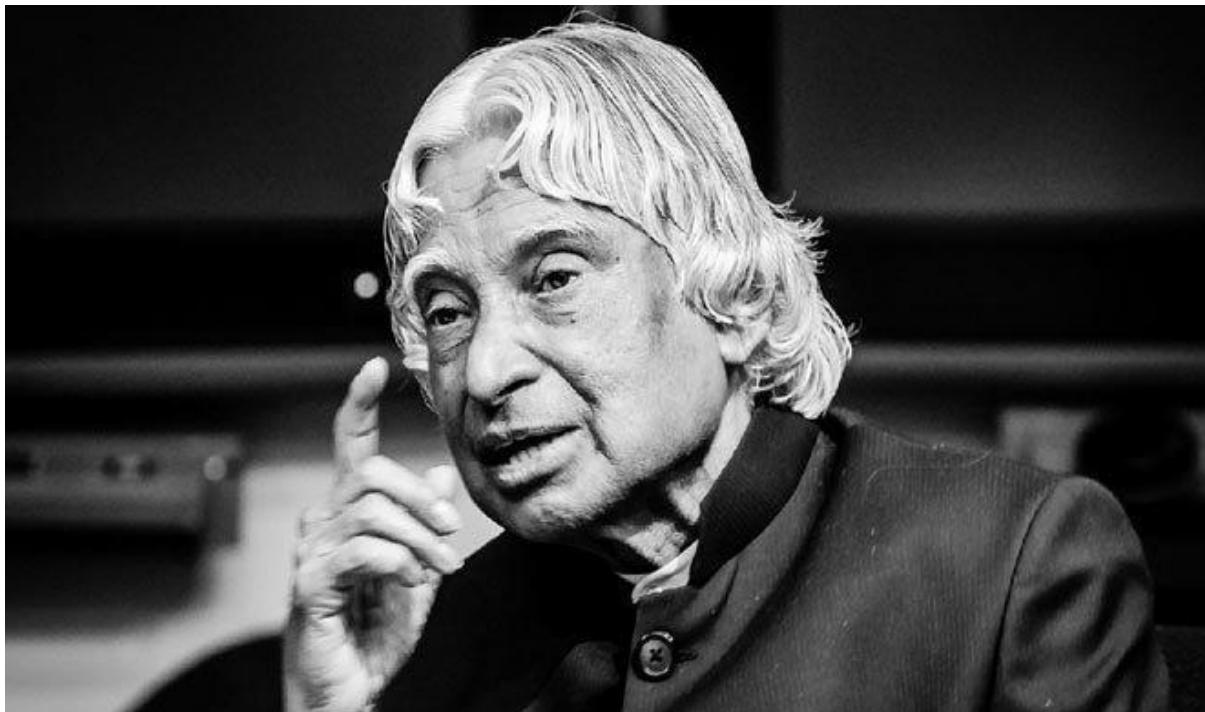
Hence we conclude this thesis with a hope,

A hope which will provide a spark to light the fire needed to light up this darkened world. As phoenixes we will rise from our own ashes we have made ourselves. We will be reborn from these ashes into a new generation, built under the foundation of trust, a generation which will know how to be trust worthy to nature and a generation which will co-operate with nature.

They will be leaders who guide the world into a better place, a place where each species can live peacefully. They will be aware of what would happen if they ever try to go against nature, and they will be educated enough to choose what is right and what is wrong. It is ultimately due to our mistakes we will be able to establish a better world.

It is time to sign armistice with nature, raise our white flag and promise it that we will never betray it once again.

If we create awareness on these issues and spread information regarding the development of our country, India will definitely become a well-developed and advanced country. That is exactly the motive of this thesis. This was the last wish of Dr. A.P.J. Abdul Kalam, former president of India and The Missile Man of India, on envisioning the future of India with advancement in technology and following a well-disciplined pattern for the development of the nation.



Our present day **Ailing planet** will rise once again, and will hail for eternity...

**HAIL MOTHER NATURE AND PLANET EARTH!**

## **SOURCES**

### **IMAGES**

Majority of the images are taken from

- <https://www.pexels.com/>
- <https://unsplash.com/images/stock/non-copyrighted>

These websites offer royalty free, non-copy righted images for free use. We greatly appreciate these websites which forges ways for students to express our ideas in a better way.

### **CONTENT**

We have referred to multiple sources to compile some data. We also encourage you to visit these websites from which we have derived data for further study on the topics.

The 17 Global sustainable goals

[https://en.wikipedia.org/wiki/Sustainable\\_Development\\_Goals](https://en.wikipedia.org/wiki/Sustainable_Development_Goals)

Agenda 2030 (targets)

- <https://www.un.org/sustainabledevelopment/poverty/>
- <https://www.coe.int/en/web/programmes/un-2030-agenda>

Global survey

<https://www.coe.int/en/web/programmes/un-2030-agenda>

Eco restructuring

<https://en.wikipedia.org/wiki/Eco-restructuring>

Implications for sustainable development

- <https://unu.edu/publications/books/eco-restructuring-implications-for-sustainable-development.html>
- [https://infogalactic.com/info/Urban\\_metabolism](https://infogalactic.com/info/Urban_metabolism)

Sustainable development in India

<https://www.jagranjosh.com/current-affairs/sustainable-development-and-india>

Brundtland commission

[https://en.wikipedia.org/wiki/Brundtland\\_Commission](https://en.wikipedia.org/wiki/Brundtland_Commission)