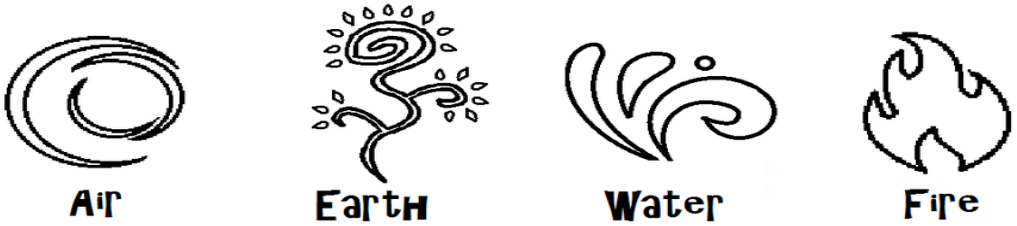
The Living Earth
Planeteers' Elementary Guide to Protecting the Environment

CONTENT



INTRODUCTION

In the beginning there were only the Sea Goddess, Maguayen, and the Sky God, Kaptan. The two were terrible rivals. Maguayen created whirlpools, hurricanes and tsunamis, and Kaptan retaliated with thunderbolts, rain and lightning. When the thunderbolts and rain hit the sea, Maguayen would conjure up storms and waves that reached the sky. To stop her, Kaptan threw stones into the sea. Over the aeons of their feuding, the stones built up to become the islands of the Philippines.

A bird – a kite – suffered from Maguayen and Kaptan's fighting, as the incessant storms and raining boulders kept it restlessly flying over the sea. It tried to make peace between the sea and the sky by persuading them to meet twice a day at the horizon. Over time, the enemies became friends – and then fell in love.

From Maguayen and Kaptan's love a small bamboo seed fell into the shallows beside one of the islands. It grew into a tall stalk, finally providing the kite with a perch. From inside the bamboo came a voice. 'O please, Lord of the birds, let us out.' The kite thought it was strange that the stalk should speak to him, but it spoke again. 'O gracious and kind bird, please let us out.'

As the cautious kite pondered what to do, a small lizard scampered across the bamboo stalk. With a quick reflex, the kite pecked hard at the lizard and the bamboo split open. Slowly a beautiful woman and a strong man climbed out of the stalk. They were the first people. In time they married, had many children and populated the Earth.

~ *Creation Stories from Philippines*

Almost all creation stories across the world begin with a void, and a larger force or power creating the order of the earth and the sky, and then filling the vast landscape with humans.

Even in these ancient stories, the responsibility of protecting and preserving the earth and all things on it has been entrusted to the humans. Human dependence on the environment and its resources cannot be extinguished, however, the cycle of replacing or refilling falls upon us.

In ancient times, when the people were fewer, the environment had a natural cycle for replenishing the resources that were used. The cycle was healthy and helped maintain the ecological balance. However, growth of civilizations and the human desire for more, lead to large scale destruction of natural resources, some which lost the capacity to regenerate any further, causing a situation of scarcity. Matters have been no better, with the advent of industrialization, global warfare and the competitive market, where the focus has shifted on plundering natural resources by might and power, over the idea of conservation and preservation. Such has been the scenario leading to our present world, where crisis have hit every aspect of our human existence, affecting not only our daily needs and health, but also the security and continuity of the future generation.

Realizing that time cannot be turned, we must step up and take action at this very hour, in our own capacities to prevent any further damage. The future and growth of our next generation depends entirely on the efforts we lay today in preserving the environment. We are the products of the earth, and it is the only planet we know that can sustain us. With this knowledge, the need to intervene and create sustainable means of functioning, for protecting our environment is not an option but a priority and need – and the sooner we realize, the more we learn, the better our chance of survival on earth which we call home.

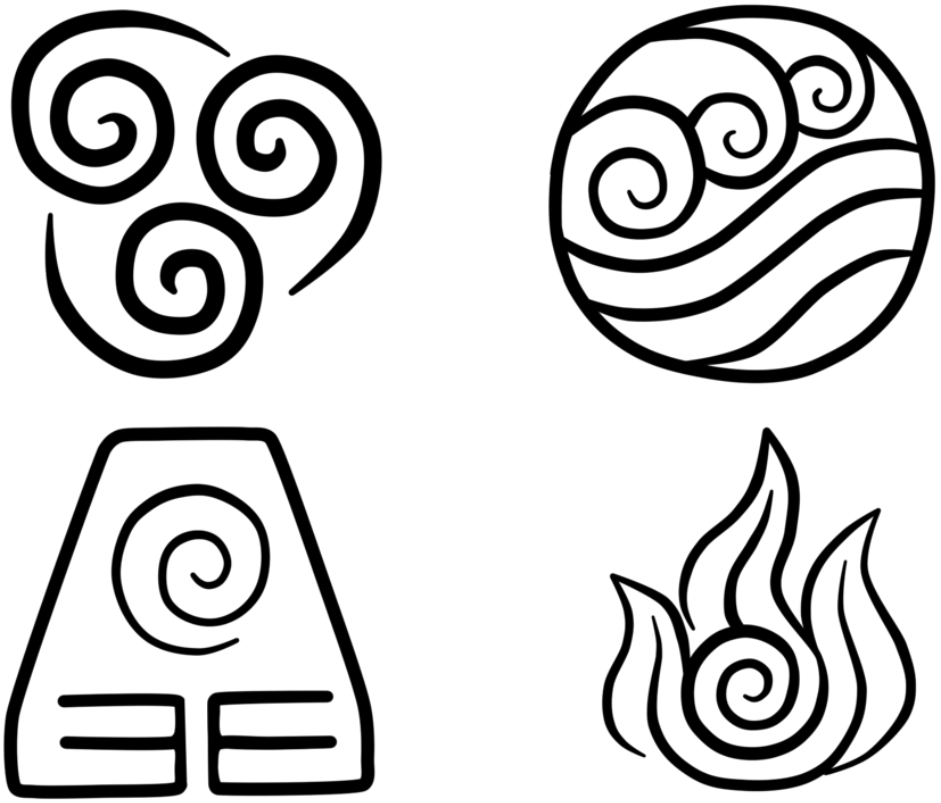
In view of this, the YWCA of India, an NGO working for the promotion of the community and its people, and especially the young, recognizes this urgency, and

therefore, has prioritized it in the Quadrennium goal – "Being Green Ambassadors' to engage as many people in not only learning about their environment but acting as role models and advocates for promoting environmental sustainability as a goal to be followed by each person. Only when we raise our voice in unison and truly recognize the environmental concerns that haunt us, will we be able to create an impact, which leads to a positive change.

The 7th edition of the Y's Eyes – a magazine for young people, focuses on educating them on the environmental concerns that we face and the present scenario across the world, including the steps taken by government and world bodies, then, to provide means and measures to follow environmentally safe ways of living and also, create action plans that can help them to protect and preserve the environment from any further damage.

The theme of the book is based on the classic elements – Air, Water, Fire and Earth to highlight each of the environmental concerns, in a reader friendly format.

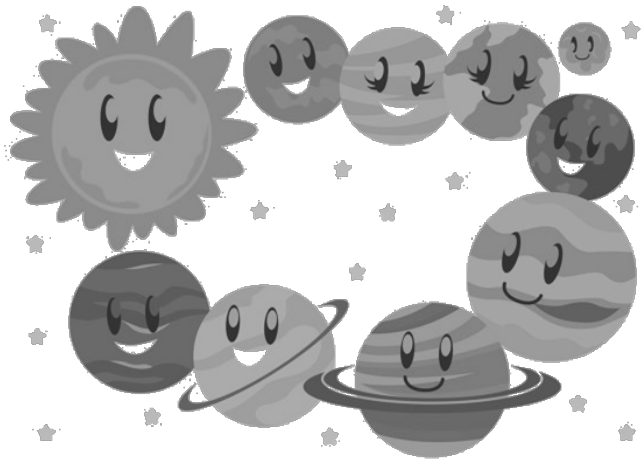
The magazine is meant for reading, to be used during trainings, and can be used as a reference material for workshops, advocacy and awareness building of the general public.



Chapter 1

The Beginning of Time

1.1Life on Earth



The Earth is thought to have been formed about 4.6 billion years ago by collisions in the giant disc- shaped cloud of material that also formed the Sun. Gravity slowly gathered this gas and dust together into clumps that became asteroids and small early planets called planetesimals. These objects collided repeatedly and gradually got bigger, building up the planets in the Solar System, including the Earth.

The earliest undisputed evidence of life on Earth dates at least from 3.5 billion years ago, during the Eoarchean Era after a geological crust started to solidify following the earlier molten Hadean Eon. There are microbial mat fossils such as stromatolites found in 3.48 billion-year-old sandstone discovered in Western Australia. Other early physical evidence of a biogenic substance include "remains of biotic life" found in 4.1 billion-year-old rocks in Western Australia. According to one of the researchers, "If life arose relatively quickly on Earth … then it could be common in the universe."

Living forms derived from photosynthesis appeared between 3.2 and 2.4 billion years ago and began enriching the atmosphere with oxygen. Life remained mostly small and microscopic until about 580 million years ago, when complex multicellular life arose, developed over time, and culminated in the Cambrian Explosion about 541 million years ago. This event drove a rapid diversification of life forms on Earth that produced most of the major phyla known today; and it marked the end of the Proterozoic Eon and the beginning of the Cambrian Period of the Paleozoic Era. More than 99 percent of all species, amounting to over five billion species that ever lived on Earth are estimated to be extinct. Estimates on the number of Earth's current species range from 10 million to 14 million, of which about 1.2 million have been documented and over 86 percent have not yet been described.

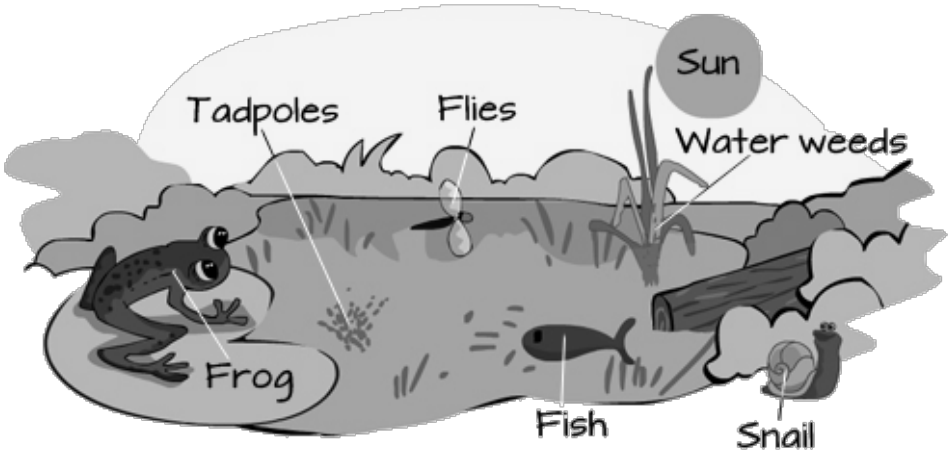
More recently, in May 2016, scientists reported that 1 trillion species are estimated to be on Earth currently with only one-thousandth of one percent described.

Geological change has been a constant of Earth's crust since the time of its formation, and biological change since the first appearance of life. Species continue to evolve, taking on new forms, splitting into daughter species or going extinct in the process of adapting or dying in response to ever-changing physical environments. Changes in the biosphere—now dominated by human activity—continue, in turn, to produce significant effects on the atmosphere and other systems of the Earth's surface, such as the integrity of the ozone layer, the proliferation of greenhouse gases, the conditions of productive soils and clean air and water, and others.

1.2 Ecosystem and Climate Change:

1.2.1 Ecosystem:

An ecosystem is a community of living organisms in conjunction with the nonliving components of their environment (things like air, water and mineral soil), interacting as a system. These biotic and abiotic components are regarded as linked together through nutrient cycles and energy flows. As ecosystems can be of any size but usually encompass specific, limited spaces (although some scientists say that the entire planet is an ecosystem).

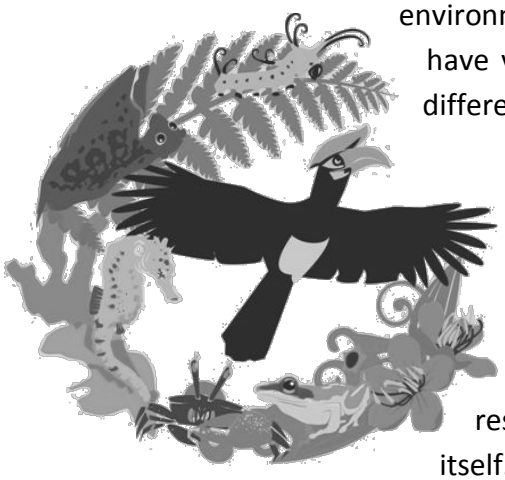


Energy, water, nitrogen and soil minerals are other essential abiotic components of an ecosystem. The energy that flows through ecosystems is obtained primarily from the sun. It generally enters the system through photosynthesis, a process that also captures carbon from the atmosphere. By feeding on plants and on one another, animals play an

important role in the movement of matter and energy through the system. By breaking down dead organic matter, decomposers release

carbon back to the atmosphere they facilitate nutrient cycling by converting nutrients stored in dead biomass back to a form that can be readily used by plants and other microbes.

Ecosystems are controlled both by external and internal factors. External factors such as climate, the parent material that forms the soil, and topography control the overall structure of an ecosystem and the way things work within it, but are not themselves influenced by the ecosystem. Other external factors include time and potential biota. Ecosystems are dynamic entities—invariably, they are subject to periodic disturbances and are in the process of recovering from some past disturbance. Ecosystems in similar environments that are located in different parts of the world can have very different characteristics simply because they contain different species.



Biodiversity affects ecosystem function, as do the processes of disturbance and succession. Ecosystems provide a variety of goods and services upon which people depend; the principles of ecosystem management suggest that rather than managing individual species, natural resources should be managed at the level of the ecosystem itself. Classifying ecosystems into ecologically homogeneous units is an important step towards effective ecosystem management, but there is no single, agreed-upon way to do this.

Classifying ecosystems into ecologically homogeneous units is an important step towards effective ecosystem management. A variety of systems exist, based on vegetation cover, remote sensing, and bioclimatic classification systems.

Some types of Ecosystems are:

1. **Aquatic ecosystem:**

Communities of organisms in and near water bodies that are dependent on each other and on their environment live in aquatic ecosystems. The two main types of aquatic ecosystems are:

a. Marine ecosystem:

Among the largest of Earth's aquatic ecosystems, it includes salt marshes, intertidal zones, estuaries, lagoons, mangroves, coral reefs, the deep sea, and the sea floor. They have a higher salt content.

i. Large marine ecosystem:

They are regions of the world's oceans, encompassing coastal areas from river basins and estuaries to the seaward boundaries of continental shelves and the outer margins of the major ocean current systems. They are relatively large regions on the order of 200,000 km² or greater, characterized by distinct bathymetry, hydrography, productivity, and trophically dependent populations.

b. Freshwater ecosystem:

They include some wetlands, streams, rivers, ponds and lakes. They are low salinity areas, with distinct animal and plant life that is typically unable to adjust to higher concentrations of salt water.

i. Lake ecosystem:

Lake ecosystems are a prime example of lentic ecosystems. Lentic refers to stationary or relatively still water.

ii. River ecosystem:

River ecosystems are prime examples of lotic ecosystems. Lotic refers to flowing water. Lotic waters range from springs only a few centimeters wide to major rivers kilometers in width.

iii. Wetland:

A wetland is a land area that is saturated with water, either permanently or seasonally, such that it takes on the characteristics of a distinct ecosystem. The primary factor that distinguishes wetlands from other land forms or water bodies is the characteristic vegetation of aquatic plants, adapted to the unique hydric soil. Wetlands play a number of roles in the environment, principally water purification, flood control, carbon sink and shoreline stability. Wetlands are also considered the most biologically diverse of all ecosystems, serving as home to a wide range of plant and animal life

2. Terrestrial ecosystem:

A terrestrial ecosystem is an ecosystem found only on landforms. Six primary terrestrial ecosystems exist:
Tundra, taiga, temperate deciduous forest, tropical rain forest, grassland and desert.

a. Tundra:

A type of biome where the tree growth is hindered by low temperatures and short growing seasons. The vegetation is composed of dwarf shrubs, sedges and grasses, mosses, and lichens, found mostly in Alaska and Siberia.

b. Taiga:

It is also known as boreal forest or snow forest, is a biome characterized by coniferous forests consisting mostly of pines, spruces and larches. It makes up 29% of the world's forest cover and the largest areas are located in Russia and Canada.

c. Temperate Deciduous Forest:

Temperate deciduous forests or temperate broad-leaf forests are dominated by trees that lose their leaves each year. They are found in areas with warm, moist summers and mild winters. The three major areas of this forest type occur in the Northern Hemisphere: eastern North America, East Asia, and Europe. Smaller areas occur in Australasia and southern South America.

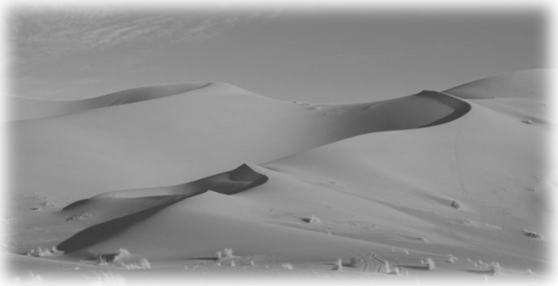
d. Tropical Rain Forest:

Tropical rainforests occur in areas of tropical rainforest climate in which there is no dry season – all months have an average precipitation value of at least 60 mm – and may also be referred to as lowland equatorial evergreen rainforest. They rarely extend more than 10 degrees north or south of the equator are a sub-set of the tropical forest biome type that occurs roughly within the 28 degree latitudes (in the equatorial zone between the Tropic of Cancer and Tropic of Capricorn). The Amazon rainforest in Brazil and the tropical rainforests of South America contain the largest diversity of species on earth.

e. Grassland:

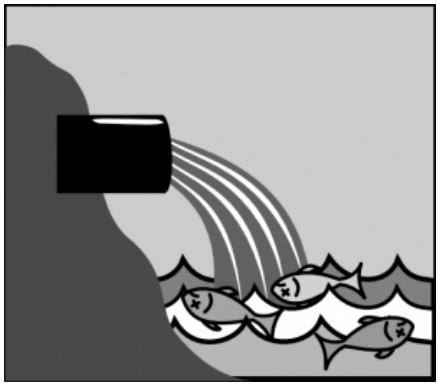
Grasslands are areas where the vegetation is dominated by grasses and occur naturally on all continents except Antarctica.

f. Desert:



A barren area of land where little precipitation occurs and consequently living conditions are hostile for plant and animal life. Plants and animals living in the desert need special adaptations to survive in the harsh environment. Plants tend to be tough and wiry with small or no leaves, water-resistant cuticles and often spines to deter herbivores. The Sahara and Thar desert serve as good examples for such an ecosystem.

1.2.2 Effect of climate change upon the ecosystems:



As human populations and per capita consumption grow, so do the resource demands imposed on ecosystems and the impacts of the human ecological footprint. Natural resources are not invulnerable and infinitely available. The environmental impacts of anthropogenic actions, which are processes or materials derived from human activities, are becoming more apparent—air and water quality are increasingly compromised, oceans are being overfished, pests and diseases are extending beyond their historical boundaries, and deforestation is exacerbating flooding downstream. It has been reported that approximately 40–50% of Earth's ice-free land surface has been heavily transformed or degraded by anthropogenic activities, 66% of marine fisheries are either overexploited or at their limit, atmospheric CO_2 has increased more than 30% since the advent of industrialization, and nearly 25% of Earth's bird species have gone extinct in the last two thousand years.

Society is increasingly becoming aware that ecosystem services are not only limited, but also threatened by human activities. The need to consider long-term ecosystem health and its role in enabling human habitation and economic activity is urgent. To help inform decision-makers, many ecosystem services are being assigned economic values, often based on the cost of replacement with anthropogenic alternatives. The ongoing challenge of prescribing economic value to nature, for example through biodiversity banking, is prompting transdisciplinary shifts in how we recognize and manage the environment, social responsibility, business opportunities, and our future as a species.

Chapter 2: Part 1

Impacting the Four Elements

Earth

(पृथ्वी)

The Earth is layered in spherical shells, like an onion. It has an outer silicate solid crust, a highly viscous mantle, a liquid outer core that is much less viscous than the mantle, and a solid inner core. Scientific understanding of the Earth's surface is based on observations of topography (study of surface land) and bathymetry (study of ocean floor and Seabed), its pressure and temperature characteristics, and the land structure and changes.

Humankind's lifespan has been intertwined with the condition of the earth, and our survival depends on it. But with massive land–use and exploitation of the surface and underground resources and growth of the population, the effect upon the environment has been devastating, where some scientists even believe that the damage may be so vast that it may be irreversible.

Thus, the pursuit of land resource is arguably the most pervasive socioeconomic force driving changes and degradation of the environment affecting the ecosystems, with its affect visible across the globe. Resources provide many economic and social benefits, but they often come at a substantial cost to the environment. Deforestation, urban development, agriculture, and other human activities have substantially altered the Earth's landscape. Such disturbance of the land affects important ecosystem processes and services, which can have wide–ranging and long–term consequences.

Some of the areas which have been impacted by human activity and constant inference have been listed below:

2.1 Soil:

Soil degradation is the decline in soil quality that can be a result of many factors, especially from agriculture. Soils hold the majority of the world's biodiversity, and healthy soils are essential for food production and an adequate water supply.

Common attributes of soil degradation can be salting, water – logging, compaction, pesticide contamination, and decline in soil structure quality, loss of fertility, changes in soil acidity, alkalinity, salinity, and erosion.

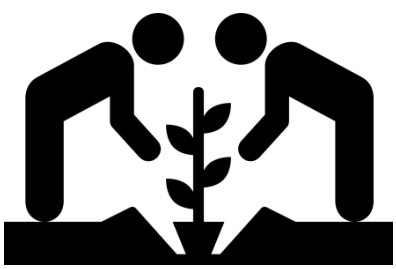
Soil degradation also has a huge impact on biological degradation, which affects the microbial community of the soil and can alter nutrient cycling, pest and disease control, and chemical transformation properties of the soil.

Main Causes of Soil Pollution are:

1. Industrial Activity:

Industrial activity has been the biggest contributor to the problem in the last century, especially since the amount of mining and manufacturing has increased. Most industries are dependent on extracting minerals from the Earth. Whether it is iron ore or coal, the byproducts are contaminated and they are not disposed off in a manner that can be considered safe. As a result, the industrial waste lingers in the soil surface for a long time and makes it unsuitable for use.

2. Agricultural Activities:



Chemical utilization has gone up tremendously since technology has provided us with modern pesticides and fertilizers. They are full of chemicals that are not produced in nature and therefore, cannot be broken down by it. As a result, they seep into the ground after they mix with water

and slowly reduce the fertility of the soil. Other chemicals damage the composition of the soil and

make it easier to erode by water and air. Plants absorb many of these pesticides and when they decompose, they cause soil pollution since they become a part of the land.

3. Waste Disposal:

Finally, a growing cause for concern is how we dispose of our waste. While industrial waste is sure to cause contamination, there is another way in which we are adding to the pollution. Every human produces a certain amount of personal waste products by way of urine and feces.

While much of it moves into the sewer system, there is also a large amount that is dumped directly into landfills in the form of diapers. Even the sewer system ends at the landfill, where the biological waste pollutes the soil and water. This is because our bodies are full of toxins and chemicals which are now seeping into the land and causing pollution of soil.

4. Accidental Oil Spills:

Oil leaks can happen during storage and transport of chemicals. This can be seen at most of the fuel stations. The chemicals present in the fuel deteriorates the quality of soil and make them unsuitable for cultivation. These chemicals can enter into the groundwater through soil and make the water undrinkable.

5. Acid Rain:

Acid rain is caused when the pollutants present in the air mixes up with the rain and fall back on the ground. The polluted water could dissolve away some of the important nutrients found in soil and change the structure of the soil.

2.2 Effects of Soil Pollution are:

1. Effect on Health of Humans:

Considering how soil is the reason we are able to sustain ourselves, the contamination of it has major consequences on our health. Crops and plants grown on polluted soil absorb much of the pollution and then pass these on to us. This could explain the sudden surge in small and terminal illnesses.

Long term exposure to such soil can affect the genetic make-up of the body, causing congenital illnesses and chronic health problems that cannot be cured easily. In fact, it can sicken the livestock to a considerable extent and cause food poisoning over a long period of time. Soil pollution can even lead to widespread famines if the plants are unable to grow in it.

2. Effect on Growth of Plants:

The ecological balance of any system gets affected due to the widespread contamination of the soil. Most plants are unable to adapt when the chemistry of the soil changes so radically in a short period of time. Fungi and bacteria found in the soil that bind it together begin to decline, which creates an additional problem of soil erosion.
The fertility slowly diminishes, making land unsuitable for agriculture and any local vegetation to survive. The soil pollution causes large tracts of land to become hazardous to health. Unlike deserts, which are suitable for its native vegetation, such land cannot support most forms of life.

3. Effect on Microorganisms:

Small life forms may consume harmful chemicals which may then be passed up the food chain to larger animals; this may lead to increased mortality rates and even animal extinction.

It can also alter metabolism of microorganisms and arthropods in a given soil environment; this may destroy some layers of the primary food chain, and thus have a negative effect on predator animal species

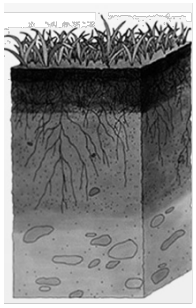
4. Decreased Soil Fertility:

The toxic chemicals present in the soil can decrease soil fertility and therefore decrease in the soil yield. The contaminated soil is then used to produce fruits and vegetables which lacks quality nutrients and may contain some poisonous substance which may cause serious health problems in people consuming them.

5. Toxic Dust:

The emission of toxic and foul gases from landfills pollutes the environment and causes serious effects on health of some people. The unpleasant smell causes inconvenience to other people.

6. Changes in Soil Structure:



The death of many soil organisms (e.g. earthworms) in the soil can lead to alteration in soil structure. Apart from that, it could also force other predators to move to other places in search of food.

A number of ways have been suggested to curb the current rate of pollution. Such attempts at cleaning up the environment require plenty of time and resources to be pitched in. Industries have been given regulations for the disposal of hazardous waste, which aims at minimizing the area that becomes polluted. Organic methods of farming are being supported, which do not use chemical laden pesticides and fertilizers. Use of plants that can remove the pollutants from the soil is being encouraged. However, the road ahead is quite long and the prevention of soil pollution will take many more years.

Some of the ways of preventing soil pollution are as follows:

1. Make people aware about the concept of Reduce, Recycle and Reuse.
2. Reduce the use of pesticides and fertilizers in agricultural activities.
3. Avoid buying packaged items as they will add to garbage and end up in landfill site.
4. Ensure that you do not litter on the ground and do proper disposal of garbage.
5. Buy biodegradable products.

6. Practice organic gardening and eat organic food that will be grown without the use of pesticides.
7. Segregating waste and creating a dumping ground away from residential areas.

Several organisms sustain themselves with the help of land resources. Disrupting its harmony is disrupting their habitat. This has led to several creatures reaching the endangered status like the Gilbert's Potoroo in Australia.

We walk and survive on land. It is literally the base of our ecosystem. It is in our good interest to take care and nurture it.

2.3 Environment and Human Health:

Many of the most challenging ethical questions of our time address interactions between human health and the environment. How should we regulate pesticides, industrial chemicals, and pollutants? Should we develop genetically modified organisms for use in agriculture, medicine, and energy production? How should we regulate them? How should we regulate energy production and use to protect the environment and human health? Should we take steps to encourage democratic participation in environmental health decision-making?

The issues that arise in environmental health ethics are often complex, interdisciplinary, dynamic, and global in scope. Finding satisfactory solutions to environmental health problems will become increasingly important as the environmental impacts of human activities continue to mount and we learn more about the relationship between human health and the environment.

2.4 The Science: Environmental Health and Hazards

All organisms depend on their environment for energy and materials needed to sustain life: clean air, potable water, nutritious food, and safe places to live. For most of human history, increases in longevity were due to improved access to these necessities. Advances in agriculture, sanitation, water treatment, and hygiene have had a far greater impact on human health than medical technology.

Although the environment sustains human life, it can also cause diseases. Lack of basic necessities is a significant cause of human mortality. Environmental hazards increase the risk of cancer, heart disease, asthma, and many other illnesses. These hazards can be

physical, such as pollution, toxic chemicals, and food contaminants, or they can be social, such as dangerous work, poor housing conditions, urban sprawl, and poverty.

Unsafe drinking water and poor sanitation and hygiene are responsible for a variety of infectious diseases, such as, diarrhea, cholera, meningitis, and gastritis. In 2015, approximately 350,000 children under age 5 (mostly in the developing world) died from diarrheal diseases related to unsafe drinking water, and approximately 1.8 billion people used drinking water contaminated with feces. More than 2 billion people lacked access to basic sanitation.

Environment-Related Illnesses:

- Cancer
- Heart disease
- Diabetes
- Asthma
- Chronic obstructive pulmonary disease
- Obesity
- Occupational injuries
- Arthritis
- Parkinson's disease
- Malaria
- Dysentery
- Depression

By contrast, activities that promote health and extend human life can have adverse environmental effects. For example, food production causes environmental damage from pesticides and fertilizers, soil salinization, waste produced by livestock, carbon emissions from food manufacturing and transportation, deforestation, and over-fishing. Health care facilities also have adverse environmental impacts. Hospitals use large quantities of electricity and fossil fuels and produce medical wastes. To prevent some diseases, it may be necessary to damage the environment. For example, malaria was eradicated in the United States and other developed nations in the 1940s and 50s as a result of draining wetlands and spraying DDT to kill mosquitoes. A reduction in mortality from starvation or disease can lead to overpopulation, which stresses the environment in many different ways – increasing use of fossil fuels, clearing of land, generating pollution and waste, and so on.

2.5 Bioethical, Social, and Legal Considerations

Relationships between human health and the environment raise many ethical, social, and legal dilemmas by forcing people to choose among competing values. These considerations can be grouped into the following categories.

Managing benefits and risks:

Many of the issues at the intersection of health and the environment have to do with managing benefits and risks. For example, pesticides play an important role in increasing crop yields, but they can also pose hazards to human health and the environment. Alternatives to pesticide use create trade-offs in health. The extreme action of stopping all pesticide uses could significantly reduce agricultural productivity, leading to food shortages and increased food prices, which would, in turn, increase starvation in some parts of the world. Public health authorities have opted to regulate the use of pesticides to enhance food production while minimizing damage to the environment and human health. Energy production and use helps sustain human life, but it can also pose hazards to human health and the environment.

No issue demands greater care in balancing benefits and risks than global warming:

A significant percentage of global climate change is due to the human production of greenhouse gases. Climate change is likely to cause tremendous harm to the environment and human health, but taking steps to drastically reduce greenhouse gases could have adverse consequences for global, national, and local economies, which would result in a general decline in human health and health care. For example, greatly increasing taxes on fossil fuels would encourage greater fuel efficiency and lower carbon dioxide emissions, but it would also increase the price of transportation, which would lead to widespread inflation and reduced consumer spending power.

Risk Factors due to Environmental degradation:

- Pollution
- Microbes in air, water, or soil
- Contaminants in food
- Weather conditions (e.g. droughts, heat waves)

- Natural disasters (e.g. hurricanes, earthquakes, floods)
- Pesticides and other chemicals
- Pests and parasites
- Radiation
- Poverty
- Lack of access to health care

For many years some politicians and scholars argued that we should wait for more evidence of global warming before taking action, since the steps needed to prevent or minimize it could have disastrous economic consequences. Others have argued that society cannot afford to wait for complete evidence because the consequences of global climate change could be catastrophic and irreversible. This difference of opinion raises fundamental questions about the ethics of risk management: what is the role of scientific evidence in decision-making? Should we use risk/benefit or precautionary decision-making to develop environmental health policies?

Most regulatory agencies make benefit/risk decisions based on information from scientific studies, such as chemical analysis, cell studies, animal experiments, and controlled clinical trials. Agencies often refrain from making regulatory decisions until they have complete scientific evidence. Many commentators and organizations have endorsed an alternative approach called the precautionary principle. The idea is that society should take reasonable steps to prevent or minimize irreversible and significant harm, even when scientific evidence is incomplete, and that regulatory decisions to avoid harm need not await the accumulation of complete scientific evidence. Although the precautionary principle has gained many adherents, it remains controversial.

Social Justice and the Environment:

Managing benefits and risks raises social justice concerns. In general, people with lower socioeconomic status have greater exposure to certain detrimental environmental conditions in their homes or at work, such as lead, mercury, pesticides, toxic chemicals, or air and water pollution. Communities and nations should minimize such injustices when making decisions such as choosing a site for a factory, a power plant, or waste dump, or regulating safety in the workplace. The decision-making process should be fair, open, and democratic, so that people who will be affected by environmental risks have a voice in these deliberations and can make their concerns known.

When drafting and implementing environmental health regulations, it is important to consider vulnerable subpopulations. A vulnerable subpopulation is a group with an increased susceptibility

to the adverse effects of an environmental risk factor, due to their age, genetics, health status, or some other condition. For example, children are more susceptible to the effects of lead, mercury, and some pesticides than adults. Some people have a genetic mutation that increases their susceptibility to cancer caused by passive smoking.

If an environmental regulation is designed to protect average members of the population it may fail to adequately protect vulnerable subpopulations. Justice demands that we take care of people who are vulnerable. Since providing extra protections to everyone would be costly and impractical, protections must be meted out carefully and the populations who are vulnerable to a particular environmental risk factor must be defined clearly. For example, about 0.4% of the U.S. population has a severe allergic reaction to peanuts. Banning the sale of peanuts would be a costly and impractical way of protecting people with peanut allergies, but requiring that products containing peanuts be labeled clearly would be reasonable.

Social justice must be a factor in allocating resources for health care. Governments spend billions of dollars trying to improve the health of citizens and prevent diseases. These funds go to biomedical research, overseeing the safety of foods and drugs, enforcing environmental or occupational health regulations, and running programs for disaster preparedness, public health, health education, sanitation, water treatment, and so on.

2.6 Human rights and Environmental Concerns:

Various public health strategies pit the rights of individuals against the good of society, such as mandatory treatment, vaccination, or diagnostic testing; isolation and quarantine; and disease surveillance. The main argument for these public health strategies is that individual human rights may have to be limited to prevent the transmission of infectious diseases, such as tuberculosis, SARS, HIV/AIDS, and pneumonia. But restrictions on rights should be well thought-out and safeguards put in place to prevent public health authorities from overstepping their bounds. Protecting the public's health should not come at the expense of human rights.

Some health and environmental protections also limit property rights. The owner of a coal-burning power plant must deal with many laws concerning the operation of the plant,

workplace safety, and carbon emissions. A developer who plans to build 150 new homes with land he has purchased may also have to deal with laws concerning storm drainage, water and sewage lines, gas lines, sidewalks, and so on. Restrictions on property rights are justified to protect human health and the environment. But opponents of these restrictions argue that they are often excessive or not adequately supported by scientific evidence.

Human rights issues also come up in research on environmental health that involves human subjects. For such research to be ethical, human subjects must give consent, and great care must be taken to ensure that they understand that they can opt out of the research project. Since the late 1990s, some pesticide companies have tested pesticides on human subjects to gather data to submit to the government for regulatory purposes. Some commentators charge that these experiments are unethical because they place people at unacceptably high risk without a clear benefit to society. Others have argued that the experiments, if properly designed and implemented, could produce important benefits to society by providing useful knowledge about the effects of pesticides, which could lead to stronger regulations.

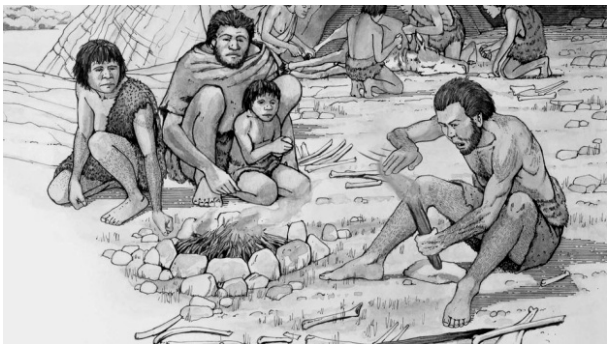
2.7 Emerging Issues

There are many new developments in science, technology, and industry that are bound to pose benefits and risks to the environment and human health. These include nanotechnology, genetic modification of plants and animals, antibiotic resistance, threats to food safety, and the growing market for bio-fuels. Longstanding challenges persist, including the preservation of ecosystems and endangered species and questions about animal experimentation among many others. To deal with them in a responsible way, we must continue to research the relationship between human health and the environment and hold fair and democratic public deliberations, such as community forums, academic conferences, and legislative debates, involving participants with diverse cultural, socioeconomic, philosophic, and scientific perspectives

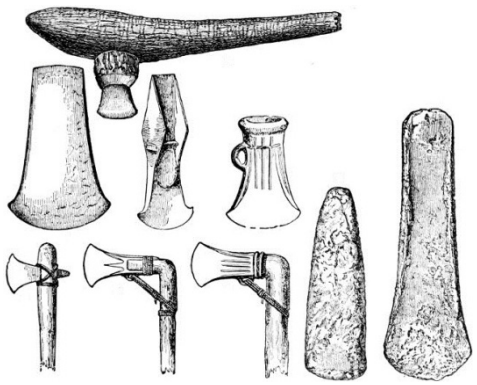
2.8 Technology and Environment

Technology dates back from Stone Age, when man first discovered how to make fire. This was the very first piece of technology and its impact on natural environment brought greenhouse gas emissions which accumulated through more than a million years of widespread use of fire.

i. Technology Developments in Man's History:



The word "technology" is a broad term and does not simply refer to high-tech inventions or computerization, which is actually the misconception. Technology comprises the crafting of materials and transforming them into implements that allow man to control or manipulate natural resources in order to meet his needs. Technology dates as far back as the Stone Age, when man discovered how to make fire, 1.4 million years ago. In fact, no one could have thought back then that fire, including its wood burning technology could create an impact on today's natural environment through its greenhouse gas emissions.



The cavemen learned how to make fire that provided them heat, light and protection against the wild animals that attacked them. They needed something to illuminate the darkness and to provide warmth when the great big ball of fire started to disappear from the sky. The cavemen's first technological tools were stone axes and spears which were used as protection and hunting implements. This further made man's living conditions better and can be called technological advancements. The impact of technology on the environment back then was not too significant because it was mainly utilized to improve the supply of man's basic needs.

As years passed, technological advancement was no longer confined to the mere purpose of meeting man's basic needs but for comforts and luxuries. Different forms of technological developments described the era of each civilization. It started from Stone Age and was elevated to the Bronze Age and finally reached the Iron Age, which brought technological advancements in weaponry.

Neighboring countries and regions came to wage war against each other and often the victor was the one with better technology as far as weapons were concerned. Even today, major countries spend a major chunk of their revenue for warfare technology to ensure that

no foreign leader or ruler can invade and claim a country or territory as his own. Thus, the negative impact of

technology on the environment began to surface as more of the Earth's natural resources and ecological habitats were being depleted or disrupted.

Technology was also used to speed up production and manufacture of goods, to provide better transport and delivery as well as make the methods of communication not only faster but also, far reaching. Trade and commerce flourished at faster rates due to technological advancements and brought about globalization. As trade and commerce grew, it heightened the impact of technology on natural environment wherein air, land and water reached certain degrees of pollution, degradation and contamination.

ii. Green Technology and the Aim to Reverse the Negative Impacts:

On a brighter side, new technology brought about what will be known in man's history as the Computer Age. This era will become significant not only in greatly improving trade and commerce but also in bringing forth instruments that will lessen the accumulated negative effects of technology on the Earth's natural resources.

Green technology has come up with better solutions of generating heat and energy. The sun's powerful UV rays are being harnessed through solar panels instead of the wood burning process. The kinetic powers of wind and water currents are being utilized to produce electricity that can lessen the demands for coal and fossil fuels.

Present day Green technology is decisively geared at lessening if not reversing all the negative impacts of technology since millions of people especially children have come to develop respiratory diseases among others because of it. In fact in China, wood burning is still prevalent among millions of the country's households. The Asia Asthma Development Board ranks China as having the highest record of fatalities of its nation's asthma sufferers. These accumulated impacts have started as far back as 1.4 million years ago when cavemen discovered how to make fire and made use of wood as fuel.

Greenhouse gas emissions have brought us global warming, melting glaciers, rising sea levels, air pollution, ocean acidification, disrupted marine and wildlife biodiversity, groundwater contamination, soil depletion and a host of other adverse effects that stem

from other technological innovations that were conceptualized without considering the consequences. All

these effects are intertwined as a result of gas emissions that accumulated in the atmosphere. It eventually penetrated the ozone layer found in the Earth's stratosphere.

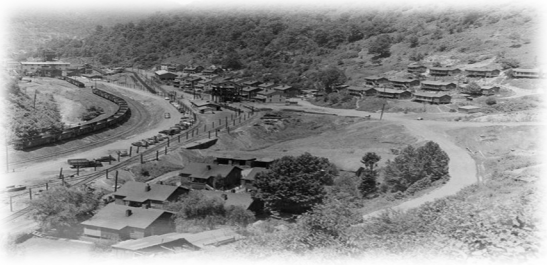
Communities take extra effort to green their lifestyle and lessen the negative impacts of technology on natural environment. However, nations continue to increase the use of technology in warfare and they produce weapons that make use of metals, chemicals and microorganisms that have far greater negative effects.

iii. Mining and its Technology:

It is said that the end of the Bronze Age began in 1200 BC, when the use of iron or metal came into the foreground as a better material for weaponry. Since then, almost every nation found it necessary to harness their environment's iron resources to produce weapons. Hence, metals even then played an important role in order for a territory or region to survive. Until mining methods were soon developed wherein mining technology had greater negative impact on the natural environment than the wood burning process that the cavemen discovered.

In the U.S., the mining industries brought acid mine drainage problems that led to a series of chemical reactions. It resulted into contamination of both surface and groundwater as natural sources of drinking water. The growth, development and propagation of fish and other aquatic life became disrupted. Waste water pipes, bridges and other metal structures submerged underwater resulted to corrosion and subsequently acid run-offs.

The Appalachian Coal Fields is the region where mining activities took place and where most of the mines produced different forms of metals. Some mines closed due to the advent of the Civil Wars in 1861-1865. Mines were abandoned and soon, the mine drainage problems surfaced with significant levels of toxic content. In fact, most of the mining industries in the Appalachian Coal Fields have since closed due to economic recession but not without



leaving pollution problems.

Inside these abandoned mines, mineral deposits became exposed to the Earth's oxygen and resulted to chemical reactions which produced sulfide bearing mineral deposits. It later formed into a substance called pyrite (FeS2) and underwent another chemical reaction when it started to precipitate. The acid substance produced after precipitation is called "poisonous copper leachate" and it leaked into underground waterways reaching several miles and mixing with river water.

Based on this, the greater negative impact of technology, especially on land and water, all started when man discovered iron or metal as the best form of weaponry.

iv. Technology in Warfare – The Use of Chemicals and Microorganisms

Technology that was used for warfare brought other detriments that emanated from the manufacture of chemical weapons for mass destruction.

Large amounts of Mercury waste material was said to have been released in the environment at the time when nuclear weapons were being manufactured. TNT or Trinitrotoluol, is a known environmental hazard because of its ability and persistence to seep into the ground.

The most frightening of all are the weapons of Biological Warfare which can be used even if there are no wars being waged but simply to sow terror. Infectious microorganisms in some form or substance will be released to cause death by way of diseases that will affect all living things, man, animals and plants.

It can be surmised that the accumulation of negative technological impact can be remedied by green technological concepts and change of lifestyle. In fact, everyone is encouraged to be patient and that the completion of environmental rehabilitation may take place not in our lifetime but of the future generations. Yet, whatever is being done to improve environmental conditions today can be easily wiped out with just one launch of warfare technology tomorrow, as man continues to engage in acts of war and terror. The more sophisticated the weapons, the more distressful the impact of technology on natural environment will take place.

Key Facts: Population and Pollution

- *The world population is growing by approximately 74 million people per year*
- *Population growth is not evenly distributed across the globe*
- *Scientists are yet to conclusively determine the human 'carrying capacity' of Earth*
- *Population is only one of many factors influencing the environment*
- *We have consumed more resources in the last 50 years than the whole of humanity before us*
- *The 20th century saw the biggest increase in the world's population in human history*

3. Our growing population

We humans are remarkable creatures. From our humble beginnings in small pockets of Africa, we have evolved over millennia to colonise almost every corner of our planet. We are clever, resilient and adaptable — perhaps a little *too* adaptable.

In 2015, the world population is more than 7.3 billion people. That's more than seven billion three hundred million bodies that need to be fed, clothed, kept warm and ideally, nurtured and educated. More than 7.3 billion individuals who, while busy consuming resources, are also producing vast quantities of waste, and our numbers continue to grow. The United Nations estimates that the world population will reach 9.2 billion by 2050.

For most of our existence the human population has grown very slowly, kept in check by disease, climate fluctuations and other social factors. It took until 1804 for us to reach 1 billion people. Since then, continuing improvements in nutrition, medicine and technology have seen our population increase rapidly. Human population has seen exponential growth over the past few hundred years.

The impact of so many humans on the environment takes two major forms:

- consumption of resources such as land, food, water, air, fossil fuels and minerals
- waste products as a result of consumption such as air and water pollutants, toxic materials and greenhouse gases

4. More than just numbers

Many people worry that unchecked population growth will eventually cause an environmental catastrophe. The impact of so many people on the planet has resulted in some scientists coining a new term to describe our time—the Anthropocene epoch. Unlike previous geological epochs, where various geological and climate processes defined the time periods, the proposed Anthropecene period is named for the dominant influence humans and their activities are having on the environment. In essence, humans are a new global geophysical force.

However, while population size is part of the problem, the issue is bigger and more complex than just counting bodies.

There are many factors at play. Essentially, it is what is happening *within* those populations—their distribution (density, migration patterns and urbanisation), their composition (age, sex and income levels) and, most importantly, their consumption patterns—that are of equal, if not more importance, than just numbers.

Let's take a closer look at the issues.

5. Population size

It's no surprise that as the world population continues to grow, the limits of essential global resources such as potable water, fertile land, forests and fisheries are becoming more obvious. You don't have to be a maths whizz to work that out, on the whole, more people use more resources and create more waste.

But how many people is too many? How many of us can Earth realistically support?
Influenced by the work of Thomas Malthus, 'carrying capacity' can be defined as the maximum population size an environment can sustain indefinitely.

Debate about the actual human carrying capacity of Earth dates back hundreds of years. The range of estimates is enormous, fluctuating from 500 million people to more than one trillion. Scientists disagree not only on the final number, but more importantly about the best and most accurate way of determining that number—hence the huge variability.

How can this be? Whether we have 500 million people or one trillion, we still have only one planet, which has a finite level of resources. The answer comes back to resource consumption. People around the world consume resources differently and unevenly. An average middle-class American consumes 3.3 times the subsistence level of food and almost 250 times the subsistence level of clean water. So if everyone on Earth lived like a middle class American, then the planet might have a carrying capacity of around 2 billion. However, if people only consumed what they actually needed, then the Earth could potentially support a much higher figure.

But we need to consider not just quantity but also quality—Earth might be able to theoretically support over one trillion people, but what would their quality of life be like? Would they be scraping by on the bare minimum of allocated resources, or would they have the opportunity to lead an enjoyable and full life?

More importantly, could these trillion people cooperate on the scale required, or might some groups seek to use a disproportionate fraction of resources? If so, might other groups challenge that inequality, including through the use of violence?

These are questions that are yet to be answered.

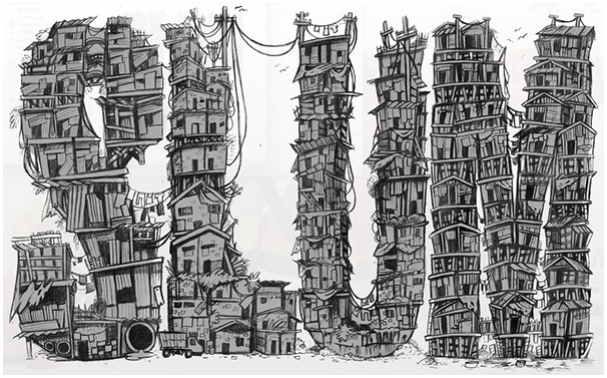
6. Population distribution

The ways in which populations are spread across Earth has an effect on the environment. Developing countries tend to have higher birth rates due to poverty and lower access to family planning and education, while developed countries have lower birth

rates. In 2015, 80 per cent of the world's population lives in less-developed nations. These faster-growing populations can add pressure to local environments. Thus proving that population density varies in different places and the adverse effects are determined by an area's population.

Globally, in almost every country, humans are also becoming more urbanised. In 1960 less than one third of the world's population lived in cities, by 2014, that figure was 54 per cent, with a projected rise to 66 per cent by 2050.

While many enthusiasts for centralisation and urbanisation argue this allows for resources to be used more efficiently, in developing countries this mass movement of people heading towards the cities in search of employment and opportunity often outstrips the pace of development, leading to slums, poor (if any) environmental regulation, and higher levels of centralised pollution. Even in developed nations, more people are moving to the cities than ever before. The pressure placed on growing cities and their resources such as water, energy and food due to continuing growth includes pollution from additional cars, heaters and other modern luxuries, which can cause a range of localised environmental problems.



Humans have always moved around the world. However, government policies, conflict or environmental crises can enhance these migrations, often causing short or long-term environmental damage. For example, since 2011 conditions in the Middle East have seen population transfer (also known as unplanned migration) result in several million refugees fleeing countries including Syria, Iraq and Afghanistan. The sudden development of often huge refugee camps can affect water supplies, cause land damage (such as felling of trees for fuel) or pollute environments (lack of sewerage systems).

7. Population composition:

The composition of a population can also affect the surrounding environment. At present, the global population has both the largest proportion of young people (under 24) and the largest percentage of elderly people in history.

Life expectancy has increased by approximately 20 years since 1960. While this is a triumph for mankind, and certainly a good thing for the individual, from the planet's point of view it is just another body that is continuing to consume resources and produce waste for around 40 per cent longer than in the past.

Ageing populations are another element to the multi-faceted implications of demographic population change, and pose challenges of their own. For example between 1970 and 2006, Japan's proportion of people over 65 years grew from 7 per cent to more than 20 per cent of its population. This has huge implications on the workforce, as well as government spending on pensions and health care.

Population income is also an important consideration. The uneven distribution of income results in pressure on the environment from both the lowest and highest income levels. In order to simply survive, many of the world's poorest people partake in unsustainable levels of resource use, for example burning rubbish, tyres or plastics for fuel. They may also be forced to deplete scarce natural resources, such as forests or animal populations, to feed their families. On the other end of the spectrum, those with the highest incomes consume disproportionately large levels of resources through the cars they drive, the homes they live in and the lifestyle choices they make.

On a country-wide level, economic development and environmental damage are also linked. The least developed nations tend to have lower levels of industrial activity, resulting in lower levels of environmental damage. The most developed countries have found ways of improving technology and energy efficiency to reduce their environmental impact while retaining high levels of production. It is the countries in between—those that are developing and experiencing intense resource consumption (which may be driven by demand from developed countries)—that are often the location of the most environmental damage.

8. Population consumption

While poverty and environmental degradation are closely interrelated, it is the unsustainable patterns of consumption and production, primarily in developed nations, that are of even greater concern.

It's not often that those in developed countries stop and consider their levels of consumption. For many, particularly in industrialised countries, the consumption of goods and resources is just a part of our lives and culture, promoted not only by advertisers but also by governments wanting to continually grow their economy. Culturally, it is considered a normal part of life to shop, buy and consume, to continually strive to own a bigger home or a faster car, all frequently promoted as signs of success. Consumer culture in excess is harming both the planet and our emotional wellbeing.

The environmental impact of all this consumption is huge. The mass production of goods, many of them unnecessary for a comfortable life, is using large amounts of energy, creating excess pollution, and generating huge amounts of waste.

To complicate matters, environmental impacts of high levels of consumption are not confined to the local area or even country. For example, the use of fossil fuels for energy has an impact on global CO_2 levels and resulting environmental effects. Similarly, richer countries are also able to rely on resource and/or waste-intensive imports being produced in poorer countries. This enables them to enjoy the products without having to deal with the immediate impacts of the factories or pollution that went in to creating them.

On a global scale, not all humans are equally responsible for environmental harm. Consumption patterns and resource use are very high in some parts of the world, while in others—often in countries with far more people—they are low, and the basic needs of whole populations are not being met. A study undertaken in 2009 showed that the countries with the fastest population growth also had the slowest increases in carbon emissions. The reverse was also true—for example the population of North America grew only 4 per cent between 1980 and 2005, while its carbon emissions grew by 14 per cent.

Individuals living in developed countries have, in general, a much bigger ecological footprint than those living in the developing world. The ecological footprint is a standardised measure of how much productive land and water is needed to produce the resources that are consumed, and to absorb the wastes produced by a person or group of people.

Today humanity uses the equivalent of 1.5 planets to provide the resources we use and absorb our waste. This means it now takes the Earth one year and six months to regenerate what we use in a year.

When Australian consumption is viewed from a global perspective, we leave an exceptionally large 'ecological footprint'—one of the largest in the world. While the average global footprint is 2.7 global hectares, in 2014 Australia's ecological footprint was calculated at 6.7 global hectares per person (this large number is mostly due to our carbon emissions). To put this in perspective, if the rest of world lived like the people in Australia, we would need the equivalent of 3.6 Earths to meet the demand.

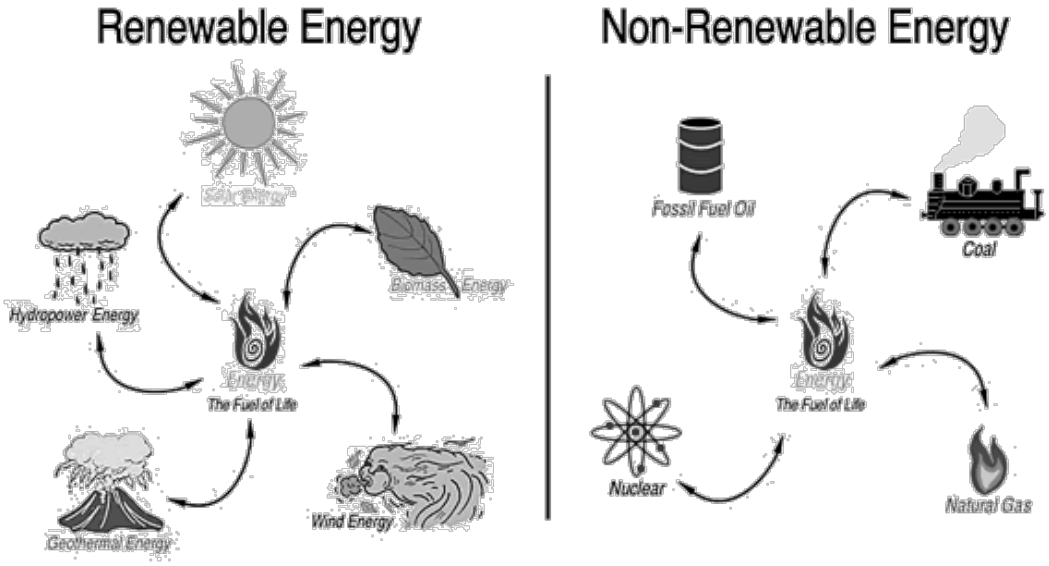
Similarly, an American has an ecological footprint almost 9 times larger than an Indian—so while the population of India far exceeds that of the United States, in terms of environmental damage.

9. What is the solution?

How do we solve the delicate problem of population growth and environmental limitations? Joel Cohen, a mathematician and author characterised potential solutions in the following way:

1. A Bigger Pie: Technical Innovation:

This theory looks to innovation and technology as Earth's saviour, not only to extend the planet's human carrying capacity, but to also improve the quality of life for each individual. Advances in food production technologies such as agriculture, water purification and genetic engineering may help to feed the masses, while moving away from fossil fuels to renewable power sources such as wind and solar will help to reducing climate change.



'Economic decoupling' refers to the ability of an economy to grow without corresponding increases in environmental pressure. In 2014 the United Nations Environment Programme (UNEP) released a report titled 'Decoupling 2', which explored the possibilities and opportunities of technology and innovation to accelerate decoupling, and an analysis of how far technical innovation can go.

Funding and research should be a high priority in these areas, but we must accept that technology can only do so much, and is only part of the solution.

2. Fewer Forks: Education and Policy Change:

This theory is based on demographic transition, effectively finding ways to slow or stop population growth resulting in fewer people fighting for resources or 'slices' of pie.

Birth rates naturally decline when populations are given access to sexual and reproductive healthcare, education for boys and girls beyond the primary level is encouraged and made available, and women are empowered to participate in social and political life. Continuing to support programs and policies in these areas

should bring a corresponding drop in birth rates. Similarly, as the incomes of individuals in developing countries increase, there is a corresponding decrease in birth rates. This is another incentive for richer countries to help their poorer neighbours reach their development potential.

Providing a health, educational or financial incentive has also proven to be effective in combating some population issues. For example, paying money to people with two or fewer children or allowing free education for families with a single child has been trialled with some success. Opponents question whether accepting these incentives is really a choice, or whether the recipient has been coerced into it through community pressure or financial desperation.

Fewer forks can also cover another complicated area — the option of seriously controlling population growth by force. China has done so in the past and attracted both high praise and severe humanitarian criticism.

10. Better Manners: Less Is More

The better manners approach seeks to educate people about their actions and the consequences of those actions, leading to a change in behaviour. This relates not only to individuals but also governments. Individuals across the world, but particularly in developed countries, need to reassess their consumption patterns. Numerous studies have shown that more 'stuff' doesn't make people happier anyway. We need to actively find ways to reduce the amount of resources we consume. Taking shorter showers, saying no to single-use plastics, buying less, recycling our waste and reviewing our mode and frequency of travel may seem trivial, but if millions around the world begin to do it as well, the difference will begin to add up.

Governments too need to instigate shifts in environmental policy to protect and enhance natural areas, reduce CO_2 and other greenhouse gas emissions, invest in renewable energy sources and focus on conservation as priorities.

Developing countries should be supported by their more developed neighbours to reach their development goals in sustainable, practical ways.

In reality, there is no single, easy solution. All three options must be part of a sustainable future.

2.10 Where to from here?

Population is an issue that cannot be ignored. While we can all do our bit to reduce our own global footprint, the combined impact of billions of other footprints will continue to add up. There are many who believe that if we do not find ways of limiting the numbers of people on Earth ourselves, then Earth itself will eventually find ways of doing it for us. Interestingly, despite population increase being such a serious issue, the United Nations has held only three world conferences on population and development (in 1945, 1974 and 1994).

However, governments around the world are beginning to recognise the seriousness and importance of the situation, and are taking steps to reduce the environmental impacts of increasing populations and consumption such as through pollution reduction targets for air, soil and water pollutants.

The United Nations Climate Change Conference in Paris, scheduled for December 2015, is one example; however any international policies need to be backed up by workable solutions at the individual, local and regional level. With more than 7.3 billion people on the planet, it's easy to assume someone else will tackle and solve the issue of population and environment. Yet it is an issue that affects us all, and as such we're all responsible for working towards a sustainable future in which everyone is able to enjoy a good quality of life without destroying the very things we rely on to survive.

Chapter 2: Part 2

Impacting the Four Elements

Air

(वायु)

The atmosphere of Earth is the layer of gases, commonly known as air that surrounds the planet. Earth and is retained by Earth's gravity. The atmosphere of Earth protects life on Earth by absorbing ultraviolet solar radiation, warming the surface through heat retention (greenhouse effect), and
reducing temperature extremes
between day and night (the diurnal temperature variation).

By volume, dry air contains 78.09% nitrogen, 20.95% oxygen, 0.93% argon, 0.04% carbon dioxide, and small amounts of other gases. Air also contains a variable amount of water vapor, on average around 1% at sea level, and 0.4% over the entire atmosphere. Air content and atmospheric pressure vary at different layers, and air suitable for use in photosynthesis by terrestrial plants and breathing of terrestrial animals is found only in Earth's troposphere and in artificial atmospheres.

However, in recent times, human activity and natural processes have caused an imbalance in the composition of the air and caused air pollution. Air pollution is basically, the introduction of harmful substances into Earth's atmosphere. It may cause diseases, allergies or death in humans; and other living organisms such as animals and food crops, and may damage the natural or built environment.

Indoor air pollution and poor urban air quality are listed as two of the world's worst toxic pollution problems in the 2008 Blacksmith Institute World's Worst Polluted Places report. According to the 2014 WHO report, air pollution in 2012 caused the deaths of around 7 million people worldwide, an estimate roughly matched by the International Energy Agency.

3.1 Effect of Air Pollution on the Environment:

Pollution is now a common place term that our ears are attuned to. We hear about the various forms of pollution and read about it through the mass media. Air pollution is one such form that refers to the contamination of the air, irrespective of indoors or outside. A physical, biological or chemical alteration to the air in the atmosphere can be termed as pollution. It occurs when any harmful gases, dust, smoke enters into the atmosphere making it difficult for plants, animals and humans to survive.

Air pollution can further be classified into two sections – Visible air pollution and invisible air pollution. Another way of looking at Air pollution could be any substance that holds the potential to hinder the atmosphere or the well being of the living beings surviving in it.

The Ozone layer considered crucial for the existence of the ecosystems on the planet is depleting due to increased pollution. Global warming, a direct result of the increased imbalance of gases in the atmosphere has come to be known as the biggest threat and challenge that the contemporary world has to overcome in a bid for survival.

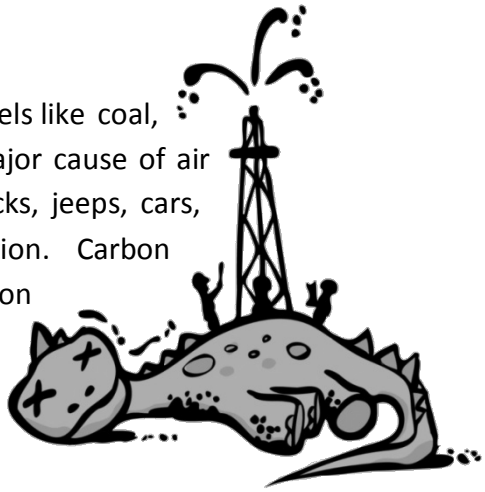
Types of Pollutants:

In order to understand the causes of Air pollution, several divisions can be made. Primarily air pollutants can be caused by primary sources or secondary sources. The pollutants that are a direct result of the process can be called primary pollutants. A classic example of a primary pollutant would be the sulfur-dioxide emitted from factories.

Secondary pollutants are the ones that are caused by the inter mingling and reactions of primary pollutants. Smog created by the interactions of several primary pollutants is known to be as secondary pollutant.

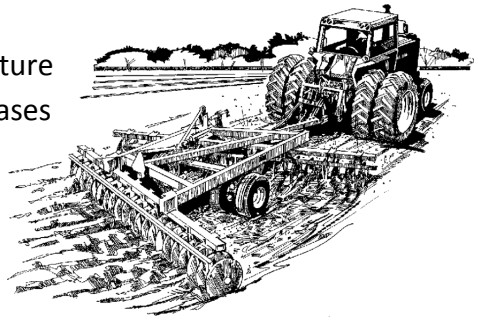
Causes of Air pollution:

1. Burning of Fossil Fuels:



Sulfur dioxide emitted from the combustion of fossil fuels like coal, petroleum and other factory combustibles is one the major cause of air pollution. Pollution emitting from vehicles including trucks, jeeps, cars, trains, airplanes cause immense amount of pollution. Carbon Monooxide caused by improper or incomplete combustion and generally emitted from vehicles is another major pollutant along with Nitrogen Oxides that is produced from both natural and manmade processes.

2. Agricultural activities:



Ammonia is a very common by product from agriculture related activities and is one of the most hazardous gases in the atmosphere. Use of insecticides, pesticides and fertilizers in agricultural activities has grown quite a lot. They emit harmful chemicals into the air and can also cause water pollution.

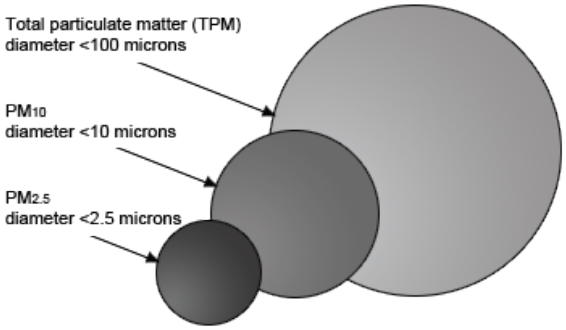
3. Exhaust from factories and industries:

Manufacturing industries release large amount of carbon monoxide, hydrocarbons, organic compounds, and chemicals into the air thereby depleting the quality of air. Manufacturing industries can be found at every corner of the earth and there is no area that has not been affected by it.

4. Mining operations:

Mining is a process wherein minerals below the earth are extracted using large equipments. During the process dust and chemicals are released in the air causing massive air pollution. This is one of the reasons which are responsible for the deteriorating health conditions of workers and nearby residents.

5. Indoor air pollution:



Household cleaning products, painting supplies emit toxic chemicals in the air and cause air pollution. Have you ever noticed that once you paint walls of your house, it creates some sort of smell which makes it literally impossible for you to breathe?

Suspended particulate matter popular by its acronym SPM, is another cause of pollution. Referring to the particles afloat in the air, SPM is usually caused by dust, combustion etc.

6. Air Traffic:

Although aviation is a relatively small industry, it has a disproportionately large impact on the climate system. It accounts for four to nine per cent of the total climate change impact of human activity.

But at a time when we urgently need to reduce our impact, greenhouse gas emissions from aviation continue to grow. For example, since 1990, CO_2 emissions from international aviation have increased 83 per cent. The aviation industry is expanding rapidly in part due to regulatory and taxing policies that do not reflect the true environmental costs of flying. "Cheap" fares may turn out to be costly in terms of climate change.

What I can do

Because the climate impacts of air transportation are at present not adequately regulated under national or international laws, the onus is on individuals and businesses to limit their flying unless absolutely necessary. This needn't be as drastic as it sounds:

- Consider taking a vacation closer to home — or even being a tourist in your own town. You'll save money and avoid the stress of airport security, travelling to and from the airport, and sitting in those tiny seats. Most of us live in places that tourists from elsewhere visit, so take a holiday in your hometown or region and find out what it has to offer.

- Use other modes of transport where possible. Trains and buses, for example, are much more energy efficient than airplanes, and for regional trips can even be faster when airports are factored in. Even cars can be more efficient than planes — especially with more than one passenger.

- Use video-conferences for meetings. The David Suzuki Foundation is doing it, and so are companies like Swiss Re and IKEA who use video-conferencing to reduce business air travel. Companies benefit from decreased costs at the same time that they're helping the planet. Employees avoid the stress of travelling and time away from home and family.

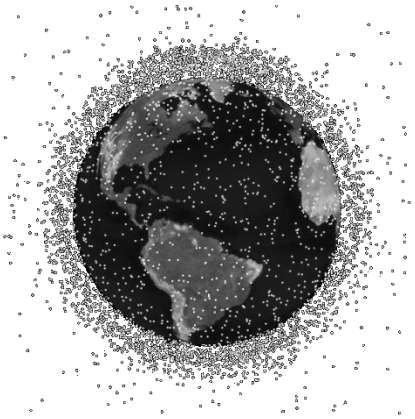
- Use webcams to keep in touch with family and friends who live far away.

- Contact your political representatives, tell them you're concerned about the contribution of aviation to global climate change, and ask them to take action to regulate and limit greenhouse gas emissions from this sector.

If you do have to fly:

- Try to minimize the number of flights you take by combining trips. For example, book more than one meeting in your destination city, so you don't need to fly there several times.
- Fly the most direct route possible, since take-offs and landings use the most fuel.
- Fly during the daytime, because studies have shown that flights taken at night have a greater impact on the climate.
- Fly economy, because more people per plane mean fewer emissions per person.
- Pack light, because lighter planes mean less fuel is burned.
- Purchase carbon offsets to account for the emissions from your flight. If the airline or travel agent you are using doesn't currently offer its customers the option of offsetting their flights, ask them to consider it.

7. Space Debris:



Although outer space is often imagined to be a desolate, empty place, the region around Earth swarms with millions pieces of man-made debris that create potential hazards for their functioning neighbors. Where did all of this junk come from? Will it ever go away? What kind of problems might it create for people stationed on Earth?

The source of space junk:

With the launch of the Soviet satellite Sputnik in 1957; mankind began its journey to reach the stars. But although the first probe in space returned to Earth after only three short months, it kicked off a series of launches that not only inspired people around the world but also filled the region with large chunks of inert metal.

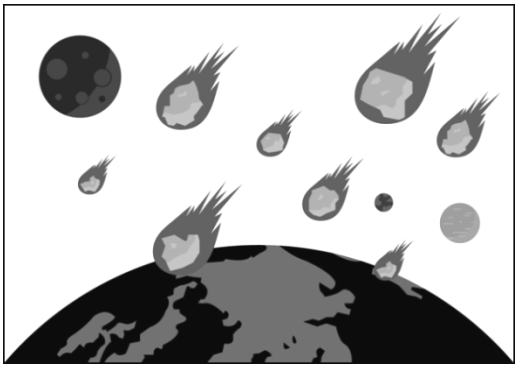
Inactive satellites, the upper stages of launch vehicles, discarded bits left over from separation, and even frozen clouds of water and tiny flecks of paint all remain in orbit high above Earth's atmosphere. When one piece collides with another, even more debris is released. Over 21,000 pieces of space trash larger than 4 inches (10 centimeters) and half a million bits of junk between 1 cm and 10 cm are estimated to circle the planet. And the number is only predicted to go up.

An ounce of prevention:

Despite the small size of most of the objects in space, the U.S. and Russian military are able to keep track of a great deal of the mess. Objects as small as 4 inches (about 10 cm) can be seen by radars or optical telescopes on Earth. When preparing a launch, mission controllers screen the predicted post-launch orbit for potential collisions to avoid as much damage as possible. Similarly, crafts such as the space shuttle and the International Space Station can change their orbits if a larger object approaches.

But everything sent into space still faces potential collisions with smaller, untrackable objects that can pit or damage them. Satellites and space craft are heavily shielded to protect vital components.

Watch for falling objects:



Earth's orbit is segregated into three distinct regions. Low Earth-orbit (LEO) covers the area 125-1,250 miles (200-2000 km). Pieces of space junk in this region are impacted by the atmosphere, which degrades their orbit, dragging them back to Earth sooner. This is a prime realm for piloted spacecraft due to its easy access. Navigation and communication satellites tend to prefer a semi-synchronous orbit 6,000 to 12,000 miles (10,000 to 20,000 km) above the surface. Satellite telecommunication and weather satellites orbit in geosynchronous Earth orbit, over 22,000 miles (36,000 km) high, and can remain aloft for

millions of years. The lower the orbit, the less time the object is likely to remain in space before returning to Earth.

Bits and pieces of trash constantly fall from the sky, but nearly everything larger than 4 inches (10 cm) survives in some form, likely in smaller fragments. In the last five decades, an average of one piece of debris fell to the Earth each day. Most of the trash raining down burns up in the atmosphere before it ever reaches the surface. Those that survive often fall into water; remember, the ocean makes up approximately 70 percent of the Earth's surface. According to NASA's Orbital Debris Program Office, no serious injury or significant property damage from falling debris has been confirmed.

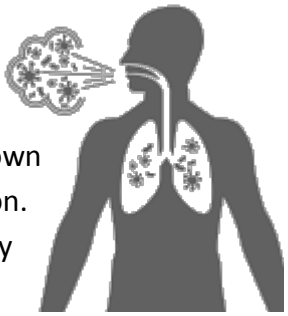
Cleaning the debris that already exists is a completely different challenge. Specific trips to larger objects could remove them from orbit, but at a high financial cost. Other proposals include the use of a laser to provide a path-shifting push that wouldn't damage the object.

More debris facts:

- NASA's Long Duration Exposure Facility spent 5.7 years in a low Earth orbit to help analyze the risk from debris. Over 20,000 impacts have been documented.
- Critical surfaces on the Space Shuttle were examined for debris after every flight.
- Even a salt-sized grain hitting the space shuttle creates orbital debris.
- The most heavily shielded spacecraft ever flown; International Space Station changes its flight path if it is expected to come within a few miles of a large piece of debris. Such course corrections happen about once a year.
- The US Vanguard 1 satellite, launched in 1958, is the oldest artificial satellite still circling the Earth, despite its low orbit.
- More than 100 trillion artificial objects smaller than one-hundred-thousandth of an inch (1 micron) could circle the globe.
- NASA was the first space agency to issue guidelines for orbital debris mitigation in 1995.

Effects of Air pollution

1. Respiratory and heart problems:

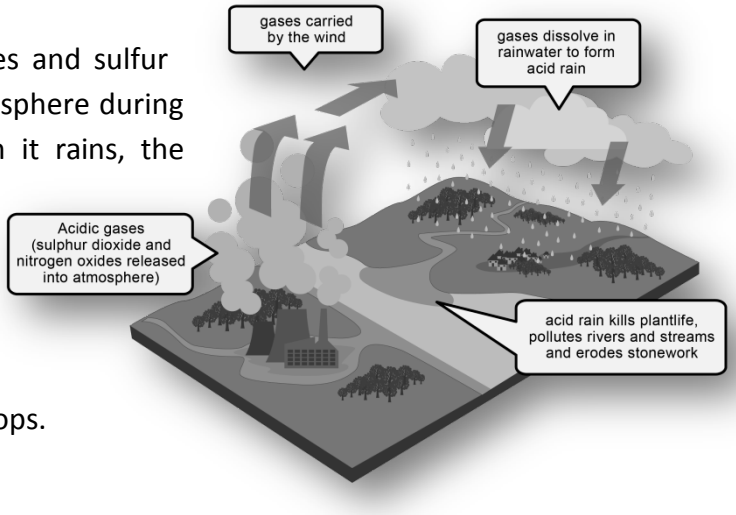


The effects of Air pollution are alarming. They are known to create several respiratory and heart conditions along with Cancer, among other threats to the body. Several millions are known to have died due to direct or indirect effects of Air pollution. Children in areas exposed to air pollutants are said to commonly suffer from pneumonia and asthma.

2. Global warming:

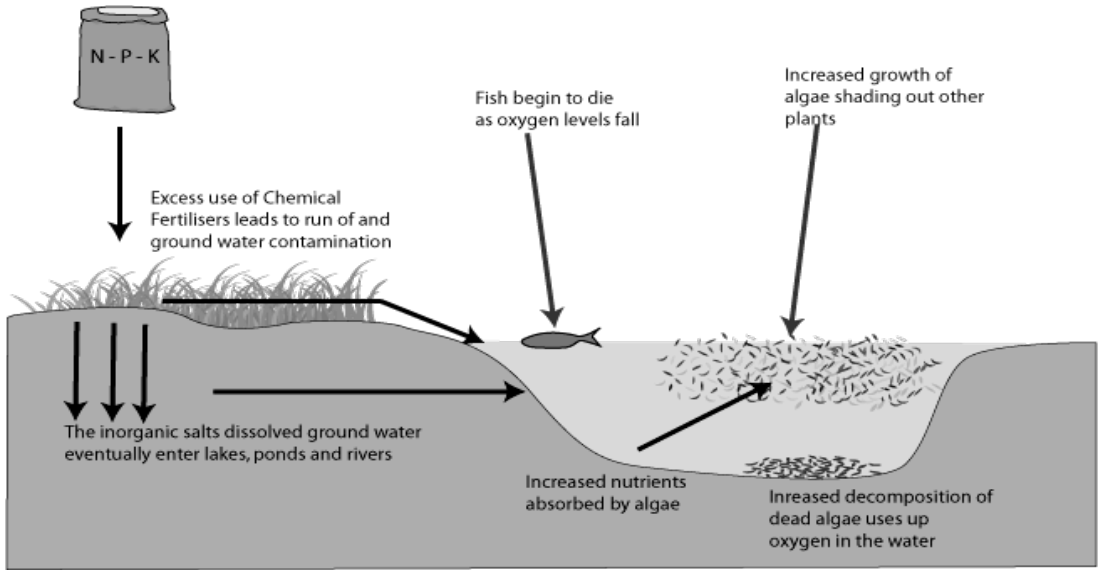
Another direct effect is the immediate alterations that the world is witnessing due to Global warming. With increased temperatures worldwide, increase in sea levels and melting of ice from colder regions and icebergs, displacement and loss of habitat have already signaled an impending disaster if actions for preservation and normalization aren't undertaken soon.

3. Acid Rain:



Harmful gases like nitrogen oxides and sulfur oxides are released into the atmosphere during the burning of fossil fuels. When it rains, the water droplets combines with these air pollutants, becomes acidic and then falls on the ground in the form of acid rain. Acid rain can cause great damage to human, animals and crops.

4. Eutrophication:

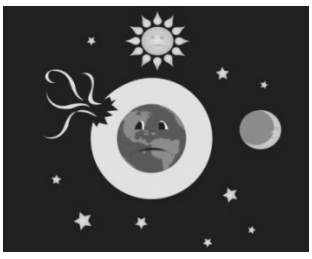


Eutrophication is a condition where high amount of nitrogen present in some pollutants gets developed on the sea's surface which turns itself into algae and adversely affects fish, plants and animal species. The green colored algae that is present on lakes and ponds is due to presence of this chemical.

5. Effect on Wildlife:

Just like humans, animals also face some devastating effects of air pollution. Toxic chemicals present in the air can force wildlife species to move to new place and change their habitat. The toxic pollutants deposit over the surface of the water and can also affect sea animals.

6. Depletion of Ozone layer:



The Ozone exists in earth's stratosphere and is responsible for protecting humans from harmful ultraviolet (UV) rays. Earth's ozone layer is depleting due to the presence of chlorofluorocarbons, hydro chlorofluorocarbons in the atmosphere. As the ozone layer grows thin, it will emit harmful rays back on earth and can cause skin and eye related problems. UV rays also have the capability to affect crops.

When you try to study the sources of Air pollution, you enlist a series of activities and interactions that create these pollutants. There are two types of sources that we will take a look at: Natural sources and Man-made sources.

Natural sources of pollution include dust carried by the wind from locations with very little or no green cover, gases released from the body processes of living beings (Carbon dioxide from humans during respiration, Methane from cattle during digestion, Oxygen from plants during Photosynthesis). Smoke from the combustion of various inflammable objects, volcanic eruptions etc along with the emission of polluted gases also make it to the list of Natural sources of Pollution.

While looking at the man-made contributions towards air pollution, smoke again features as a prominent component. The smoke emitted from various forms of combustion like in bio mass, factories, vehicles, furnaces etc. Waste used to create landfills generates methane, which is harmful in several ways. The reactions of certain gases and chemicals also form harmful fumes that can be dangerous to the well being of living creatures.

Solutions for Air Pollution

1. Use public mode of transportation:

Encourage people to use more and more public modes of transportation to reduce pollution. Also, try to make use of car pooling. If you and your colleagues come from the same locality and have same timings you can explore this option to save energy and money.

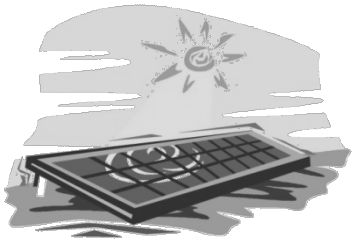
2. Conserve energy:

   Switch off fans and lights when you are going out. Large amount of fossil fuels are burnt to produce electricity. You can save the environment from degradation by reducing the amount of fossil fuels to be burned.

3. Understand the concept of Reduce, Reuse and Recycle:

   Do not throw away items that are of no use to you. In-fact, you can reuse them for different purpose. For e.g. you can use old jars to store cereals or pulses.

4. Emphasis on clean energy resources:



   Clean energy technologies like solar, wind and geothermal are on high these days. Governments of various countries have been providing grants to consumers who are interested in installing solar panels for their home. This will go a long way to curb air pollution.

5. Use energy efficient devices:

   CFL lights consume less electricity as against their counterparts. They live longer, consume less electricity, lower electricity bills and also help you to reduce pollution by consuming less energy.

Several attempts are being made worldwide on a personal, industrial and governmental level to curb the intensity at which Air Pollution is rising and regain a balance as far as the proportions of the foundation gases are concerned. This is a direct attempt at slacking Global warming. A series of innovations and experiments aimed at alternate and unconventional options to reduce pollutants have also been on the rise. Air Pollution is one of the larger mirrors of man's follies, and a challenge we need to overcome to see a better tomorrow.

Chapter 2: Part 3

Impacting the Four Elements

Water

(जल)

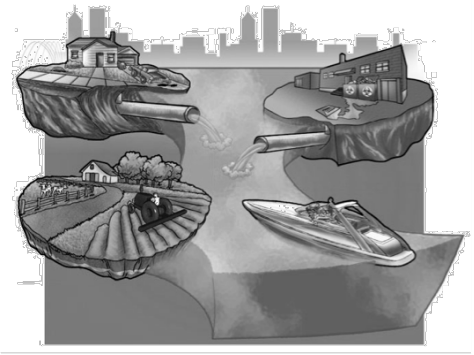
The earth is the only known planet with huge bodies of water. Seventy percent of its surface area consists of oceans, lakes, and seas surrounding huge bodies of land. The few other planets that have water contain only moisture floating as vapor on their surface or small amounts of ice or liquid water on the planet itself, not large bodies of liquid water as on earth.

Water can absorb enormous amounts of heat without a large alteration in its temperature. Its heat absorption level is about ten times greater than steel. During the day, the earth's bodies of water rapidly soak up enormous amounts of heat; thus, the earth stays fairly cool. At night, they release the vast amounts of heat that they absorbed during the day, which, combined with atmospheric effects, keeps most of the surface from freezing solid at night. If it were not for the tremendous amounts of water on the earth, far greater day and night temperature variations would exist. Many parts of the surface would be hot enough to boil water during the day, and the same parts would be cold enough to freeze water at night. Because water is an excellent temperature stabilizer, the large oceans on earth are vital for life to exist on earth.

In contrast to virtually all other materials (the rare exceptions include rubber and antimony), water contracts when cooled only until it reaches 4 degrees Celsius. Then it amazingly expands until it freezes. Thus, because of this anomaly, the ice that forms in seas, oceans, and lakes stays near the surface, where the sun heats it during the day and the warm water below melts it in the summer. This and the Coriolis effect, which produces ocean currents, ensure that most of the ocean stays in a liquid form, allowing the myriads of water creatures to live.

However, as our population grows, more and more people are sharing this limited resource. The more water consumed the less there is available for the environment. Therefore, it is important that we use water wisely and do not waste it.

Water Pollution:



Water they say is life, and indeed they were right. With about 70% of the earth's cover being water, it undeniably becomes one of our greatest resources. It is an important element in both domestic as well as industrial purposes. However on closer inspection of our water resources today, gives a rude shock.

Infested with waste ranging from floating plastic bags to chemical waste, our water bodies have turned into a pool of poison. The contamination of water bodies in simplest words means water pollution. Thereby the abuse of lakes, ponds, oceans, rivers, reservoirs etc is water pollution. Pollution of water occurs when substances that will modify the water in negative fashion are discharged in it. This discharge of pollutants can be direct as well as indirect.

Water pollution is an appalling problem, powerful enough to lead the world on a path of destruction. Water is an easy solvent, enabling most pollutants to dissolve in it easily and contaminate it. The most basic effect of water pollution is directly suffered by the organisms and vegetation that survive in water, including amphibians. On a human level, several people die each day due to consumption of polluted and infected water.

As per the Economist report (dated 2008) each day over 1000 children die of diarrheal sickness in India and the numbers have only increased alarmingly in the last five years. Water is polluted by both natural as well as man-made activities. Volcanic eruptions, earthquakes, Tsunamis etc are known to alter water and contaminate it, also affecting ecosystems that survive under water.

Sources of Water Pollution:

There are various classifications of water pollution. The two chief sources of water pollution can be seen as Point and Non Point.

- 'Point' refers to the pollutants that belong to a single source. An example of this would be emissions from factories into the water.

- 'Non Point' on the other hand means pollutants emitted from multiple sources. Contaminated water after rains that has traveled through several regions may also be considered as a Non point source of pollution.

Causes of Water Pollution:

Let us now study the causes of water pollution.

1. Industrial waste:

Industries produce huge amount of waste which contains toxic chemicals and pollutants which can cause air pollution and damage to us and our environment. They contain pollutants such as lead, mercury, sulphur, asbestos, nitrates and many other harmful chemicals. Many industries do not have proper waste management system and drain the waste in the fresh water which goes into rivers, canals and later in to sea. The toxic chemicals have the capability to change the color of water, increase the amount of minerals, also known as Eutrophication, change the temperature of water and pose serious hazard to water organisms.

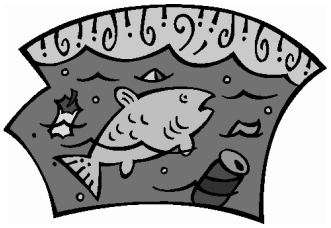
2. Sewage and waste water:

The sewage and waste water that is produced by each household is chemically treated and released in to sea with fresh water. The sewage water carries harmful bacteria and chemicals that can cause serious health problems. Pathogens are known as a common water pollutant; the sewers of cities house several pathogens and thereby diseases. Microorganisms in water are known to be causes of some very deadly diseases and become the breeding grounds for other creatures that act like carriers. These carriers inflict these diseases via various forms of contact onto an individual. A very common example of this process would be Malaria.

3. Mining activities:

Mining is the process of crushing the rock and extracting coal and other minerals from underground. These elements when extracted in the raw form contain harmful chemicals and can increase the amount of toxic elements when mixed up with water which may result in health problems. Mining activities emit several metal waste and sulphides from the rocks and is harmful for the water.

4. Marine dumping:



The garbage produce by each household in the form of paper, aluminum, rubber, glass, plastic, food is collected and deposited into the sea in some countries. These items take from 2 weeks to 200 years to decompose. When such items enter the sea, they not only cause water pollution but also harm animals in the sea.

5. Accidental Oil leakage:

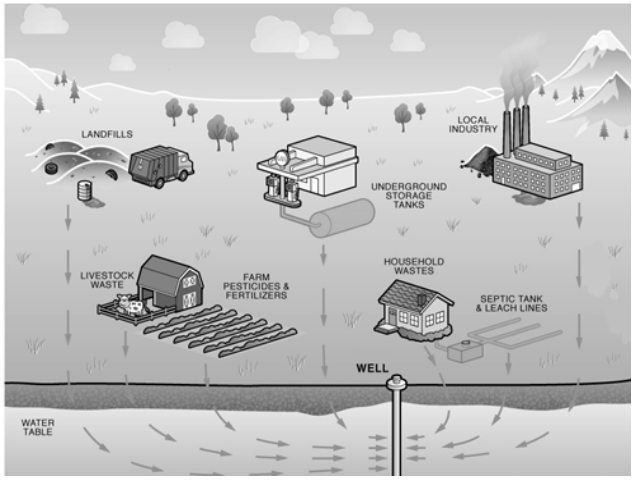
Oil spills pose a huge concern as large amounts of oil enters into the sea and does not dissolve in water; there by opens problem for local marine wildlife such as fish, birds and sea otters. For e.g.: a ship carrying large quantity of oil may spill oil if met with an accident and

can cause varying damage to species in the ocean depending on the quantity of the oil spill, size of ocean, toxicity of pollutant.

6. Burning of fossil fuels:

Fossil fuels like coal and oil when burnt produce substantial amount of ash in the atmosphere. The particles which contain toxic chemicals when mixed with water vapor result in acid rain. Also, carbon dioxide is released from burning of fossil fuels which result in global warming.

7. Chemical fertilizers and pesticides:



Chemical fertilizers and pesticides are used by farmers to protect crops from insects and bacteria. They are useful for the plants growth. However, when these chemicals are mixed up with water and are harmful for plants and animals. Also, when it rains, the chemicals mixes up with rainwater and flow down into rivers and canals which pose serious damages for aquatic animals.

8. Leakage from sewer lines:

A small leakage from the sewer lines can contaminate the underground water and make it unfit for the people to drink. Also, when not repaired on time, the leaking water can come on to the surface and become a breeding ground for insects and mosquitoes.

9. Global warming:

An increase in earth's temperature due to greenhouse effect results in global warming. It increases the water temperature and results in death of aquatic animals and marine species which later results in water pollution.

10. Radioactive waste:

Nuclear energy is produced using nuclear fission or fusion. The element that is used in production of nuclear energy is Uranium which is highly toxic chemical. The nuclear waste that is produced by radioactive material needs to be disposed off to prevent any nuclear accident. Nuclear waste can have serious environmental hazards if not disposed of properly. Few major accidents have already taken place in Russia and Japan.

11. Urban development:

As population has grown, so has the demand for housing, food and cloth. As more cities and towns are developed, they have resulted in increased use of fertilizers to produce more food, soil erosion due to deforestation, increase in construction activities, inadequate sewer collection and treatment, landfills as more garbage is produced, increase in chemicals from industries to produce more materials.

12. Leakage from the landfills:

Landfills are nothing but huge pile of garbage that produces awful smell and can be seen across the city. When it rains, the landfills may leak and the leaking landfills can pollute the underground water with large variety of contaminants.

13. Animal waste:

The waste produce by animals is washed away into the rivers when it rains. It gets mixed up with other harmful chemicals and causes various water borne diseases like cholera, diarrhea, jaundice, dysentery and typhoid.

14. Underground storage leakage:

Transportation of coal and other petroleum products through underground pipes is well known. Accidentals leakage may happen anytime and may cause damage to environment and result in soil erosion.

Water pollutants also include both organic and inorganic factors. Organic factors include volatile organic compounds, fuels, waste from trees, plants etc. Inorganic factors include ammonia, chemical waste from factories, discarded cosmetics etc. The water that travels via fields is usually contaminated with all forms of waste inclusive of fertilizers that it swept along the way. This infected water makes its way to our water bodies and sometimes to the seas endangering the flora, fauna and humans that use it along its path.

The current scenario has led to a consciousness about water preservation and efforts are being made on several levels to redeem our water resources. Industries and factory set-up's are restricted from contaminating the water bodies and are advised to treat their contaminated waste through filtration methods. People are investing in rain water harvesting projects to collect rainwater and preserve it in wells below ground level.

Water Pollution is common, and is an area of high alert. Water needs to be preserved and respected today, for us to live a better tomorrow.

Water Pollution Facts:

Following are some facts on water pollution:

- Fourteen billion pounds of garbage, which is mostly plastic, is dumped into the ocean every year.
- The Ganges River in India is one the most polluted rivers in the world with sewage, trash, food, and animal remains.
- According to United States Environmental Protection Agency (U.S. EPA) estimates, 1.2 trillion gallons of untreated sewage, storm water, and industrial waste is dumped into U.S. waters annually.
- About 700 million people globally drink contaminated water.
- Aquatic animals face an extinction rate of five times more than that of terrestrial animals.
- Over 30 billion tons of urban sewage is discharged into lakes, rivers and oceans every year.
- The massive oil spill that was caused by British Petroleum (BP) in the year 2010 caused over 1,000 animals to die. Many of them were on the endangered species list.
- According to UNICEF, more than 3,000 children die every day all over the world due to consumption of contaminated drinking water.
- Pollution is one of the biggest killers in the world, affecting over 100 million people.

- Lack of proper sanitation in water leads to diseases like cholera, malaria and diarrhea.
- At least 320 million people in China do not have access to clean drinking water

Water pollution has been extensively documented as a contributor to health problems in humans and marine animal ecosystems. It has a huge impact on our lives, and if we do our part by not throwing trash or chemicals into our water supplies and drains, we can contribute to the improvement of aquatic life and of our health in general.

Major Adverse Effects of Water Pollution:

Water pollution adversely affects the health and life of man, animals and plants alike. Polluted water is also harmful for agriculture as it adversely affects the crops and the soil fertility. Pollution of sea water damages the oceanic life.

1. Health Aspects of Water Quality:

Consumption of polluted water is a major cause of ill health in India. Polluted water causes some of the deadly diseases like cholera, dysentery, diarrhea, tuberculosis, jaundice, etc. About 80 per cent of stomach diseases in India are caused by polluted water.

2. Effect of Organic Pollution on Water Quality:

All organic materials can be broken down or decomposed by microbial and other biological activity (biodegradation). Organic and some of the inorganic compounds exhibit a biochemical oxygen demand (BOD) because oxygen is used in the degradation process.

Oxygen is a basic requirement of almost all aquatic life. Aquatic life is adversely affected if sufficient oxygen is not available in the water. Typical sources of organic pollution are sewage from domestic and animal sources, industrial wastes from food processing, paper mills, tanneries, distilleries, sugar and other agro based industries.

3. Effect of Nutrients on Water Quality:

Water supports aquatic life because of the presence of nutrients in it. Here the primary focus is on fertilizing chemicals such as nitrates and phosphates. Although these are important for plant

growth, too much of nutrients encourage the overabundance of plant life and can result in environmental damage called ‘entrophication’.

This can occur at both microscopic level in the form of algae and macroscopic level in the form of aquatic weeds. Nitrates and phosphates are contributed by sewage, agricultural run-off and run-off from unsewered residential areas.

4. Effect of High Dissolved Solids (TDS) in Water Quality:

Water is the best solvent and can dissolve a large variety of substances which come in its contact. The amount of dissolved solid is a very important consideration in determining its suitability for drinking, irrigation and industrial uses. In general, waters with total dissolved solids of less than 500 mg/litre are most suitable for drinking purposes.

Higher amount of dissolved solids may lead to impairment of physiological processes in human body. Dissolved solid is a very important requirement for irrigation. This is due to the fact dissolved solid accumulates on the ground resulting in salinization of soil.

In this way it renders the agricultural land non-productive. Dissolved solids are harmful for industries also because they form scales, causing foaming in boilers, accelerate corrosion and interfere with the colour and taste of many finished products.

5. Effect of Toxic Pollutants on Water Quality:

Toxic pollutants mainly consist of heavy metals, pesticides and other individual xenobiotic pollutants. The ability of a water body to support aquatic life, as well as its suitability for other uses depends on many trace elements. Some metals e.g., Mn, Zn and Cu present in trace quantity are important for life as they help and regulate many physiological functions of the body. Some metals, however, cause severe toxicological effects on human health and the aquatic ecosystem.

6. Effect of Thermal Discharges on Water Quality:

The discharge of cooling water from industrial and commercial operations generally heats up the aquatic environment. Organisms may become physiologically stress or may even be killed when exposed to heated water. If water heating is supplemented by the summer heat, the impact on aquatic environment can be disastrous.

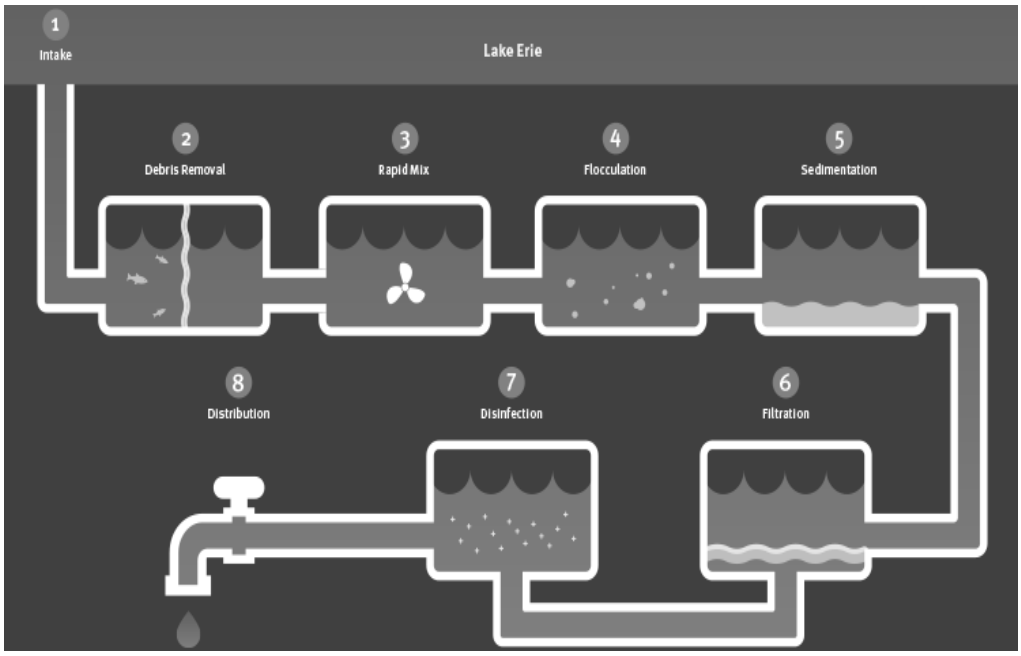
Thermal pollution also causes a decrease on the driving force or oxygenation which may directly kill aquatic life through asphyxiation. Bioavailability of many pollutants may also increase due to thermal pollution, which may ultimately adversely affect the aquatic life.

Preventing Water Pollution:

As there are many factors that affect the health and safety of worldwide populations and threaten the future of the environment, water pollution is a serious problem.

In order to combat the severe health and safety implications that come with destroying such a precious resource, one may participate in preventing water pollution by:

1. Sewage treatments:



The household water should be treated properly so that they become environmentally safe. Adequate care should be taken to ensure that effective sewage treatment process is in place in order to prevent water pollution, human and animal excreta should be prevented from mixing with its sources. Construction of pit toilet and proper sewage treatments can offer some solution to this problem.

2. Prevent river water from getting polluted:

The flowing water of the river cannot be cleaned easily by natural process. Since, a large number of external substances are discharged into the water, the river water becomes polluted. This may cause diseases to the people using river water. Thus, every effort should be made to prevent the river water from getting contaminated. People should not be allowed to throw wastes into the river water.

3. Treatment of wastes before discharge:

Factories are expected to treat its effluent wastes prior to discharge. Toxic material must be treated chemically and converted into harmless materials. If possible, factories should try to recycle the treated water.

4. Strict adherence to water laws:

Laws and legislation relating to pollution should be strictly followed by all. People should be made aware that adherence to water laws is in their own interest.

5. Treatment of drainage water:

It cities, a huge amount of water is put into drains every day. The water that flows through the city drainage system should be properly treated. Harmful pollutants must be removed, before they are introduced into reservoirs. If this water allowed going into water reservoirs without treatment, it will pollute them.

6. Treatment plants:

Big cities and towns usually have effluent treatment plants. These plants filter out undissolved materials. Chemical treatment is also given to separate out unwanted dissolved

chemicals. The treated water is either allowed to go into the water reservoirs or refused in houses. Occasionally, the treated water is used for farming if the fields to be irrigated lie in the vicinity of the water treatment plants.

7. Keep the pond water clean and safe:

Washing, bathing of cattle in the pond that is used by humans should not be done. Washing of dirty clothes and bathing of cattle make the pond water dirty and unsuitable for human use. If these ponds are continually misused, then it may lead to severe consequences.

8. Routine cleaning:

Ponds, lakes and wells meant for human use should be routinely cleaned and treated, so that it remains fit for human use. It is an essential step that should not be avoided. A system of regular testing of pond and lake water can be introduced to ensure the safety of the water.

9. Don’t pour insecticides in sinks and toilets:

Never pour household insecticides, medicines, etc. down the sink, drain or toilet. At homes, people often throw wastes and old medicines into the bathroom toilet. This practice is discouraged for the reason that the chemical compounds of medicines, insecticides, etc., when mixed with other chemicals, may result in formation of harmful substances.

10. Self hygiene:

Self hygiene must be maintained and drinking water must not be polluted. Drinking water should be kept undercover in a clean place. One should not put his hands into the drinking water containers. Also, the practice of cleaning the drinking water reservoirs on a regular basis needs to be strictly followed. The water meant for drinking should be purified prior to use. In the absence of a good water purifier, it is recommended to drink boiled water. This is also important to prevent water borne diseases.

11. Sanitation system must be improved.

The benefits of cleanliness on human health needs to be understood. Human contact with hazardous materials should be prevented. After using the toilet, one should always use the flush and wash their hands with soap and water.

12. Public Awareness:

Common public should be made aware about the effect of water pollution. Voluntary organizations should go door-to-door to educate the people about environmental problems. They should perform street plays for creating awareness about the environment. They should run environmental education centers. Students can impart health education to enable people to prevent water pollution

Water pollution may disrupt human life to a great extent and therefore it is essential to take steps to prevent water pollution and causing further damage to our environment.

Chapter 2: Part 4

Impacting the Four Elements

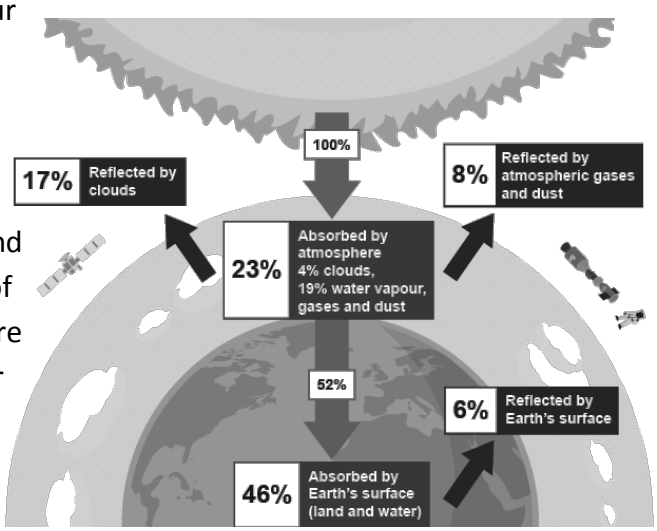
Fire

(अग्नि)

In Greek mythology, Prometheus was the creator of mankind and he is famously known to have stolen fire and given it to the humans against Zeus' wishes, because he had grown fond of them. Many stories surround the aspect of fire in many cultures, some others connect to the way the earth was formed, through a raging hell and into the living breathing planet we have today. The big bang theory itself point to the creation of earth, and the earth's core is living proof of its fiery birth.

The earth has a tendency to balance its system and restore order – a natural cycle it has maintained for billions of years. But this has not been the case in recent times, with the emergence of human beings, especially with the progress of industry and a hunger for more resource our world has changed, and the change has not been for the better. In fact, the best we have now, to reduce the amount of damage we can do to our planet to combat the negative effects that human activity has brought upon the planet. Let us learn a little more about the concept of the earth's heat budget, aspects of global warming, green house effect and ways we can prevent further damage in our own capacities.

Heat Budget of the Earth:



Incoming heat being absorbed by the Earth and outgoing heat escaping the Earth in the form of radiation are both perfectly balanced. If they were not balanced, then Earth would be getting either progressively warmer or progressively cooler with each passing year. This balance between incoming and outgoing heat is known as

Earth’s heat budget. While on average, Earth’s heat budget is balanced, the interactions that take place as heat and electromagnetic radiation interact with Earth and its many objects, oceans, and atmosphere are complex. Over all they balance out, however, some places are hotter or cooler day in and day out.

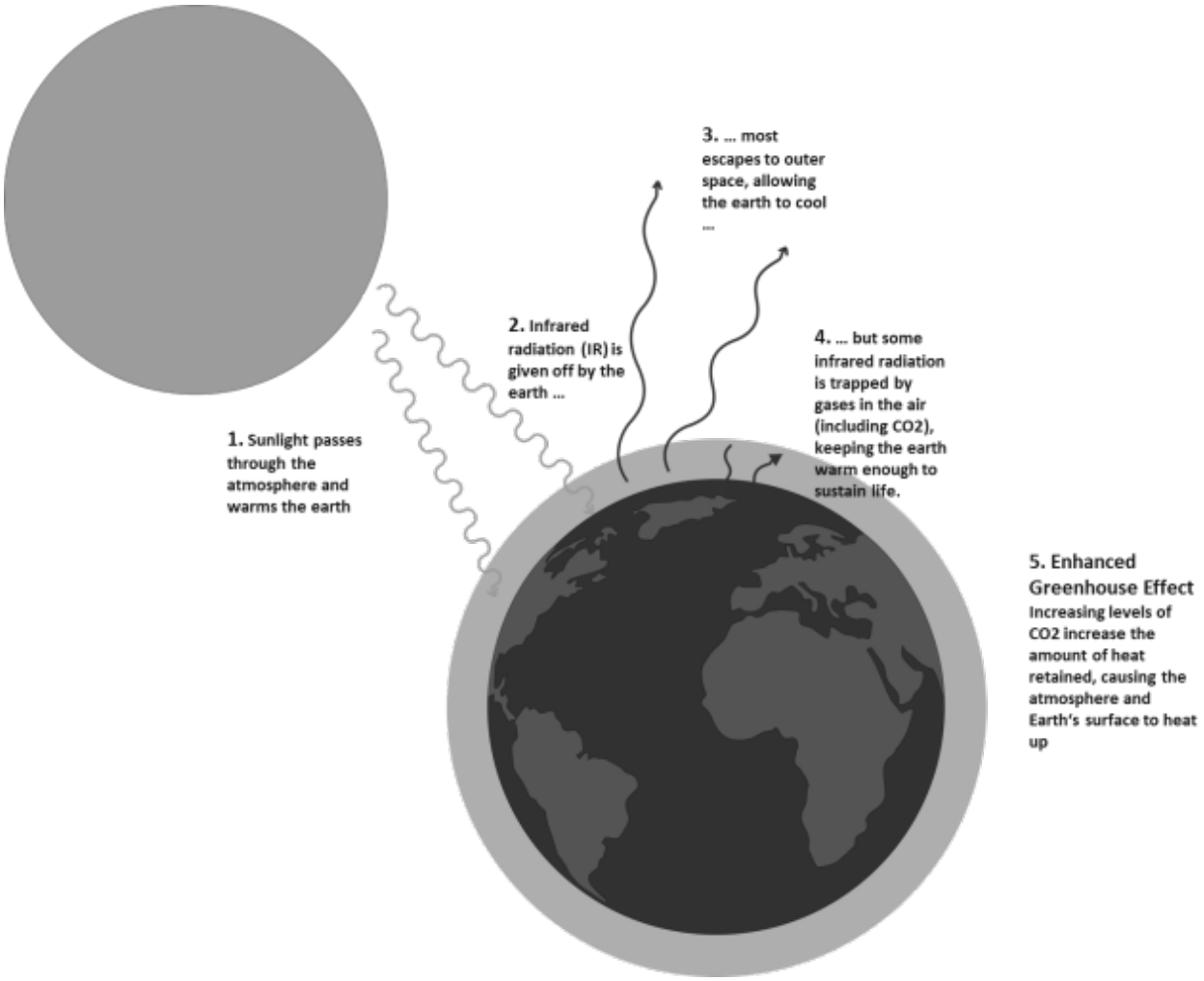
Earth's energy budget accounts for the energy Earth receives from the Sun. Much of this energy is lost when the earth re-radiates it back into outer space, and the rest of the energy is distributed throughout the five components of Earth's climate system. This system is made up of earth's water, ice, atmosphere, rocky crust, and all living things.

Received radiation is unevenly distributed over the planet, because the Sun heats equatorial regions more than Polar Regions. Energy is absorbed by the atmosphere, hydrosphere, and lithosphere, and, in a process informally described as Earth's heat engine, the solar heating is redistributed through evaporation of surface water, convection, rainfall, winds, and ocean circulation. When the incoming solar energy is balanced by an equal flow of heat to space, the Earth is said to be in radiative equilibrium and under that condition, global temperatures will be stable.

Disturbances of Earth's radiative equilibrium, such as an increase of greenhouse gases, will change global temperatures in response. However, Earth's energy balance and heat fluxes depend on many factors, such as atmospheric composition (mainly aerosols and greenhouse gases), the albedo (reflectivity) of surface properties, cloud cover and vegetation and land use patterns. Changes in surface temperature due to Earth's energy budget do not occur instantaneously, due to the inertia of the oceans and the cryosphere. The net heat flux is buffered primarily by becoming part of the ocean's heat content, until a new equilibrium state is established between radiative forcings and the climate response.

Greenhouse Effect

While other planets in Earth's solar system are either scorching hot or bitterly cold, Earth's surface has relatively mild, stable temperatures. Earth enjoys these temperatures because of its atmosphere, which is the thin layer of gases that cloak and protect the planet.



However, 97 percent of climate scientists agree that humans have changed Earth's atmosphere in dramatic ways over the past two centuries, resulting in global warming. To understand global warming, it's first necessary to become familiar with the greenhouse effect.

The exchange of incoming and outgoing radiation that warms the Earth is often referred to as the greenhouse effect because a greenhouse works in much the same way.

Incoming UV radiation easily passes through the glass walls of a greenhouse and is absorbed by the plants and hard surfaces inside. Weaker IR radiation, however, has difficulty passing through the glass walls and is trapped inside, thus warming the greenhouse. This effect lets tropical plants thrive inside a greenhouse, even during a cold winter.

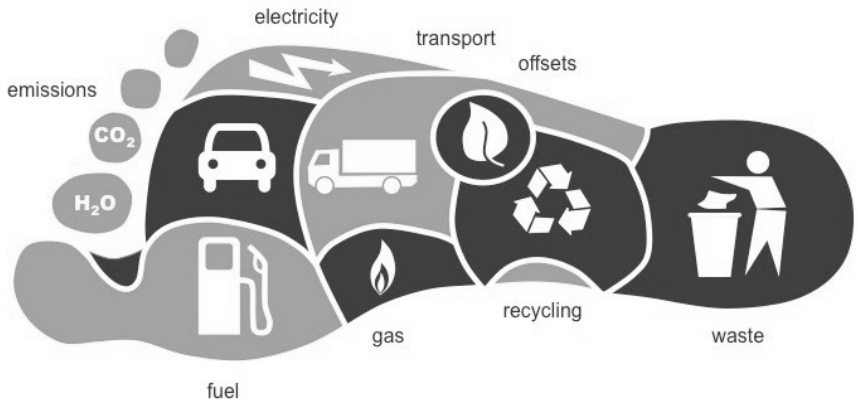
A similar phenomenon takes place in a car parked outside on a cold, sunny day. Incoming solar radiation warms the car's interior, but outgoing thermal radiation is trapped inside the car's closed windows.

Since the dawn of the Industrial Revolution in the early 1800s, the burning of fossil fuels like coal, oil and gasoline have greatly increased the concentration of greenhouse gases in the atmosphere, especially CO_2; and deforestation is the second largest anthropogenic source.
The greenhouse effect, combined with increasing levels of greenhouse gases has resulted in global warming.
If global warming continues unchecked, it will cause significant climate change, a rise in sea levels, increasing ocean acidification, extreme weather events and other severe natural and societal impacts

Many scientists agree that the damage to the Earth's atmosphere and climate is past the point of no return. There are three options from this point forward:

- Do nothing and live with the consequences.
- Adapt to the changing climate (which includes things like rising sea level and related flooding).
- Mitigate the impact of climate change by aggressively enacting policies that actually reduce the concentration of CO2 in the atmosphere.

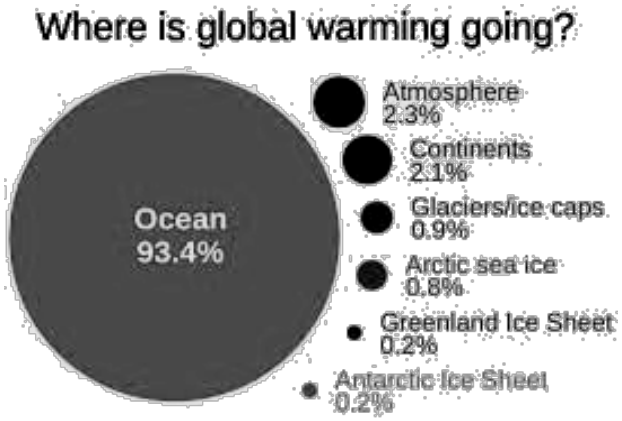
Carbon Footprint



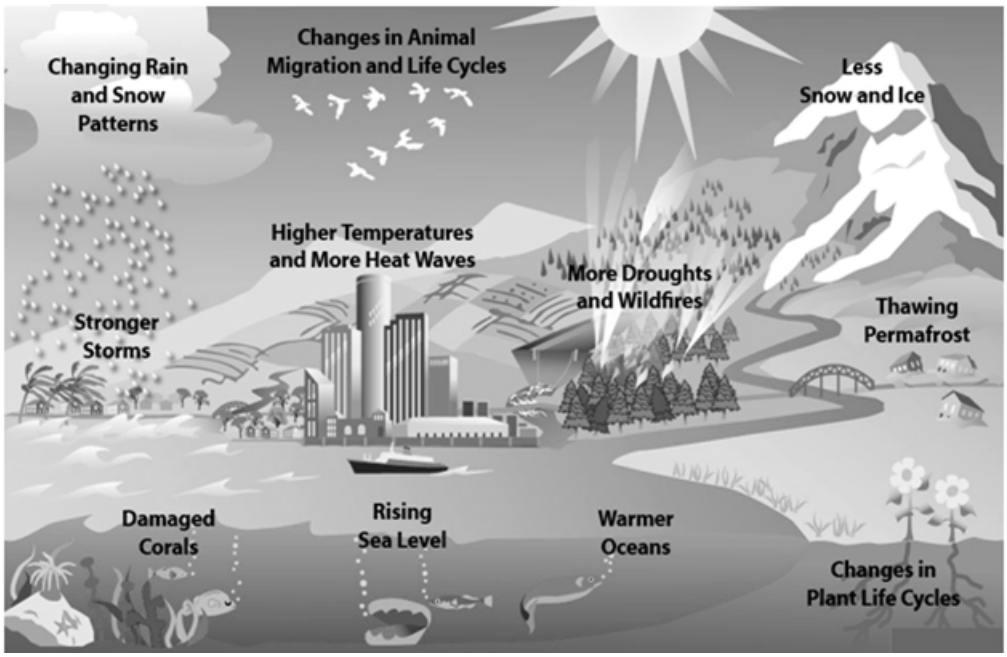
A carbon footprint measures the total greenhouse gas emissions caused directly and indirectly by a person, organisation, event or product.

Global Warming:

Global warming is the term used to describe a gradual increase in the average temperature of the Earth's atmosphere and its oceans, a change that is believed to be permanently altering the Earth's climate. There is great debate among many people, and sometimes in the news, on whether global warming is real. But climate scientists looking at the data and facts agree the planet is warming. While many view the effects of global warming to be more substantial and more rapidly occurring than others do, the scientific consensus on climatic changes related to global warming is that the average temperature of the Earth has risen between 0.4 and 0.8 °C over the past 100 years. The increased volumes of carbon dioxide and other greenhouse gases released by the burning of fossil fuels, land clearing, agriculture, and other human activities, are believed to be the primary sources of the global warming that has occurred over the past 50 years. Scientists from the Intergovernmental Panel on Climate carrying out global warming research have recently predicted that average global temperatures could increase between 1.4 and 5.8 °C by the year 2100.



Effect of Global Warming:

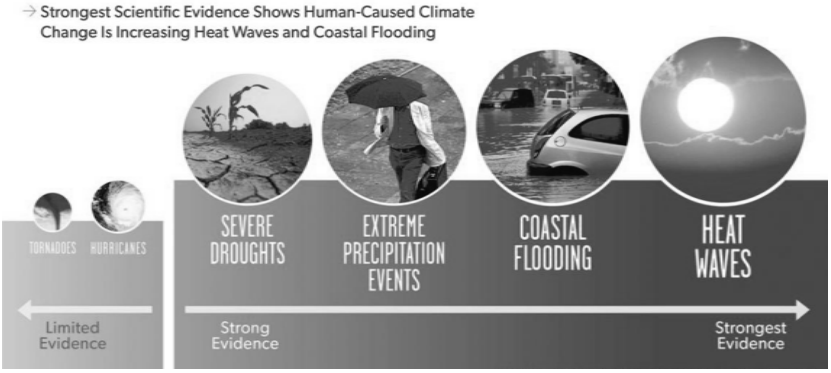


Eight degrees Fahrenheit – It may not sound like much—perhaps the difference between wearing a sweater and not wearing one on an early-spring day. But for the world in which we live, this small rise will have grave consequences, ones that are already becoming apparent, for every ecosystem and living thing—including us.

According to the National Climate Assessment, human influences are the number one cause of global warming, especially the carbon pollution we cause by burning fossil fuels and the pollution-capturing we prevent by destroying forests. This warming is altering the earth's climate system, including its land, atmosphere, oceans, and ice, in far-reaching ways.

i. More frequent and severe weather:

Higher temperatures are worsening many types of disasters, including storms, heat waves, floods, and droughts. A warmer climate creates an atmosphere that can collect, retain, and drop more water, changing weather patterns in such a way that wet areas become wetter and dry areas drier. "Extreme weather events are costing more and more," says Aliya Haq, deputy director of NRDC's Clean Power Plan initiative. "The number of billion-dollar weather disasters is expected to rise."



The increasing number of droughts, intense storms, and floods we're seeing as our warming atmosphere holds—and then dumps—more moisture poses risks to public health and safety, too. Prolonged dry spells mean more than just scorched lawns. Drought conditions jeopardize access to clean drinking water, fuel out-of-control wildfires, and result in dust storms, extreme heat events, and flash flooding.

At the opposite end of the spectrum, heavier rains cause streams, rivers, and lakes to overflow, which damages life and property, contaminates drinking water, creates hazardous-material spills, and promotes mold infestation and unhealthy air. A warmer, wetter world is also a boon for food-borne and waterborne illnesses and disease-carrying insects such as mosquitoes, fleas, and ticks.

ii. Higher death rates:

Today's scientists point to climate change as "the biggest global health threat of the 21st century." It's a threat that impacts all of us—especially children, the elderly, low-income communities, and minorities—in a variety of direct and indirect ways. As temperatures spike, so does the incidence of illness, emergency room visits, and death.

"There are more hot days in places where people aren't used to it," Haq says. "They don't have air-conditioning or can't afford it. One or two days aren’t a big deal. But four days straight where temperatures don't go down, even at night, leads to severe health consequences." Hundreds of heat-related deaths occur each year due to direct impacts and the indirect effects of heat-exacerbated, life-threatening illnesses, such as heat exhaustion, heatstroke, and cardiovascular and kidney diseases.

iii. Dirtier air:

Rising temperatures also worsen air pollution by increasing ground level ozone, which is created when pollution from cars, factories, and other sources react to sunlight and heat. Ground-level ozone is the main component of smog, and the hotter things get, the more of it we have. Dirtier air is linked to higher hospital admission rates and higher death rates for asthmatics. It worsens the health of people suffering from cardiac or pulmonary disease. And warmer temperatures also significantly increase airborne pollen, which is bad news for those who suffer from hay fever and other allergies.

iv. Higher wildlife extinction rates:

As humans, we face a host of challenges, but we're certainly not the only ones catching heat. As land and sea undergo rapid changes, the animals that inhabit them are doomed to disappear if they don't adapt quickly enough. Some will make it, and some won't. According to the Intergovernmental Panel on Climate Change's 2014 assessment, many land, freshwater, and ocean species are shifting their geographic ranges to cooler climes or higher altitudes, in an attempt to escape warming. They're changing seasonal behaviors and traditional migration patterns, too. And yet many still face "increased extinction risk due to climate change." Indeed, a 2015 study showed that vertebrate species—animals with backbones, like fish, birds, mammals, amphibians, and reptiles—are disappearing 114 times faster than they should be, a phenomenon that has been linked to climate change, pollution, and deforestation.

v. More acidic oceans:

The earth's marine ecosystems are under pressure as a result of climate change. Oceans are becoming more acidic, due in large part to their absorption of some of our excess emissions. As this acidification accelerates, it poses a serious threat to underwater life, particularly creatures with calcium carbonate shells or skeletons, including mollusks, crabs, and corals. This can have a huge impact on shellfisheries.

In January through March 2016, record high temperatures in the Pacific Ocean, fueled by global warming and a powerful El Niño, and caused mass bleaching throughout the Great Barrier Reef.

vi. Higher sea levels:

The Polar Regions are particularly vulnerable to a warming atmosphere. Average temperatures in the Arctic are rising twice as fast as they are elsewhere on earth, and the world's ice sheets are melting fast. This not only has grave consequences for the region's people, wildlife, and plants; its most serious impact may be on rising sea levels. By 2100, it's estimated our oceans will be one to four feet higher, threatening coastal systems and low-lying areas, including entire island nations and the world's largest cities, including New York, Los Angeles, and Miami as well as Mumbai, Sydney, and Rio de Janeiro.

There's no question – Climate change promises a frightening future, and it's too late to turn back the clock. We've already taken care of that by pumping a century's worth of pollution into the air nearly unchecked. "Even if we stopped all carbon dioxide emissions tomorrow, we'd still see some effects," Haq says. That, of course, is the bad news. But there's also good news. By aggressively reducing our global emissions now, "we can avoid a lot of the severe consequences that climate change would otherwise bring," says Haq.

What we can do to reduce the effects of Global Warming:

Nations around the world are upping their game in the fight against climate change. At the Paris climate summit in 2015, 195 countries signed a historic agreement to reduce their carbon emissions, with the goal of limiting future warming to well below 2 degrees Celsius.
It was a big step in the right direction. But it’s important to remember the equally vital contributions that can be made by private citizens.

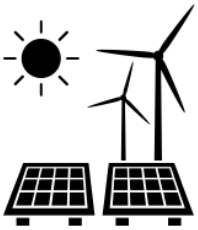
The goal is simple. Carbon dioxide is the climate’s worst enemy. It’s released when oil, coal, and other fossil fuels are burned for energy—the energy we use to power our homes, cars, and smartphones. By using less of it, we can curb our own contribution to climate change while also saving money.

Here are 10 easy, effective ways each one of us can make a difference:

1. **Speak up!**

What's the single biggest way you can make an impact on global climate change?
Talk to your friends and family, and make sure your representatives are making good decisions. By voicing your concerns—via social media or, better yet, directly to your elected officials—you send a message that you care about the warming world.
Encourage your local leaders to enact laws that limit carbon emissions and require polluters to pay for the emissions they produce.

2. Power your home with renewable energy:



Choose a utility company that generates at least half its power from wind or solar and has been certified, or an organization that provides renewable energy options. If that isn't possible, take a look at the electric bill; many utilities now list other ways to support renewable sources on their monthly statements and websites.

3. Weatherize:

Building heating and cooling are among the biggest uses of energy. You can make your space more energy efficient by sealing drafts and ensuring it's adequately insulated.

4. Invest in energy-efficient appliances:

Since they were first implemented nationally in 1987, efficiency standards for dozens of appliances and products have kept 2.3 billion tons of carbon dioxide out of the air. When shopping for refrigerators, washing machines, and other appliances, look for the Energy Star label. It will tell you which are the most efficient.

5. Reduce Wastage:

Wasting less food helps in cutting down energy consumption. And since livestock products are among the most resource-intensive to produce, eating meat-free meals can make a big difference, too.

6. Buy better bulbs:

LED lightbulbs use up to 80 percent less energy than conventional incandescent. They're also cheaper in the long run.

7. Drive a fuel-efficient vehicle:

Gas-smart cars, such as hybrids and fully electric vehicles, save fuel and money. Before you buy a new set of wheels, compare the fuel-economy performance.

8. Maintain your ride:

A simple tune-up can boost miles per liter anywhere from 4 percent to 40 percent, and a new air filter can get you a 10 percent boost.

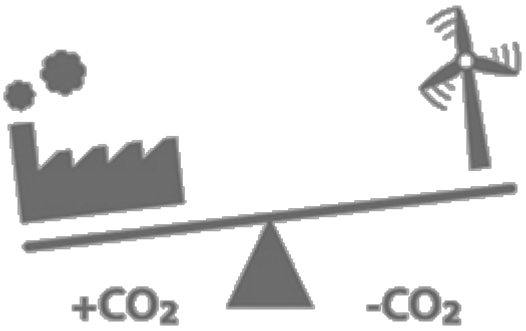
9. Rethink planes, trains, and automobiles:

Choosing to live in walkable smart-growth cities and towns with quality public transportation leads to less driving, less money spent on fuel, and less pollution in the air. Less frequent flying can make a big difference, too.

10. Shrink the carbon profile:

You can offset the carbon you produce by purchasing carbon offsets, which represent clean power that you can add to the nation's energy grid in place of power from fossil fuels.

Carbon Offsets:



Carbon offsets are a form of trade. When you buy an offset, you fund projects that reduce greenhouse gas (GHG) emissions. The projects might restore forests, update power plants and factories or increase the energy efficiency of buildings and transportation. Carbon offsets let you pay to reduce the global GHG total instead of making radical or impossible reductions of your own. By being just a little more mindful, we all can play our part in combating global warming. These easy tips will help preserve the planet for future generations. Scientists won't have to defy the space time continuum to keep life on planet earth from continuing.

Chapter 3: Part 1

What's Being Done

Treaties and Pacts – Organizations for Environment

Global environmental conventions – also known as treaties or agreements – are an integral part of the international environmental governance system. They are essential legal instruments to raise awareness, gather information, and promote coordinated action towards solving global environmental concerns such as biodiversity loss, climate change, desertification, and the management of hazardous chemicals and waste.

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The key areas of concern International Treaties is to regulate the following at a global level:

- Protection of animals and plants
- Planning the use and development of land
- Land, Agriculture, Mining and exploration and extractive industries
- Waste Management
- Climate Change and emission control
- Water resource Management
- Conservation of Natural and Cultural heritage

The Treaties are meant to:

- Set offences and penalties for causing harm to the environment
- Assess, control or stop certain activities which are harmful to the environment
- Set policies and standards for use of natural resources
- Enable members of the public to take part in environmental decision - making
- Create regulatory structures for protecting the environment
- Create specialized courts and tribunals and hold countries accountable for their pledges through signed agreements.

The degree to which countries have acted on their obligations under these conventions varies widely from country to country, and is largely unknown in the aggregate.

Some of the essential international treaties on environment are as follows:

- International Convention for the Prevention of Pollution of the Sea by Oil, 1954
  The treaty was to take action to prevent pollution of the sea by oil discharged from ships.

- The Ramsar Convention, 1971
  The Convention on Wetlands of International Importance, called the Ramsar Convention, is the intergovernmental treaty that provides the framework for the conservation and wise use of wetlands and their resources.

- MARPOL, 1973
  “Marpol," the short form for marine pollution, is also the name of an international convention for the prevention of environmental pollution from any sea going vessel.

- CITES, 1973
  CITES is a multilateral treaty to protect endangered plants and animals. It was drafted as a result of a resolution adopted in 1963 at a meeting of members of the International Union for Conservation of Nature (IUCN).

- Convention on Long-Range Trans – boundary Air Pollution, 1979
  The Convention is meant to improve air quality on the local, national and regional levels, UNECE member States and to focus on gradually reducing and preventing air pollution in the region. It also provides information on the effects of air pollution on ecosystems, health, crops and materials.

- Montreal Protocol, 1987
  It is an international treaty designed to protect the ozone layer by phasing out the production of numerous substances that are responsible for ozone depletion.

- Basel Convention, 1989
  The convention's objective was to protect human health and the environment against the adverse effects of hazardous wastes. Its scope of application covers a wide range of wastes defined as "hazardous wastes" based on their origin and/or composition and their characteristics, as well as two types of wastes defined as "other wastes" - household waste and incinerator ash.

- Convention on Biological Diversity, 1992
  The Convention has three main goals including: the conservation of biological diversity (or biodiversity); the sustainable use of its components; and the fair and equitable sharing of benefits arising from genetic resources.

- U.N. Framework Convention on Climate Change, 1992
  In 1992, countries joined an international treaty, the United Nations Framework Convention on Climate Change, as a framework for international cooperation to combat climate change by limiting average global temperature increases and the resulting climate change, and coping with impacts that were, by then, inevitable.

- Effect of Industrial Accidents, 1992
  The Convention is designed to protect people and the environment against industrial accidents. It aims to prevent accidents from occurring, or reducing their frequency and severity and mitigating their effects if required. It promotes active international cooperation between countries, before, during and after an industrial accident.

- U.N. Convention to Combat Desertification, 1994
  It was meant to combat desertification and mitigate the effects of drought through national action programs that incorporate long-term strategies supported by international cooperation and partnership arrangements.

- Kyoto Protocol, 1997
  The protocol commits State Parties to reduce greenhouse gas emissions, based on the premise that global warming exists and that human-made CO2 emissions have caused it.

- Paris Agreement, 2015
  It is an agreement within the United Nations Framework Convention on Climate Change (UNFCCC) dealing with greenhouse gases emissions mitigation, adaptation and finance starting in the year 2020.

Chapter 3: Part 2

What's Being Done

UN Sustainable Development and Millennium Goal

The Sustainable Development Goals (SDGs), otherwise known as the Global Goals, are a universal call to action to end poverty, protect the planet and ensure that all people enjoy peace and prosperity.

These 17 Goals build on the successes of the Millennium Development Goals, while including new areas such as climate change, economic inequality, innovation, sustainable consumption, peace and justice, among other priorities. The goals are interconnected – often the key to success on one will involve tackling issues more commonly associated with another. They provide clear guidelines and targets for all countries to adopt in accordance with their own priorities and the environmental challenges of the world at large.

The Resolution is broader intergovernmental agreement that, while acting as the Post 2015 Development Agenda (successor to the Millennium Development Goals), builds on the Principles agreed upon under Resolution A/RES/66/288, popularly known as The Future We Want. The SDGs were in large measure informed by the oft quoted assertion by United Nations Secretary-General Ban Ki-moon that "there can be no Plan B, because there is no Planet B."

On 25 September 2015, the 194 countries of the UN General Assembly adopted the 2030 Development Agenda titled *Transforming our world: the 2030 Agenda for Sustainable Development*. Following the adoption, UN agencies, under the umbrella of the United Nations Development Group, decided to support a campaign by several independent entities, among them corporate institutions and International Organizations.

The Campaign, known as Project Everyone, introduced the term *Global Goals* and is intended to help communicate the agreed Sustainable Development Goals to a wider constituency.

The SDGs have also met with several criticisms though. For instance, the decision to support what is an independent campaign, without the approval of the member states, has met resistance from several sections of civil society and governments, who accuse the UNDG of ignoring the most important communication aspect of the agreement: Sustainability. There are also concerns that Global Goals is a term used to refer to several other processes that are not related to the United Nations. None the less, the key agendas are broadly laid down under certain priorities headings.

The Official Agenda for Sustainable Development included the following goals:

1. **No Poverty** - End poverty in all its forms everywhere

- Extreme poverty has been cut by more than half since 1990 – however, more than 1 in 5 people live on less than $1.25 a day

- Poverty is more than lack of income or resources- it includes lack of basic services, such as education, hunger, social discrimination and exclusion, and lack of participation in decision making.

- Gender inequality plays a large role in the perpetuation of poverty and its risks; they then face potentially life-threatening risks from early pregnancy, and often lost hopes for an education and a better income.

- Age groups are affected differently when struck with poverty; its most devastating effects are on children, to whom it poses a great threat. It affects their education, health, nutrition, and security. It also negatively affects the emotional and spiritual development of children through the environment it creates.

2. **Zero Hunger** - End hunger, achieve food security and improved nutrition and promote sustainable agriculture

- Globally, 1 in 9 people are undernourished, the vast majority of these people live in developing countries

- Agriculture is the single largest employer in the world, providing livelihoods for 40 per cent of today's global population. It is the largest source of income and jobs for poor rural households. Women comprise on average 43 per cent of the agricultural labor force in developing countries, and over 50 per cent in parts of Asia and Africa, yet they only own 20% of the land.

- Poor nutrition causes nearly half (45 per cent) of deaths in children under five – 3.1 million children each year.

3. **Good Health and Well-being** - Ensure healthy lives and promote well-being for all

- Significant strides have been made in increasing life expectancy and reducing some of the common killers associated with child and maternal mortality, and major progress has been made on increasing access to clean water and sanitation, reducing malaria, tuberculosis, polio and the spread of HIV/AIDS.

- However, only half of women in developing countries have received the health care they need, and the need for family planning is increasing exponentially, while the need met is growing slowly - more than 225 million women have an unmet need for contraception.

- An important target is to substantially reduce the number of deaths and illnesses from pollution-related diseases.

4. **Quality Education** - Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all

- Major progress has been made for education access, specifically at the primary school level, for both boys and girls. However, access does not always mean quality of education, or completion of primary school. Currently, 103 million youth worldwide still lack basic literacy skills, and more than 60 per cent of them are women

- Target 1 "By 2030, ensure that all girls and boys complete free, equitable and quality primary and secondary education leading to relevant and Goal-4 effective learning outcomes"- shows the commitment to nondiscriminatory education outcomes

5. **Gender Equality** - Achieve gender equality and empower all women and girls

- Providing women and girls with equal access to education, health care, decent work, and representation in political and economic decision-making processes will fuel sustainable economies and benefit societies and humanity at large

- While a record 143 countries guaranteed equality between men and women in their Constitutions by 2014, another 52 had not taken this step. In many nations, gender discrimination is still woven through legal and social norms

- Though goal 5 is the gender equality stand-alone goal- the SDG's can only be successful if women are completely integrated into each and every goal

6. **Clean Water and Sanitation** - Ensure availability and sustainable management of water and sanitation for all

7. **Affordable and Clean Energy** - Ensure access to affordable, reliable, sustainable and modern energy for all

8. **Decent Work and Economic Growth** - Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all

9. **Industry, Innovation and Infrastructure** - Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation

10. **Reduced Inequalities** - Reduce income inequality within and among countries

11. **Sustainable Cities and Communities** - Make cities and human settlements inclusive, safe, resilient and sustainable

12. **Responsible Consumption and Production** - Ensure sustainable consumption and production patterns

13. **Climate Action** - Take urgent action to combat climate change and its impacts by regulating emissions and promoting developments in renewable energy

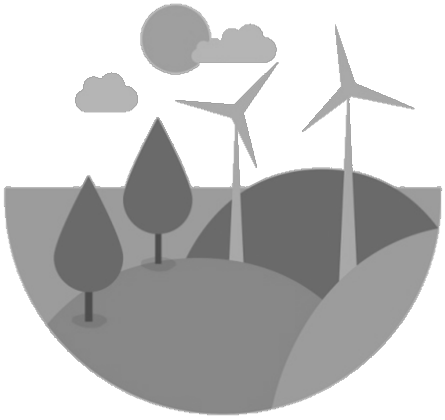
14. **Life Below Water** - Conserve and responsible use the oceans, seas and marine resources for sustainable development

15. **Life on Land** - Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss

16. **Peace, Justice and Strong Institutions** - Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels

17. **Partnerships for the Goals** - Strengthen the means of implementation and revitalize the global partnership for sustainable development

As of August 2015, there were 169 proposed targets for these goals and 304 proposed indicators to show compliance



Chapter 3: Part 3

What's Being Done

Being Green Ambassadors – YWCA of India

Humans and the environment have been interconnected through evolution. We cannot exist one without the other. The natural cycle of the earth relies on the balance which has been created over centuries. However, due to the human hunger to expand materialistic possessions and accumulate resources with selfish interests the delicate balance of the planet has been disturbed. Many scientists believe that there is no way to undo the damage we have caused; at best we can only slow the process of deterioration of the planet.

Therefore, many countries along with the United Nations have taken steps to contain the pollution levels that have caused dangerous repercussions and have threatened the persistence of species on earth. Therefore, in harmony with the need to conserve and preserve the environment, the YWCA of India has been consistently working on various programs and projects which are aimed at protecting our planet and reducing the harm caused by human interference.

Every four years, also known as the Quadrennium, the YWCA of India selects themes based on the pressing concerns of the society. During the year 2010 – 2014, one of the sub themes was titled ' Neighbor to the Earth' which ensured that the focus of the movement was geared to three broad aspects – firstly, to live up to its Christian basis to 'love your neighbor as yourself' (Matthew 19: 19), secondly to highlight the intertwined relationship of the earth with humans.

The theme was also inspired from Mother Teresa's words where she said, 'I want you to be concerned about your next door neighbor. Do you know your next door neighbor?'. Often times, we neglect those closest to us and take things for granted; much like the earth that sustains us. In order to open our eyes to the deterioration of our planet, the themes of the YWCA have included the need to protect and preserve our planet.

In continuation of this, the YWCA of India integrated the concept of protecting the environment into the next Quadrennium for 2014 - 2018, under the theme of 'Being Green

Ambassadors'. The theme ensured that the work of the YWCA to preserve the environment about social justice

continued to progress. To this day, many projects and programs have been conducted by the volunteers and partners of the movement which are focused not only on the environment but also encouraging people, especially young people to be empowered to understand the necessity of it, and to make a positive impact in their community, as per their own capacities.

Within the past few years, the YWCA in India has established various plantation drives, especially with the help of school students under the YDEEPA project (action oriented and awareness building project for young people between the ages of 8 – 18 years), and the creation of compost pits which is an effective and environmentally friendly solution for turning yard waste and kitchen scraps into a beneficial soil amendment. Besides, many of the buildings, hostels and guest houses of the YWCA now run on electricity generated by solar panels.

Besides many toolkits, IEC (Information, Education and Communication) material and publication centered on the theme is produced by the organization from time to time, for awareness building and advocacy.

Chapter 4: Part 1

The Road Ahead

4.1 Environment Heroes

Conferences and meets on climate change and environment protection regularly take place across the world. Leaders suggest policies, academicians write papers and debates rage across the world on the politics and effectiveness of environment protection policies. But without the effort and personal initiative of citizens towards the cause, these policies are mere pieces of paper.

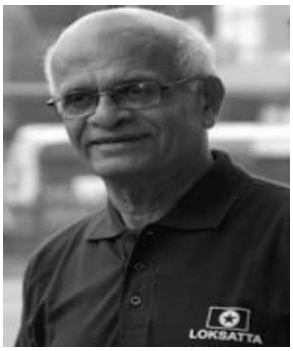
Following are stories of individuals and groups who single-handedly took it upon themselves to solve environmental issues. Their awe-inspiring achievements have helped to spread the message that every effort taken for a better environment counts.

1. Dr Kalu Dangar: Gujarat's Dandi Beach

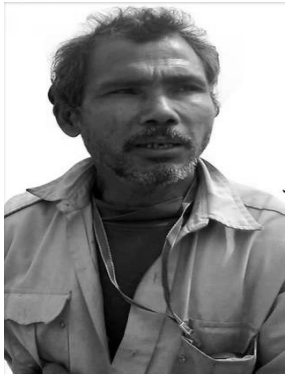
Every morning, Gujarat's Dandi beach sees a man in a khadi shirt picking up litter. He has been doing this relentlessly since the last four years. He walks the three-kilometer path by the sea daily, picking up each piece of litter, following which he cleans the main entrance and fills the overhead water tank. Every day, he hopes to see lesser waste than the day before.

2. V Balasubramanian: Saving Bengaluru's Lakes

V Balasubramanian, the former additional chief secretary of Karnataka and chairman of Centre for Policy and Practices made a prediction that Bangalore will have to be evacuated in the next 10 years if the water scarcity situation continues.
He drew a link between the scarcity of water and excessive pollution of the city's lakes. NS Ramakanth, a 77-year-old retired engineer, had it all figured out much before.



When he returned to India from Germany in 1989 to attend to his ailing mother, he was shocked by the filthy condition of the city's lakes. To this day, he can be seen chasing municipal officials to clean up the lakes in the city and motivating volunteers into getting involved in solving civic issues. He recently ran a campaign against the use of PoP-made idols during Ganesha Utsava which cause major damage to the lakes where they are immersed at the end of the festival. He encouraged the use of clay-made idols and made efforts to make them accessible to citizens.



3. Jadav Payeng: Restoring forest ecosystem

Three decades ago, a 16-year-old boy noticed a large number of reptiles dying in his home district in Assam's Jorhat. When he asked the village elders what would happen if they start dying like the reptiles, they told him that the reptiles died because they lost their homes - the forests.

This drove the young boy to get involved in a tree plantation project at Aruna Chapori near Golaghat. After the project was completed, he decided to stay back and cultivate the forest further.

Today the forest is spread across 1,300 acres and the young boy Jadav 'Molai' Payeng is now a frail 50-something ageing man but his battle continues. The forest is now home to Bengal tigers, Indian rhinoceros, over 100 deer and rabbits besides apes and several varieties of birds - including a large number of vultures. There are several thousand trees. Bamboo alone covers an area of over 300 hectares. A herd of around 100 elephants regularly visits the forest every year. In 2015 , Payeng was awarded the Padma Shri for his efforts, the fourth highest civilian award.

4. Dr. Vandana Shiva: Promoting Organic methods of farming

Born in Uttarakhand in 1952, Vandana Shiva is a determined protector of the environment. She is an Indian activist who opposed the modern day agricultural practices and the use of technology in agriculture.

Her campaign mainly focuses on the use of organic seeds and indigenous technology for agriculture and anti-globalization. Dr. Vandana Shiva strongly opposes the industrial model of controlling the seeds. A scientist by profession, Vandana Shiva has always questioned conventional wisdom. She is the founder of Navdanya, which conserves biodiversity and protects the farmers' rights. Dr. Vandana Shiva's father was also a protector of environment, which motivated Vandana since she was a child.

5. Arun Krishnamurthy: Reviving Lakes

An Indian environmental activist, Arun's efforts of initiating a campaign to clean various lakes of India and restoring them is praiseworthy.

Since his childhood, which he spent in a village near Chennai, Arun has been deeply motivated by the village head's effort to keep the pond water clean and encouraging people to throw the garbage at proper places. This young lad left his high profile job at Google and set a dream float to preserve the environment. Sensing his favorite lake getting polluted, Arun did not stay quiet and started cleaning the pond himself. His efforts influenced several other individuals and like-minded people and this was the beginning of a grand initiative and resolute campaign. A paradise for the kingfisher bird, the lake at Pallikaranai was getting polluted with construction debris and plastics. Arun and his band of youngsters started cleaning up the lake and revived it into a beautiful place.

Arun Krishnamurthy also founded an international organization, Environmentalist Foundation of India, better known as EFI. The organization mainly focuses on conservation of wildlife and restoration of habitats. Arun Krishnamurthy and his team at EFI have cleaned up various lakes in Chennai, Hyderabad and nearby places. Their campaign to restore the natural habitats all over the country has resulted into increased public awareness for environmental conservation.

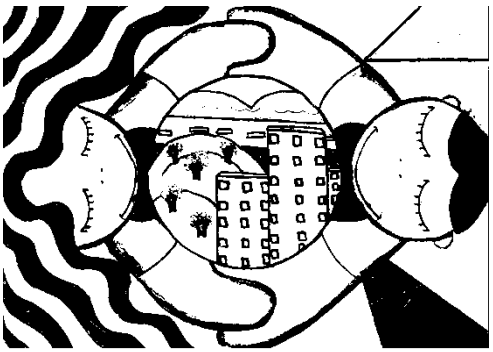
The team EFI works with the help of volunteer support across India. Arun Krishnamurthy and his team work on Sundays to clean up the lakes. Don't be surprised if you see a bunch of youngsters cleaning up your surroundings on a typical Sunday morning. They could be the crew members of EFI. As of 2015, Arun Krishnamurthy and his volunteers have revived more than 39 lakes across the country. He also started the 'Green Gramam', a strategy to build eco-friendly villages. Arun Krishnamurthy is also accredited with the setting up of more

than 19 biodiversity parks in several schools across India. His effort to clean a lake in Delhi got huge public support and appreciation from all quarters. The team uses scientific methods and techniques for restoration and cleaning the lakes.

At an age where the youth demands a comfortable and happy go lucky life, Arun Krishnamurthy stands out as an inspiration for Indians, making them aware of the urgent need for environmental conservation of resources. Arun Krishnamurthy and his group also organize weekly 'Lake Savaari' in an effort to connect people with the nearby surroundings. For his determination and dedication towards the cleaning of the lakes across India and other initiatives, Arun Krishnamurthy was awarded the Google Alumni Impact award in 2011 and Rolex Enterprise award in the year 2012.

4.2 Gender Justice and Environmental Sustainability

Women work closely with natural resources — and need to be closely involved in managing them, says Lakshmi Puri (UN Women Deputy Executive Director)



The first-ever United Nations Environment Assembly, that took place in Nairobi, Kenya, last month (23-27 June), came at a historic conjunction of events, as the international community discusses a new generation of Sustainable Development Goals and a post-2015 development agenda that will build on earlier successes and address gaps left over from the Millennium Development Goals.

The Assembly convened a Gender and Environment Forum and reviewed the Beijing Platform for Action, through which 189 countries adopted an agenda for empowering women close to 20 years ago (in 1995). The Forum's High-Level Panel specifically looked at Section K, which deals with women and the environment. And it found an unfinished agenda.

Close to nature

Activities traditionally carried out by women are closely linked to the environment. They are often tied to ecosystem goods and services, such as clean water, and influence and maintain ecosystem resilience.
For instance, UNICEF estimates that across 25 Sub-Saharan African countries women spend a combined total of at least 16 million hours each day collecting drinking water (compared with men's six million hours). In many regions, women's care work includes water use and management: cooking, cleaning, and laundry, which all require fetching and hauling water.

Similarly, women and girls spend a significant portion of their time (up to four hours a day each in Sub-Saharan Africa) performing subsistence tasks linked to natural resources, such as gathering fuel wood or growing vegetables to feed their families. This deprives them of time or access to other activities — like education, decently paid employment and leisure — that could enhance their welfare and wellbeing and that of their families. And it limits their options for social and political interaction outside the household.

Yet it also means women are well placed to understand first-hand how important environmental sustainability and resource management are for their families and communities.

In spite of this, women remain insufficiently recognised and involved in environmental policy-making and environmental management. This must change; achieving environmental sustainability, gender equality and women's empowerment are closely intertwined.

Platform needs political push

A major recommendation of last month's Forum was political commitment to and accelerated implementation of the Platform for Action agenda for empowering women.

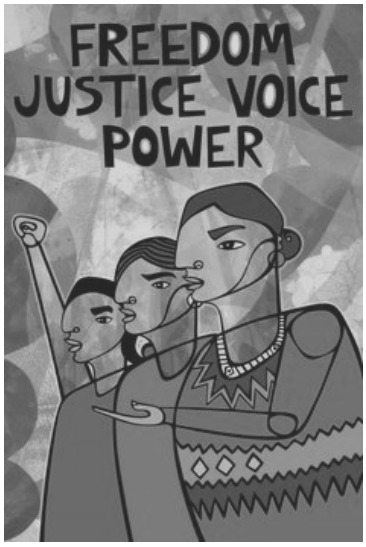
This requires renewed efforts by governments, civil society, the private sector and others. Supporting women's engagement in policy formulation — as professionals, resource users and members of women's organisations — is critical for all spheres of life, including for natural resource management.

"In spite of this, women remain insufficiently recognised and involved in environmental policy-making and environmental management. This must change; achieving environmental sustainability, gender equality and women's empowerment are closely intertwined." Lakshmi Puri

The post-2015 sustainable development agenda must put renewed focus on women, households and communities in the context of environmental management. And it must respect and uphold women's rights to essential environmental goods and services such as water, energy and food.

It will be crucial to put in place an environment that is conducive to gender equality more broadly — through promoting gender-sensitive legislation; enforcing existing legislation; making judicial systems more accessible and responsive to women; and providing legal aid to women seeking to claim their rights. For example, legal provisions and policies for improved access to adequate land are essential for women's economic empowerment.

Build on success stories



Despite obstacles, women everywhere show that they can be resourceful leaders, innovators and powerful agents of environmental change. One prominent example is the late Nobel Peace Prize winner Wangari Maathai and her Green Belt Movement in Kenya, through which women have planted more than 20 million trees on their farms, schools and church compounds, helping to conserve the environment and improve livelihoods.

There are many other successful initiatives led by amazing women, some of them recipients of the SEED Award for Entrepreneurs in Sustainable Development, which rewards local entrepreneurs that make real improvements in poverty eradication and environmental sustainability. In Colombia, through the business venture 'PROVOKAME', rural women produce, market, and distribute biodegradable plates made from natural fibres, recycled paper and seeds that may germinate after disposal. In Uganda, BanaPads Social Enterprise employs young rural women to manufacture and distribute sanitary pads produced from natural agricultural waste materials. The enterprise provides young entrepreneurial 'champions' with a complete start-up kit of inventory, training and marketing support.

These innovative initiatives and many more deserve greater support by governments and donors to take them to scale and broaden their impact. As the world experiences combined fuel, food, climate, economic and financial crises, now is the time to leverage our collective creativity — including that of the female half of our population — to find solutions to the world's challenges.

Gender equality needs to be front and centre in plans and policies to achieve environmental and economic sustainability. Such efforts will have the highest returns if women can exercise their collective voice as managers, decision makers, leaders, innovators, and contributors in all aspects of environmental management.

4.3 Youth Action for Environment: Awareness Building and Advocacy

Youth have both special concerns and special responsibilities in relation to the environment. A number of environmental risks and hazards disproportionately affect young people, who have to live for an extended period with the deteriorating environment bequeathed to them by earlier generations. Young people will be compelled to engage in new forms of action and activism that will generate effective responses to ecological challenges.

Many young people are keen to actually do their bit for the community, society and the environment. The green cause has been highlighted to people of all ages over recent years, and it is up to everyone to get involved in helping to protect the environment, including young people.

Helping the environment doesn't have to be complicated or even particularly time consuming. No matter what your age, there are many simple yet highly effective ways in which you can do your bit for the environment, both at home and out and about.

The 5 very simple yet effective methods include:

1. Turning things off when not in use:

Many people are guilty of leaving things on even when they are not using them. This could be anything from the light switch in the bedroom to the computer or the TV set. Even on standby, this can use up unnecessary energy, which impacts on the environment and household bills. Taking a second to switch things off when not in use is one of the simplest ways to do your bit.

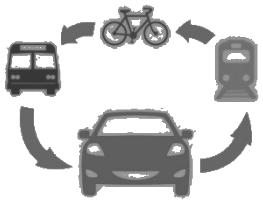
2. Avoid littering:

Littering is a big problem in many towns and cities in countries around the world. Another very simple way of helping the environment and helping to clean up the local area is to ensure that you do not litter. If you can't see a bin right next to you when you are out, just hang on to your rubbish and wait until you get to one.

3. Recycle your stuff:

Recycling is an important part of protecting the environment, and there are many things you can recycle. In fact, recycling can benefit you as well as the environment. You can recycle your old mobile phones or sell your clothes for cash, for example. Many of the things you own and no longer need or use can be recycled and in some cases you can get a little money back for them in to the bargain.

4. Cut back on car usage:



When you first pass your driving test in your teens and get a car, it can be sorely tempting to drive pretty much everywhere, even if you are only going around the corner. Be mindful about how much you are using the car, and if possible leave it at home and walk. This is healthier for you, cheaper, and means that you can go that extra mile to help the environment.

5. Get involved in a community project:

If you want to get more involved with protecting the environment, take some time to find out about local community projects or projects at school or college.

No matter how big or small your contribution is, every step you take towards protecting the environment is a step that will benefit the whole planet.

Life on Earth

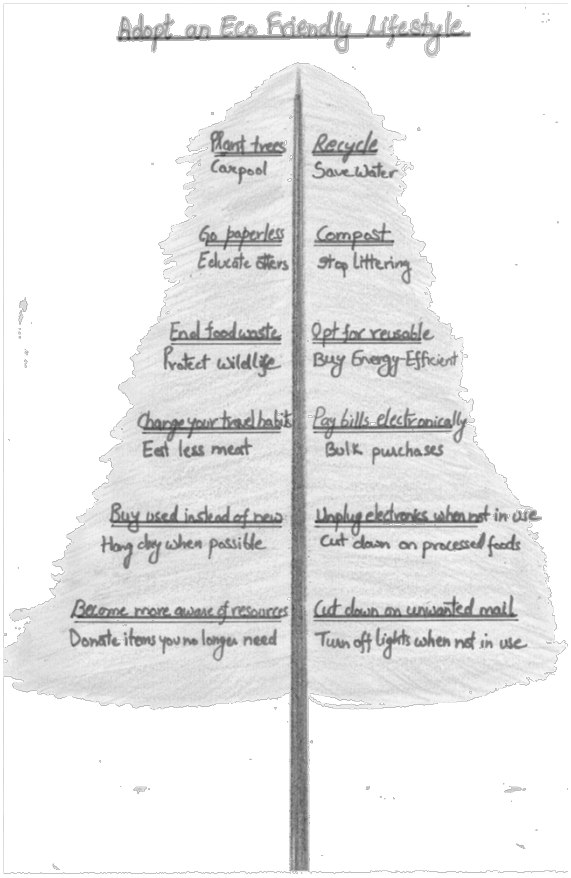
Upon this soil, my soil
Has, ever since my Birth
Held freedom as its goal
And roamed with ease on Earth

My hands and eyes and mind
I've used to prove my Worth
To no cause I've been signed
Nor lived to place out the Earth

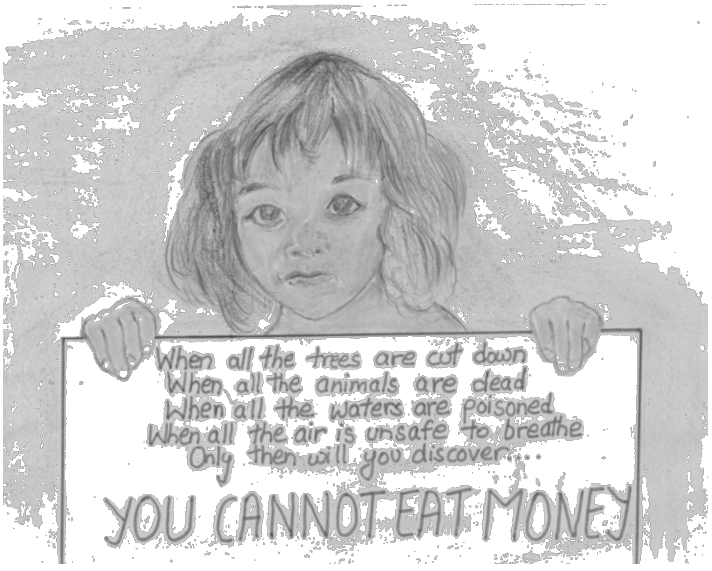
Yes other souls I've known
A few bestowed my Mirth
But most I left alone
Desiring place on Earth

Of fertile soil and plans
I'll one day find death
The mind and eyes and hands
Will reset as ease in Earth

~ Joanne Mary Ling – YWCA of Shimla



Images by Rohini Singh – YWCA of Shimla



Change is Now or Never

A friend used to tease me that I belonged to the "Save the Earth" brigade. This common attitude speaks volumes about our arrogance! The Earth does not need saving. We do. The Earth has been around for aeons, and will be for many more. Humans have been around, but for a brief period of time. And, if we continue to be arrogant, it might well be a brief interlude indeed. The Earth would continue merrily spinning around, just like the other inhabitable planets in our solar system.

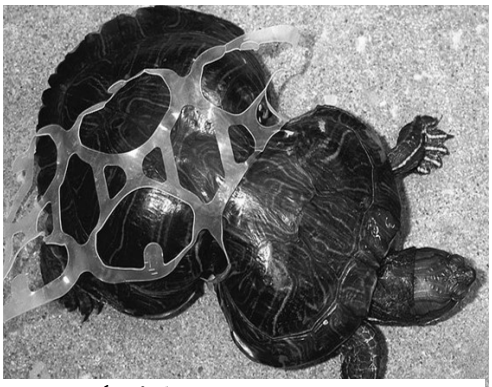
I grew up in a mining Town. When I was a kid I used to be awed by the huge open cast mine, and the huge bucket wheel excavators. Later, visiting the hills, I used to be fascinated by the tea gardens. But when I got a little older, these only bring to my mind the words of John Denver

"Why they try to tear the mountains down to bring in couple more,
More people, more scars upon the land"

The mines leave an ugly hole, and a huge pile of earth. The tea gardens must have once been lush sholas, with magnificent trees, and teeming with various fauna.

So why do we scar the land constantly? As Gandhi said, there is enough for everyone's need, but not for everyone's greed. Capitalism, as an economic philosophy, with its stress on consumerism, has failed mankind. Artificial demands are created through marketing, often by making people feel inadequate, to push useless things. Most of its technologies are 'violent'.

So what can we do, to save ourselves?


Peanut - the Tortoise

To start with every one of us should get an education, not just schooling. We should explore the natural world and learn about it, of how finely Nature is balanced, and of how everything in it is interrelated. We also need to read about the effects of our "development". Unless each one of us understands the issue, we can never be committed to the cause.
For example, this one image below haunts me. A magnificent sea turtle, which would probably outlive every single one of us, has been terribly deformed, by getting caught in a carelessly thrown piece of plastic, at some point in its life.

We need to be humble enough to understand that **we are a part of Nature - not its Master**. Taking time to consider the Universe and what a tiny speck the Earth is, as a part of it, and what we are in relation to that Earth, cannot but help us make humble, and less full of ourselves.

Though the problem may be huge, each one of us can integrate some small initiatives in our daily lives, to see if we can leave the world a better place for the future generations.

- **To start with we could limit our consumption.**

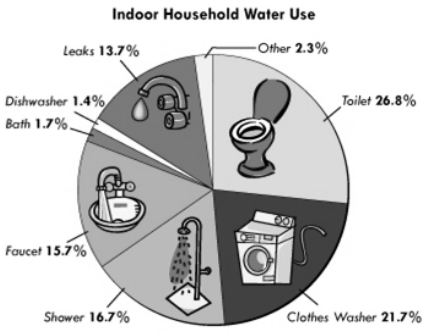
Before we buy something, we could ask ourselves if it is something we could do without. There is an environmental cost to everything we use, be it paper, a laptop, electricity, or whatever. Reuse, recycle whatever is possible. Nature's resources are finite, and just one species has heavily overdrawn on it!

- **Avoid using disposables**

Our lifestyles have changed so much in just a generation. There are non-biodegradable disposables and plastics everywhere. It is a pity that people even delay potty training their toddlers, since they can now use "Pampers"; without stopping to think of the environmental consequences.

Yes, disposables are convenient, but can we start to look at biodegradable alternatives? For instance, today plates and even spoons made of plant material are available. Most organic stores sell these. Indeed even here some designer ware is now available!

We can carry our own bags when we go shopping. Ever wonder where the plastic shopping bags go? Into some landfill or the other, leaching their poison into our water table, killing living things, and they do not degrade over years.



- **Collect and save water**

Water has always been taken for granted. So much so by our careless ways, today it has become a commodity, over which they say the next war will be fought. In many cities, lakes and marshes that used to be sources for recharging the water table have been

built upon. We could help by investing in inexpensive Rain Water Harvesting systems, and grey water recycling systems in our houses. In Chennai in 2001 the government took very strict measures to make citizens invest in RWH systems in individual houses, and apartment complexes. There was a positive result in subsequent years, with the water tables going up by over 5 meters.

We could also take shorter showers, or use a bucket and mug to bathe to save on water, as showers tend to waste a lot.

- **Use electricity carefully and sensibly**

We could turn electricity off, as soon as we are done with it. A TV on stand-by mode will still consume electricity, as would many other appliances. It is best to switch them off completely. Likewise, we could try to use natural light during day time, instead of electric lamps. Every small measure counts.

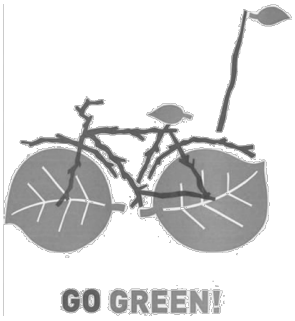
- **Go Organic or Buy local produce**

Organic farming, by its very nature, is congruent with Natural Systems. Chemical farming on the other hand poisons the earth, and the consumers. Organic food is healthier and free from poisonous chemicals. We could argue that it is expensive. Chemical farming is almost always subsidised, and hence cheaper. If more of us started consuming organic produce, then the economies of scale will apply there too, and the produce will become cheaper.

We could support our local producer, instead of buying some packaged stuff, transported over miles using precious resources in packaging and transport.

- **Walk or use a bicycle**

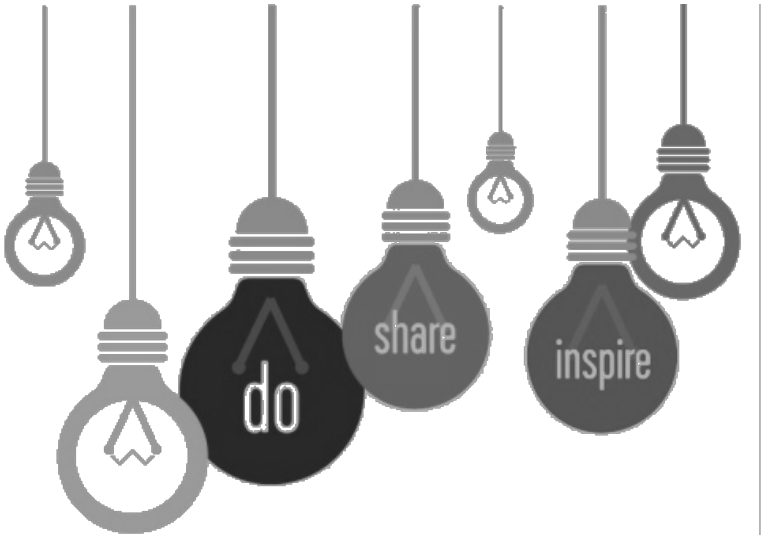
Our lifestyles have changed so much that we do not use our limbs, nor even public transport as much as we could. Where possible walk, or use bicycles.



➢ Be inspired, be an inspiration

There are stories of innovations on sustainability, of youngsters quitting high paying jobs to get back to the fields to practice sustainable, organic agriculture, of brilliant efforts in recycling, which abound the internet. Look them up, join groups, and seek other ways to be inspired. Then go on to be an inspiration yourself. Tread lightly!

Written By:
Suresh Kumar



Life on Earth

Plastic contraptions wrapped around necks

Of penguins, suffocating them, killing them.

Long straws lodged up a turtle's nose, that it lives its life

Longing for a breath of fresh air. How much longer do we need to

Understand that,

Thousands of innocent voiceless creatures that

Inhabit this earth are on the verge of being wiped

Out, all because each one of us do

Not bother to recycle our small pile of plastic waste? Think!

Size matters?

We as a human race,
Want the largest properties, biggest houses, tallest buildings, most money and so on…
Size has always mattered to us.

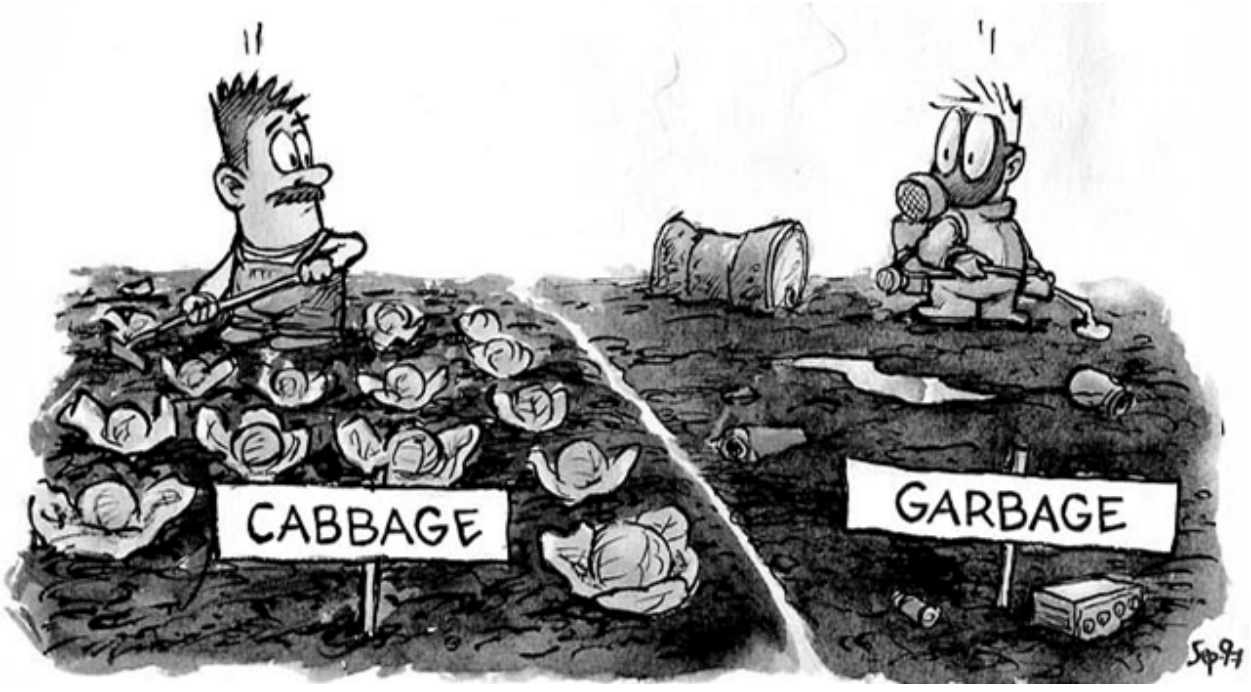
If size matters so much,
Shouldn't it matter that,
we are just one among the millions of life forms living on this earth?
Shouldn't it matter that,
in comparison to how big the earth is, we aren't even as big as a speck of dirt?
Shouldn't it matter that there are 500 million ant species but only 7 million of us?

Given how small we actually are,
Shouldn't we realize that we are the ones who are destroying the planet?

Would you destroy your neighbor's house, and leave them homeless just because you need more space to live?
Then why is it okay to cut trees and destroy forests, dry up or pollute rivers which leave millions of insects, birds and animals completely homeless?

Isn't all life sacred?
Don't all lives matter?
Or is it just human lives that matter?

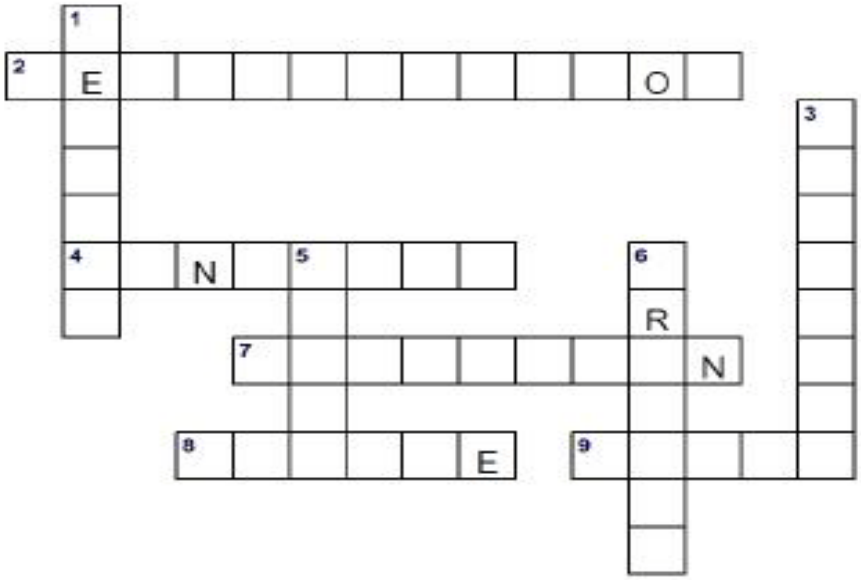
Written By:
Vrindha Pari



Crossword

ENVIRONMENT

Using the Across and Down clues, write the correct words in the numbered grid below.



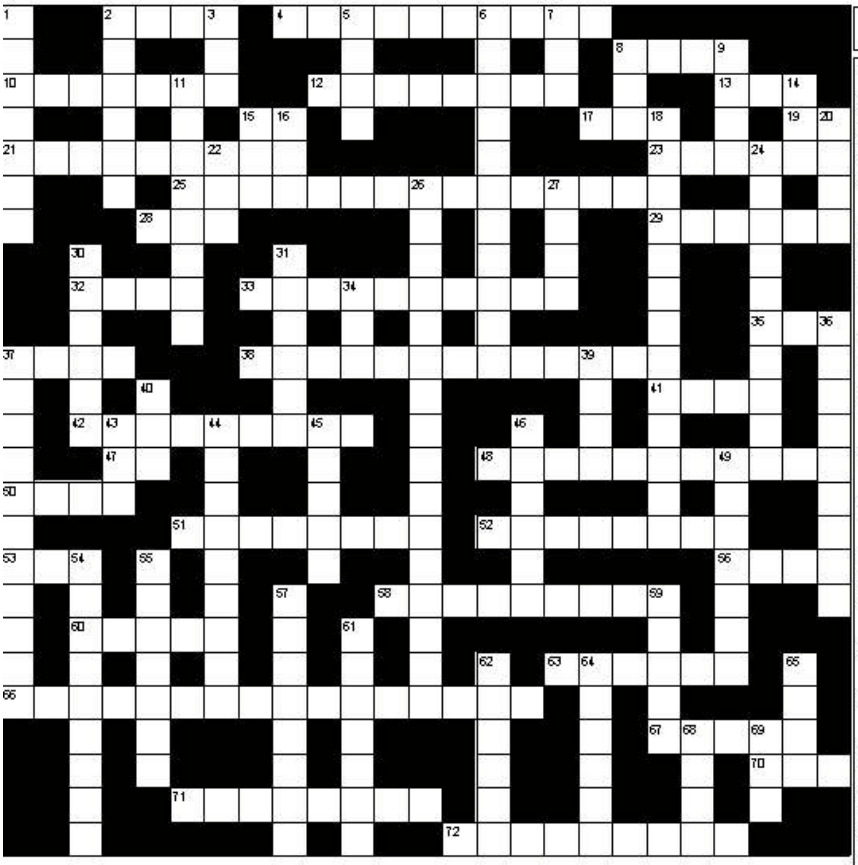
ACROSS

2. the act of cutting down or burning trees in a area
4. an area of land where large amounts of waste material are buried under the earth
7. something making land, water or sky dirty
8. to make less rubbish
9. to use something again

DOWN

1. to treat things that have already been used so they can be used again.
3. to keep safe from injury, harm, or destruction
5. a large number of water covering an area that is usually dry
6. to watch and help an animal or the environment

LANDFILL	RECYCLE	PROTECT	PRESERVE
POLLUTION	FLOOD	REDUCE	REUSE
DEFORESTATION			



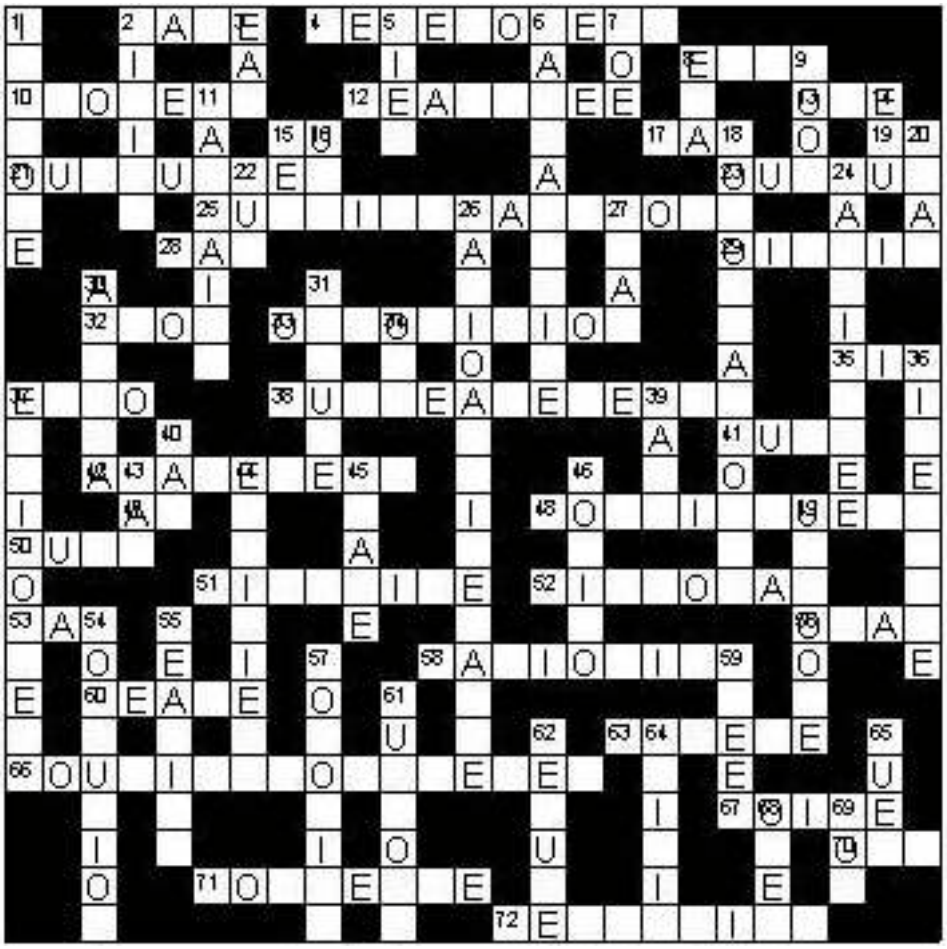
Across

2. To conserve (4)
4. People who use land for new buildings (10)
8. Large deer (4)
10. Take care of (7)
12. Without the chemical Pb (4, 4)
13. Solid material from which metal is extracted (3)
15. A dialect of Chinese spoken in the Kiangsu and Chekiang Provinces (2)
17. Congestion i.e. traffic _ _ _ (3)
19. A gas used in crowd control (2)
21. To be more (9)
23. Productivity (6)
25. Vehicles carrying fare-paying passengers (6, 9)
28. A clean fuel (3)
29. Large platform used for extracting petroleum (3, 3)
32. Polluted fog (4)
33. Resistance or disagreement (10)
35. Zero (3)
37. A repeated sound (4)
38. Atomic power (7, 6)
41. A layer of grass (4)
42. Understanding (9)
47. The indefinite article (2)
48. Coal or gas, for example (6, 5)
50. A rare precious stone of purplish-red in colour (4)
51. Tall buildings (4, 4)
52. Getting rid of nuclear waste (7)
53. A rest (3)
56. Egg-shaped (4)
58. A system of distribution other than price (9)
60. We do not own the earth; we just _ _ _ _ _ it! (5)
63. A plan (6)
66. Holiday villages (7, 9)
67. Unwelcome sounds (5)
70. Elderly (3)
71. Save or protect (8)
72. Using again (9)

Down

1. Make better (7)
2. Locating (6)
3. Consume (3)
5. Panorama (4)
6. Leave your car and take the bus (4, 3, 4)
7. Small deer (3)
8. A period of time (3)
9. Black substance found in chimneys (4)
11. Programme of action (8)
14. European Currency Unit (3)
15. WWW or World Wide _ _ _ (3)
16. The address of a page on the WWW (3)
18. Charges for using fast roads (8, 5)
20. A male deer (4)
22. A means of public transport (3)
24. Charge for leaving your car (7, 3)
26. Unusable by-products of nuclear power (11, 5)
27. Scheme (4)
30. Allergic respiratory disease (6)
31. A coniferous tree (6)
34. A nocturnal bird (3)
36. Way of living (4, 5)
37. Surroundings (11)
39. Rodents found in sewers (4)
40. Prohibition (3)
43. A direction (3)
44. Productive with minimum waste (9)
45. A general fear, often without reason (5)
46. A theory that one event will cause a sequence of similar events (6)
49. To set free (7)
54. Contamination of the environment (9)
55. Means of keeping warm (7)
57. Car driver (9)
59. Environmentally friendly (5)
61. Assist (7)
62. Cut down on (6)
64. A person who censures (6)
65. Fossil _ _ _ _ (4)
68. A warning sign (4)
69. Help! (3)

Answer



Think Tank

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