# COMMUNITY HEALTH II

DIPLOMA IN CLINICAL MEDICINE & SURGERY

KMTC MWINGI CAMPUS

1ST YEARS, MARCH 2019 [YR 1 SEM 2]

# MODULE 24:

## 2.24: COMMUNITY HEALTH II

**Code: CMCH12; Hours - 30; Credits - 3**

# Module Competence

- This Module is designed to equip the learner with knowledge, skills and attitudes necessary to identify environmental factors that have adverse effects on health and environment.

# Module Units

| Module Units | Hours |
|---|---|
| 1. Introduction to Environmental Health and pest control | 10 |
| 2. Waste management and housing | 10 |
| 3. Water supply and food hygiene | 10 |

# Module Learning Outcomes

- By the end of this module, the learner shall be able to: -

1. Assess the various environmental factors that have adverse effects on health
2. Identify factors that influence housing in relation to health and waste management
3. Apply hygienic methods in food handling, storage and water supply.

# Module Content

1. **Introduction to environmental health:** definitions, types of environment, factors influencing the environment, pest control, pollution: sources of pollution and its control.
2. **Waste management and housing:** Definition, types of waste, disposal methods and sewage treatment. Housing: definitions, house patterns in the community, characteristics of a good house and diseases associated with housing.
3. **Water supply and food hygiene:** Definition, sources, protection, sampling, treatment and storage, water borne diseases. Food hygiene: definition, handling and storage, food spoilage, hygiene principles, common poisonous foods, milk and milk products. Public Health Act (Cap 242)

# Reference


1. Cannolly, M.A. (ed), (2005). Communicable Disease Control in Emergencies: A Field Manual. Geneva: WHO
2. Service, M. (2008). Medical Entomology, 4th Cambridge: Cambridge University Press.
3. Afubwa, S.O.and Mwanthi, A.M. (2014). Environmental Health and Occupational Health & Safety. Nairobi: Acrodile Publishing Ltd.
4. Peirce. J., Vesilind, P.A. and Weiner, R (1997). Environmental Pollution and Control, 4th ed. Madison: Butterworth-Heinemann
5. Government of Kenya. (1999). Environmental Management and Coordination Act. Nairobi: Government Printers.
6. Chesworth, N. (1999). Food Hygiene Auditing. Philadelphia: Springer Publishing.

# Reference – Continued


7. Mortimore, S. and Wallace, C. (1998). HACCP: A Practical Approach (Practical Approaches to Food Control and Food Quality Series), 2nd ed. Philadelphia: Springer Publishing.
8. Blanch, S. (2003). Food Hygiene> London: Hodder Education.
9. Ministry of Health. (2008). The National Healthcare Waste Management Plan for 2008-2012. Nairobi: Government Printers.

# Mode of Learning

1. Interactive Lectures
2. Participatory learning
3. Group Discussions
4. Assignments

## Definition:

**Health: (WHO)** - A state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity.

**Environmental Health:**

- Comprises those aspects of human health, including quality of life, that are determined by physical, chemical, biological, social, and psychosocial factors in the natural environment. Or
- It also refers to the theory and practice of assessing, correcting, controlling, and preventing those factors in the environment that can potentially affect adversely the health of present and future generations.
- Involve the study of all the physical, chemical, and biological factors external to a person, and all the related factors impacting behaviour.

- It encompasses the assessment and control of those environmental factors that can potentially affect health.
- It targets preventing disease and creating health-supportive environments.
- It encompasses the assessment and control of those environmental factors that can potentially affect health.
- It targets preventing disease and creating health-supportive environments.
- Environmental health describes the aspects of health related to or emanating from your interaction with the environment.

# Scope of practice of Environmental Health.

The practice of environmental health in the public and private sector includes prevention of environmental health hazards, the promotion and protection of the public health and the environment in the following areas:-

- Food protection.
- Housing.
- Institutional environmental health.
- Land use.
- Community noise control.
- Recreational swimming areas and waters.
- Electromagnetic radiation control.
- Solid, liquid, and hazardous materials. management
- Underground storage tank control.
- Onsite septic systems.
- Vector control.
- Drinking water quality.
- Environmental sanitation.
- Emergency preparedness.
- Milk and dairy products, etc.

## Broad Scope of practice

1. Sanitation and hygiene promotion
2. Food safety & quality control
3. Occupational Health & Safety
4. Water safety & quality control
5. Vector & Vermin Control
6. Pollution Control and Housing
7. Disease control
8. Institutional /general inspections
9. Public health law enforcement

## Community health

- This is the science and art of preventing disease, prolonging life and health efficacy through organized community effort. Or
- It's the science and art of promoting health and preventing diseases through organized community participation.
- The term 'community health' is also referred to as:
  - ✓ Population medicine
  - ✓ Social medicine
  - ✓ Community medicine
  - ✓ Preventive medicine

**Public Health:**

Field of medicine and hygiene dealing with

- ✓ Prevention of disease
- ✓ Promotion of health
- ✓ Treatment of minor ailments

- ❑ The promotion of health and the prevention of disease through the organized efforts of society
- ❑ Public Health focuses on the health of populations and communities rather than individuals. ….social, physical and political environments play major roles in the amelioration of the problem.

## Community

- A community is a group of people (a large or small group) living in a certain geographical area and working together for a common goal.
- They share the same resources such as water, climatic and geographic conditions, health services, administration and leadership, as well as disadvantages such as shortages, risks and dangers.

## Environment

- The sum total of all surroundings of a living organism, including natural forces and other living things, which provide conditions for development and growth as well as of danger and damage.
- Also defined as "the sum of all external conditions affecting the life, developments and survival of an organism".
- is all that which is external to the individual human host
- The term environment comes from the French word **"environmer"** which means 'surroundings'.
- Comprises all things that make up your surroundings,
- Everything, which surrounds us whether, living or a non-living is a component of our environment.
- It includes the air we breathe, the water we use for our needs, the soil we cultivate, the flora and the fauna we enjoy.

- The external conditions include both physical and biological. By physical conditions (also called physical environment) we mean non-living attributes like air, water, soil, climate, heat, light, noise, housing, radiations, and debris, whereas the biological factors (also called biological environment) include all types of flora, fauna and the micro-organisms.
- The physical and the biological environments are interdependent. For example, deforestation leads to decline in wildlife population (biological environment) as well as increase in atmospheric temperature (physical environment).
- In the human environment social conditions like customs, religion, habit, and occupation are also included since they affect the living conditions.

## Types of Environment:

1. Biological environment
2. Physical environment
3. Socio-cultural environment
4. Economic / political environment
5. Technological environment

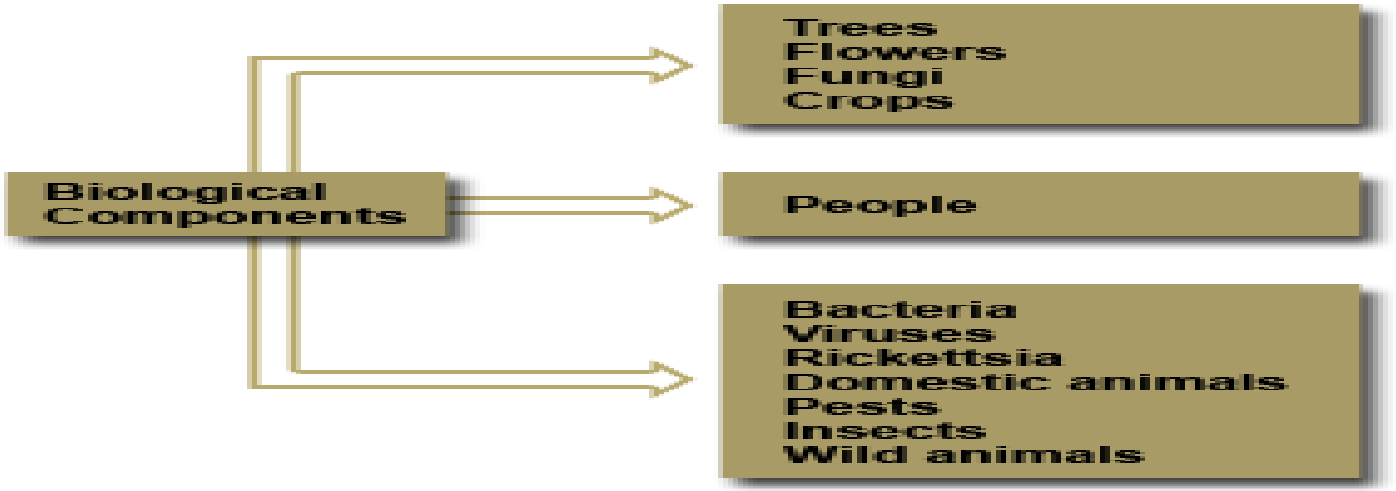
1. Biological environment
   - ✓ All types of flora, fauna and the micro-organisms.
   - ✓ Plants, animals, micro-organisms
2. Physical environment
   - ✓ Air, water, soil, climate, heat, light, noise, housing, radiations, and debris, rocks, minerals, temperature, humidity, wind, rain, other related non-living elements
3. Socio-cultural environment
   - ✓ Customs, religion, habit, culture, family, kinship, cultural pressures on lifestyle, factors like personal, domestic.
4. Economic / political environment
   - ✓ Occupation, resources, governance, infrastructure
5. Technological environment
   - ✓ Internet, new technology

## 1. Biological Environment

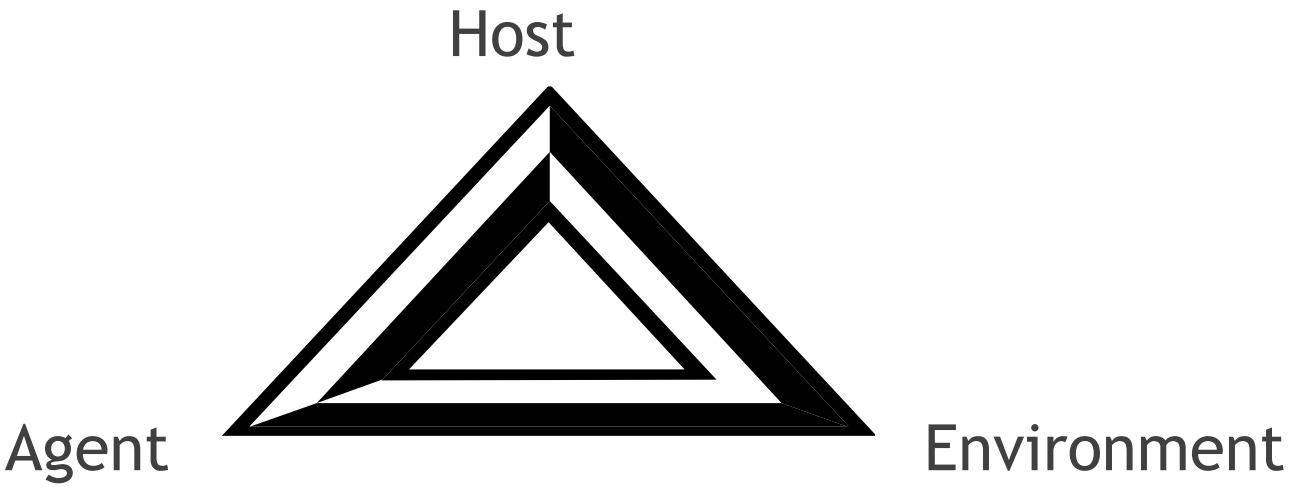
- is made up of living things, which include plants, people and animals.
- Includes the influence of all biological factors such as warmth, moisture and humidity.
- It influences vectors, humans and plants serving as reservoirs of infection. It is the interaction of the agent, the host and the environment which determines whether or not a disease develops, and this can be illustrated using the epidemiologic triangle.
- The **epidemiologic triangle** depicts the relationship among three key factors in the occurrence of disease or injury - agent, environment and host.
- An agent is a factor whose presence or absence, excess or deficit is necessary for a particular disease to occur. The agents comprises of the disease causing organisms like bacteria, viruses, parasites, protozoa, fungi etc.

- Plants provide vegetables, fruits, tubers and seeds as food. Trees act as windbreakers, provide firewood, charcoal, timber and paper among others. They also influence weather patterns.
- Human beings (people) and their activities can be a big source of infection. For example, overcrowding and slum settlements brought about by urbanisation, can promote the transmission of diseases, especially those diseases that are spread through droplets and contact.
- Animals: Domestic animals such as cattle, sheep, goats and poultry provide meat, milk and eggs for consumption. Cats and dogs are kept as pets, but they can also transmit diseases such as cat scratch fever and rabies, respectively. Other hazards include snakebites, which can be fatal and insect bites, which may act as vectors of various diseases.

## Biological Environment:



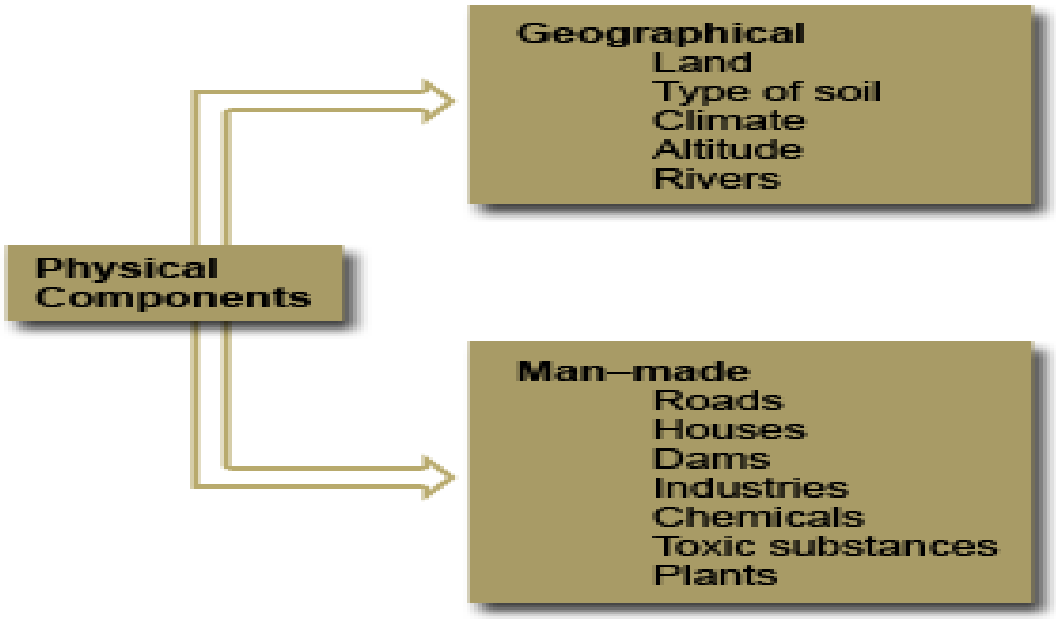

## Epidemiological Triangle



## 2. Physical Environment:

- It is the product of nature where there is no direct or indirect effect of human activity
- It relates to the material and tangible conditions in which we live in.
- It also refers to geographical climate and weather or physical conditions wherein and individual lives.
- The physical components of the environment are divided into geographical and man-made components.
- Land is used for settlements. The type of soil, climate and altitude determine the type of crops that can be grown in a specific area.
- cold climates encourage respiratory diseases and joint problems such as arthritis. Some diseases are associated with hot climates like malaria.
- Each type of climate has its own pattern of vegetation and animals to control. Man has to adjust to the animals and the vegetation since they affect health. Additionally, to adjust to the different temperatures man has to use appropriate clothing.

## Physical Environment:




**Remember:** Most micro-organisms that cause disease are transmitted through air, water and food.

Therefore, constructing houses too close to a dam or where animals are kept facilitates the transmission of vector borne diseases. Industrial wastes that consist of chemicals and toxic substances, may also pollute the water, air and food.

**The concerns of physical environment are;**

- Built environment – houses, roads, transport systems, buildings, infrastructure etc.
- Socio-economic and Cultural – the social and economic characteristics of the societies and communities in which we live in.
- A clean, beautiful and healthy environment- is attractive and important for people's physical and emotional wellbeing. Factors such as clean air and good quality drinking water are vital for people's physical health.
- Noisy environment- can cause both physical harm and psychological stress.
- A healthy environment also provides recreational opportunities, allowing people to take part in activities they value.
- The 'clean, green' environment is also an integral part of national identity, and guardianship of the land and other aspects of the physical environment.

**Physical environmental effects on health.**

The physical environment is an important **determinant of health** influencing the prospects of health in many ways;

i. Air quality affects people's health and especially that of people with respiratory diseases.
ii. Infectious diseases may be transmitted through water, air and food.
iii. Quality of housing affects many aspects of people's health.
iv. The attractiveness of the environment influences people's readiness to be physically active and to socialize with their neighbours.
v. Toxic materials in the environment can cause disease and interfere with development.
vi. Road design and transport systems affect the risk of accidents.
vii. Access to green space is good for mental health, fresh air and friendly environment.

**Note**

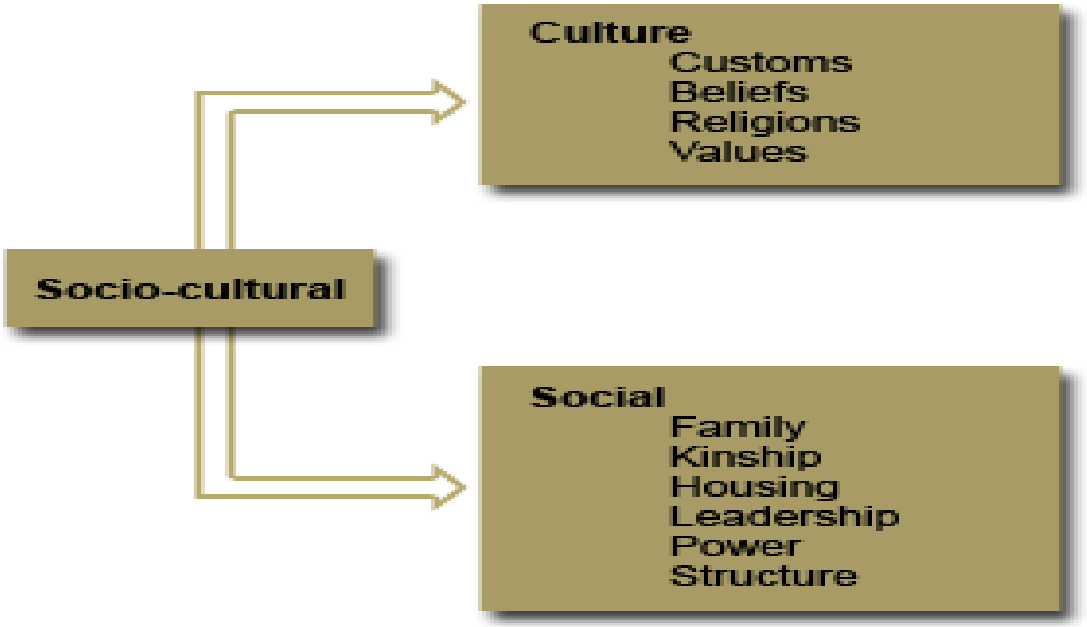
**Greenhouse gases and climate change.**

- One important way in which man is damaging his physical environment is through emissions of carbon dioxide and other greenhouse gases like CFCs (Chlorofluorocarbons)
- The rise in carbon dioxide concentration in the atmosphere is resulting in global warming and climate change.
- Unless we drastically reduce the rate of carbon dioxide emission into the atmosphere the ability of the planet to support life will be seriously damaged.
- The United Nations Organization has therefore set a target to reduce carbon dioxide emissions by 80% by 2050.

## 3. Socio-Cultural Environment

- The social environment, sociocultural context refers to the immediate physical and social setting in which people live or in which something happens or develops. It includes the culture that the individual was educated or lives in and the people and institutions with whom they interact.
- Social environment includes an individual's social, economic and political condition wherein he lives. The moral, cultural and emotional forces influence the life and nature of individual behaviour.
- Solidarity - People with the same social environment often develop a sense of social solidarity. They often tend to trust and help one another and to congregate in social groups. They will often think in similar styles and patterns even when their conclusions differ.
- Customs and beliefs have an effect on human health.
- It is important to listen to the community's reasons for their beliefs and practices. This will facilitate the choice of the health measures and suitable solutions after
- Some of the health issues affected by these Socio-Cultural environment are food habits and cooking practices. Different communities have different food habits and cooking practices.

## Socio-cultural Environment




**The impact of social and cultural environment on health.**

- The influence of social and cultural variables on health involves dimensions of both time as well as place. The contexts in which social and cultural variables operate to influence health outcomes are called the social and cultural environment.
- The social determinants of health can be conceptualized as influencing health and the life course.

## 4. Economic / political environment

- These components include work, money and government.
- The economic factor relates to both rural and urban economies as well as local community organisation. Rural and urban economics will determine to a great extent the quality of environmental health. People can change their environment either positively or negatively. Some of these changes are described as development.
- Some development projects may make the environment healthier, while others make it a suitable habitat for diseases.
- The government involves political influences into development policies.
- The government develops policies, which enforce environmental health. It also plays a great part in influencing the implementation of health activities. Political instability causes unrest, insecurity and psychological problems. Management of disease outbreaks may be lacking as health facilities may be destroyed.

## Political Environment

Refers to the actions taken by the Government, which potentially affects the daily business activities of any business, company or public facilities.

- According to the Law, such actions occur on a local or international scale depending on the governmental authority.
- The political environment is the state, government, its institutions, public and private stakeholders who operate that system.
- Political environment includes the political culture i.e. "widely held views, beliefs and attitudes concerning what governments should try to do and the relationship between the citizens and the government."
- Political culture includes peoples participation and involvement in the electoral process and the level of government acceptance by the population. This is of importance in countries where democratic processes are practiced, like Kenya.
- The political process is important in policy development, implementation and reform.
- Policy reform is inevitably political because it seeks to change who gets valued goods in the society.

**The Political Spectrum**

- Political constructs are integrated bodies of ideas (ranging from simple to very complex) that constitute socio-political platforms for different societies. A variety of political ideologies exists in the same society.

**Political ideologies practiced in Kenya:**

**Democracy.**

- Involves wide participation by citizens in the decision-making process.
- Freedom of expression.
- Voting rights for election of representatives.
- Independence of judiciary.
- Limited terms of elected officials.
- Empowerment of the citizens.

- Assurance of political rights of citizens as indicated by:
  - ✓ Fair and competitive elections.
  - ✓ Power for elected representatives.
  - ✓ Safeguards on rights of minorities.
  - ✓ Freedom of press.
  - ✓ Equal rights of everyone under the law.
  - ✓ Personal social freedom.

Democracy in its purest form hardly exists. Various forms of representative in our Governments exists. The major forms include:

- Presidential: Direct election of a president who is in power for a limited period of time.
- Governorship: Direct election of a Governor who is in power for a limited period of time.
- Senatorial: Direct election of a Senator who is in the senate for a limited period of time.
- Parliamentary: Members of Parliament. Party with a majority of elected representatives and higher numbers of votes form the Government.
- Member of County Assembly (MCA): Represents the people's views at County Assembly level.
- Women representative: Represents women views at national level.

## Economic Environment

- It's the totality of economic factors, such as employment, income, inflation, interest rates, productivity, and wealth, that influence the buying behavior of consumers and institutions.
- Environmental economics undertakes theoretical studies of the economic effects of national or local environmental policies around the world.
- Particular issues include the costs and benefits of alternative environmental policies to deal with air pollution, water quality, toxic substances, solid waste and global warming.

**Market failure.**

- Central to environmental economics is the concept of market failure.
- Market failure means that markets fail to allocate resources efficiently. A market failure occurs when the market does not allocate scarce resources as per the demand.

## Economic Market Development

Global markets can be divided into five categories based on the criterion of gross national product per capita:-

1. Pre-industrial countries - Limited industrialization, low literacy rates, high birth rates, heavy reliance on foreign aid, political instability, little market potential – (parts of Sub-Saharan Africa).
2. Less developed countries - Early stages of industrialization, growing domestic market, mature product markets, increasing competitive threat.
3. Developing countries - Decrease in percentage of agricultural workers, industrialization, rising wages, high literacy rates, lower wage rates than developed countries, formidable competitors.
4. Industrialized countries - Moving towards post industrialization, high standard of living.
5. Advanced countries - Post industrialization, information processors, knowledge based, less machine based. Product opportunities are in new products, innovations and raw materials plus fresh foods.

## 5. Technological Environment (Internet, New Technology).

- It’s the development in the field of technology which affects business by new inventions of productions and other improvements in techniques to perform the business work.
- We see that in 21st century, technology is changing fast. Now, all work is done online and business shops are using machinery at high level.

**Health and Technology.**

(How technological environment is affecting health positively and negatively)

- Technology can have a large impact on users' mental and physical health.
- Being overly connected can cause psychological issues such as distraction, narcissism, expectation of instant gratification, and even depression.
- Besides affecting users' mental health, use of technology can also have negative repercussions on physical health causing vision problems, hearing loss, and neck strain. Fortunately, there are steps that can be taken to help alleviate these health issues.

**Technology and psychological issues**

Digital technology can be harmful to your health.

**1. Digital eyestrain.**

- When we gaze at a screen for long periods of time, we often forget to blink. In fact, research has shown we blink 10 times less than usual, which means the tears that protect our eyes evaporate without being replaced. Additionally, reading the smaller fonts on a smartphone or other portable device can intensify the strain.

**2. Sleep disorders.**

- We love our devices so much that many of us even sleep with them.
- It might seem like a harmless habit, but late-night technology use can interfere with your ability to sleep.
- “Artificial light exposure between dusk and the time we go to bed at night suppresses release of the sleep-promoting hormone melatonin, enhances alertness and shifts circadian rhythms to a later hour, making it more difficult to fall asleep.
- To avoid sleep disruption, try replacing late-night technology use with sleep-conducive activities such as taking a bath or reading in bed.

**3. Physical inactivity**

- When we're using technology, we generally aren't exercising. That's why there's an increasing body of research linking overuse of digital devices to a drop in exercise and fitness levels.

**4. Neck and back problems**

- According to research, smartphones are responsible for the rise in the number of young people with back and neck problems, as the amount of time spent leaning over small phone screens can put spinal discs under pressure.

**5. Tunes tinnitus.**

- Unfortunately, most hearing loss or tinnitus caused by noise exposure is permanent.
- Listening to any sound at a high volume, more than 89 decibels for more than five hours a week can damage hearing permanently over time. Listening to music at a loud volume is a common risk factor yet research has found that 39 per cent of 18 to 24 year olds listen to their favourite tunes at a dangerously loud volume.

**6. E-mentia.**

- Our ability to read a map and even remember phone numbers faces extinction due to our reliance on modern technology.
- Overreliance on computer aids of all kinds may rob our brains of the stimulation they need to stay healthy.
- Research suggests that people who don't regularly challenge themselves intellectually through work or learning are more likely to suffer from dementia (insanity) in later life.

**7. Laptop laziness.**

- While fitness trackers and running apps can encourage exercise, the chances are that modern technology is only contributing to your sedentary lifestyle. Gaming, online shopping and mindless eating in front of laptops and tablets mean that you're probably moving about less. Studies shows that physical inactivity causes twice as many deaths as obesity.

**8. Screen strain.**

- We spend nearly 50 hours a week looking at computer screens, according to research conducted by the College of Optometrists. But prolonged use can result in what has been dubbed "computer vision syndrome", with symptoms including eye strain, double vision and temporary short-sightedness.

## ELEMENTS OF ENVIRONMENT

- Environment is constituted by the interacting systems of physical, biological and cultural elements inter-related in various ways, individually as well as collectively.
- These elements include:-

**1. Physical elements**

- Physical elements are as space, landforms, water bodies, climate soils, rocks and minerals.
- They determine the variable character of the human habitat, its opportunities as well as limitations.

**2. Biological elements**

- Biological elements such as plants, animals, microorganisms and men constitute the biosphere.

**3. Cultural elements**

- Cultural elements such as economic, social and political elements are essentially man-made features, which make cultural milieu.

## FACTORS INFLUENCING ENVIRONMENT:

- Environmental factors. An identifiable element in the physical, cultural, demographic, economic, political, regulatory, or technological environment that affects the survival, operations, and growth of an living things.
- An environmental factor, ecological factor or eco factor is any factor, abiotic or biotic, that influences living organisms. Abiotic factors include ambient temperature, amount of sunlight, and pH of the water soil in which an organism lives.
- Environmental factors entail everything that changes the environment. Some factors are visible, while others cannot be seen. In some situations, only the effects of environmental changes are evident. Environmental factors may affect living things either directly or indirectly.
- Many aspects of the physical and social environment can affect people's health.
- Environmental factors make up the physical, social and attitudinal environment in which people live and conduct their lives. They can act as facilitator and barrier

**1. Physical environmental factors.**

- The factors in the physical environment that are important to health include harmful substances, such as air pollution or proximity to toxic sites (the focus of classic environmental epidemiology); access to various health-related resources (e.g., healthy or unhealthy foods, recreational resources, medical care); and community design and the "built environment" (e.g., land use mix, street connectivity, transportation systems).
- Examples: more buildings, road system, drought, more rain, factories, physical insecurity, etc.
- Factors that can affects air, water, soil, housing, climate, geography, heat, light, noise, debris, radiation, etc.

## 2. Social Environmental Factors

- Factors in the social environment that are important to health include those related to safety, violence, and social disorder in general, and more specific factors related to the type, quality, and stability of social connections.
- Social participation and integration in the immediate social environment (e.g., school, work, neighborhood) appear to be important to both mental and physical health
- This including social participation, social cohesion, social capital, and the collective efficacy of the neighborhood, environment Social participation and integration in the immediate social environment (e.g., school, work, neighbourhood).These appears to be important to both mental and physical health.
- Example: increase in the availability of professional expertise in different occupations; women present in every sector of the government, appreciation and enjoyment once again of music and the arts. People are exposed to more of what's going on through TV and mobile communications
- Can include: cultural values, customs, beliefs, habits, attitudes, morals, religion, education, lifestyles, community life, health services, social and political organization.

## 3. Biological environmental factors.

- Biological factors are microorganisms (bacteria, viruses, fungi and microscopic parasites), cell cultures, human endoparasites and components from microorganisms that can cause damage to health in humans.
- Factors that affect man, microbial agents, insects, rodents, animals and plants, etc.
- Organic objects such as timber, paper, textiles, bone in response to relative humidity (RH) is an indication of how much water vapour is in the air at a particular temperature.
- Ideally the RH reading should be between 40-60%. High RH (above 65%) can encourage the growth of moulds and other fungi, cause swelling of moisture-absorbent materials and corrosion in metals, whereas low RH (below 40%) can lead to some organic materials drying out and becoming brittle.
- Examples: growth of fungi, moulds, etc.

## Other Factors

- Political/Legal Factors
  - ✓ Rules and regulations that govern government and business operations
- Economic Factors
  - ✓ inaccurate and incomplete reporting on progress and funds used on some projects
- Technological Factors
  - ✓ Increased availability of and accessibility to electronic technology, more building equipment available

**Pollution**:

- This is the introduction of contaminants into the environment in such amount and duration that affect health or adverse change.
- Can take the form of chemical substances or energy, such as noise, heat or light.
- Pollution is often classed as point source or nonpoint source pollution.
- **Pollutants:** These are the components of pollution. They can be either foreign substances/energies or naturally occurring contaminants.
- **Environmental pollution:** The introduction of different harmful pollutants into certain environment that make the environment unhealthy to live in.

- **Contaminants:** Biological, chemical, physical, or radiological substance (normally absent in the environment) which, in sufficient concentration, can adversely affect living organisms through air, water, soil, and/or food.

– **Point source Pollution -** any single identifiable source of pollution from which pollutants are discharged, such as a pipe, ditch, ship or factory smokestack.

– Factories and sewage treatment plants are two common types of point sources.

– **Non point source (NPS) pollution** – this is pollution caused by rainfall or snowmelt moving over and through the ground.

– As the runoff moves, it picks up and carries away natural and human-made pollutants, finally depositing them into lakes, rivers, wetlands, coastal waters, and even our underground sources of drinking water.

## Sources of Pollution:

❑ Environmental pollution is mostly due to direct or indirect human activities, arising out of the built-world created by him.

❑ There are six major sources of environmental pollution:

1. Industrial sources
2. Agricultural sources
3. Biogenic sources

✓ Produced or brought about by living organisms. Emissions from natural sources, such as plants and trees.

✓ reg. volatile organic compounds (BVOCs) from vegetation for natural areas, crops, and urban vegetation.

4. Anthropogenic sources

✓ Resulting from human activities. Emissions that are produced as a result of human activities. e.g. transportation, fuel combustion

5. Unnatural sources

✓ Not made or caused by humankind

6. Extra-terrestrial sources.

Refers to natural objects now on Earth that originated in outer space. Such materials include cosmic dust and meteorites, as well as samples brought to Earth by sample return missions from the Moon, asteroids and comets, as well as solar wind particles.

**Nature of Pollutants:**

- The pollutants that occur in the environment may be chemical, biological and physical in their nature.

**1. Chemical pollutants:**

- Gaseous pollutants (sulfur dioxide, nitrogen dioxide), toxic metals, pesticides, herbicides, hydrocarbons, toxins, acidic substances, carcinogens.

**2. Biological pollutants:**

- Pathogenic organisms, products of biological origin.

**3. Physical pollutants:**

- Heat (thermal), sound, odours, radiation and radioactive substances.

**Types of pollutants:**

Ecologically, pollutants can be divided into three types

1. Degradable or non – persistent pollutants
2. Slowly degradable or persistent pollutants
3. Non – degradable pollutants.

Degradable or non – persistent pollutants

- Pollutants that can be rapidly decomposed by natural processes. Example – domestic sewage, discarded vegetable,

Slowly degradable pollutants

- Pollutants that remain in environment for longer time because they decompose very slowly by the natural processes.
- Example: plastics, pesticides, etc.

Non-degradable pollutants

- Pollutants that cannot be decomposed by natural processes
- Example – Lead, mercury, nuclear wastes etc.

**Classification of Environmental Pollution:**
**(Types of Pollution)**

- There are several types of pollution which may come from different sources and have different consequences.
- The environmental pollution may be categorized into six major groups: (but three major types of pollution are:-)

1. Air/ atmosphere pollution
2. Water pollution
3. Land / soil pollution

**Others include:-**

1. Noise pollution
2. Thermal pollution
3. Radioactive pollution

✓ Visual pollution, light pollution, marine pollution

**Air pollution:**

- It is any contamination of the atmosphere that disturbs the natural composition and chemistry of the air.
- It occurs when gases, dust particles, fumes (or smoke) or odour are introduced into the atmosphere in a way that makes it harmful to humans, animals and plant.
- Pure air which exists in nature becomes adulterated (contaminated or unclean).
- The pollutants dilute the natural/original air.
- These particulate matter cannot be effectively removed through natural cycles, such as the carbon cycle or the nitrogen cycle.

**Air pollutants**

✓ These are the things that pollute the air.

**There are two types of air pollutants:**

1. Primary Pollutants
2. Secondary pollutants

**Primary pollutants**

✓ These are those gases or particles that are pumped into the air to make it unclean.

✓ They include carbon monoxide from automobile (cars) exhausts and sulfur dioxide from the combustion of coal.

**Secondary pollutants:**

✓ Occurs when pollutants in the air mix up in a chemical reaction and they form an even more dangerous chemical.

✓ Photochemical smog is an example of this, and is a secondary pollutant.

**SOURCES of air pollution**

- Air pollution can result from both human and natural actions
- Natural events that pollute the air include:-

– Forest fires
– Volcanic eruptions
– Wind erosion
– Pollen dispersal
– Evaporation of organic compounds
– Natural radioactivity.
– Pollution from natural occurrences are not very often.

- **Human activities that result in air pollution include:**

1.Emissions from industries and manufacturing activities
2. Burning Fossil Fuels
3. Household and Farming Chemicals
4. Deforestation

**SIX COMMON AIR POLLUTANTS**

1. Carbon monoxide
2. Lead
3. Sulfur Dioxide
4. Particulate Matter
5. Nitrogen Dioxide
6. Ozone (Ground-level ozone)

## GENERAL EFFECTS OF AIR POLLUTION

**1. Acidification:**

– Chemical reactions involving air pollutants can create acidic compounds which can cause harm to vegetation and buildings.

**2. Eutrophication:**

– Rain can carry and deposit the Nitrogen in some pollutants on rivers and soils.

– This will adversely affect the nutrients in the soil and water bodies.

**3. Ground-level Ozone**

– Chemical reactions involving air pollutants create a poisonous gas ozone (O3).

– Gas Ozone can affect people's health and can damage vegetation types and some animal life too.

**4. Particulate Matter**

– Air pollutants can be in the form of particulate matter which can be very harmful to our health.
– Short-term effects include irritation to the eyes, nose and throat, and upper respiratory infections such as bronchitis and pneumonia.
– Others include headaches, nausea, and allergic reactions.
– Long-term health effects can include chronic respiratory disease, lung cancer, heart disease, and even damage to the brain, nerves, liver, or kidneys.

**5. Economic Effects**

Damage to properties, equipment's and facilities

– Affects zinc coatings
– Steel corrodes 2-3times faster
– Paints pigments are destroyed
– Building materials, surfaces and arts works corrodes

**6. Effects on plants**

– Plants could be used as good indicators of air pollution since they are very sentive.

– Sulphur dioxide, hydrogen sulphide, harm plants.

– Crops and vegetations are affected.

**7. EFFECTS ON ANIMALS**

– Lead and arsenic affects sheep and cattle.

– Flouride may lead skeletal flourisis to animals

**8. Aesthetic and Climatic effects**

– Smog and dusts cause reduced visibility causing accidents.

– Carbon dioxide causes the green house effects by forming a blanket in the atmosphere, thus reducing radiation and causing increase in temperature resulting to global warming which affects ecosystems in many ways.

**Prevention and control of air pollution**

Since smoke is as result of unburned flue, then Prevention and control measures can be:-

- Improvement in burning
- Ban open fires e.g. refuse fires
- Provide stacks –this will dilute and disperse smoke
- NOx control
  - Low NOx burners
- Acid Gas/SO2control
  - scrubbers
  - Flue-gas desulfurization
- Reducing air pollutants from industry

– The following items are used as pollution control devices by industry or transportation devices.
– Can either destroy contaminants or remove them from an exhaust stream before it is emitted into the atmosphere.

**1. Particulate control**

- Mechanical collectors
- Settling chambers
- Electrostatic precipitators - removes particles from a flowing gas (such as air) using the force of an induced electrostatic charge.
- can easily remove fine particulates such as dust and smoke from the air stream.
- Baghouses Designed to handle heavy dust loads,
- Particulate scrubbers
- High pressure water spry is applied to the waste gas passing through washers and the gas gets cleared.

**2. Mercury control**

**3. Health education**

**4. Good policies on vehicles**

# SOIL POLLUTION

– This is the contamination of soil causing adverse effects on living organisms in it.

– It is the degradation of the earth's surface caused by a misuse of resources and improper disposal of waste.

**Causes of soil pollution**

1. Soil erosion
2. Industrial wastes
3. Urban wastes
4. Agricultural practice
5. Biological agents:

**Effects of soil pollution**

1. Toxic compounds affect plant growth and human life also.
2. Water logging and salinity makes soil infertile.
3. Hazardous chemicals enter into food chain from soil disturbing the biochemical process.
4. Nervous disorders, gastrointestinal disorder, joint pain, respiratory problems are the effects seen on human beings.

**Control measures for preventing soil pollution**

1. Soil erosion must be prevented or controlled by proper tree plantation.
2. All the wastes from industry, domestic, must be dumped with proper treatment.
3. Use of synthetic fertilizers must be avoided instead natural fertilizers must be preferred.
4. Educate people regarding consequences of soil pollution and to prevent soil pollution.
5. Strict enforcement of environment protection law.
6. Toxic and non-degradable materials must be totally banned.
7. Recycling and reuse of industrial and domestic wastes can minimize soil pollution considerably.

**Examples of soil / land pollution**

- Litter found on the side of the road
- Illegal dumping in natural habitats
- Oil spills that happen inland
- The use of pesticides and other farming chemicals
- Damage and debris caused from unsustainable mining and logging practices
- Radiation spills or nuclear accidents

– Soil /Land pollution is responsible for damage done to natural habitat of animals, deforestation and damage done to natural resources, and the general ugly-ing up of our communities.

## WATER POLLUTION

- It is the contamination of water bodies (e.g. lakes, rivers, oceans, aquifers and groundwater).
- Occurs when pollutants are discharged directly or indirectly into water bodies without adequate treatment to remove harmful compounds.

**Sources and causes of water pollution**

- The causes of water pollution is directly related to the type of water pollution in question.
- Pollutants may be natural or human caused.
- May include nutrients, sediments, organochlorines, heavy metals, oil and hydrocarbons, chemical constituents and pathogens.

1. **Microbial**
2. **Persistent organic chemicals**
3. **Solid waste**
4. **Chemical**
5. **Oxygen demanding substances**
6. **Oil pollution**
7. **Plants Nutrients (Eutrophication)**
8. **Suspended Matter**

**Effects of water pollution:**

**1. Death of aquatic (water) animals**

- Animals, including water animals die when water is poisoned for various reasons.
- Stress endangered species.

**2. Disruption of food-chains**

- Disrupts the natural food chain as well.
- Pollutants such as lead and cadmium are eaten by tiny animals.
- Later, these animals are consumed by fish and shellfish, and the food chain continues to be disrupted at all higher levels.

**3. Human Health**

- Many people often get water-borne disease outbreaks such as cholera and tuberculosis from drinking contaminated water
- Taking toxins emitted by algae growth for instance can cause stomach aches and rashes.
- Excess nitrogen in drinking water also pose serious risks to infants.

## 4. Destruction of ecosystems

- Nutrient pollution from upstream often flow downhill and even travel miles into other larger water bodies.
- It breeds algae growth and causes the growth of many more water organism.
- Algae attack affects fish and other aquatic animals by absorbing and reducing their oxygen supply.
- It also clogs fish gills.

## 5. Economic cost

- It can cost a lot more to purify drinking water that takes its source from nutrient polluted water bodies.

**Prevention and control of water pollution**

1. Do not throw waste water into drains.
2. Compost organic waste or follow laid down instructions given by your local council on how to dispose off organic waste.
3. Ensure that you comply with the waste disposal arrangements made by your council.
4. Maintain your vehicle so as to prevent any leakages.
5. Control Oils and other toxic fluids like antifreeze from automobiles
6. Proper sewage treatment plants so that most of the household and industrial wastes can be treated prier to disposal.

7. Reduce waste creation. We all have a rather bad culture of want and waste.
8. Proper disposal of hazardous chemicals and medicines
9. Don't dispose paints, oils, polish and any cleaning products in the toilet, sink or down the drain.
10. Governments to invest in research and assist with the provision of logistics for industries, farms and businesses to dispose off waste.

- Planning with these industries and farms creates an awareness of the consequences of their actions and establishes a commitment to reducing the negative impact of nutrient pollution.

**11. Education on the dangers of water pollution**

- It helps people to apply the right attitudes when dealing with the environment.
- Education activities that get people informed and empowered to help protect water should be encouraged and invested in.

**12. Laws enforcement**

- With very hefty fines and actions for industries that do not comply with water pollution prevention laws.
- If industries know that they are being monitored and checked regularly, they will usually ensure best practices of waste and chemical dumping at all cost

## NOISE POLLUTION

- Sound becomes unwanted when it either interferes with normal activities such as sleeping, conversation, or disrupts or diminishes one's quality of life.
- Not all noise can be called noise pollution.
- Not only humans who are affected e.g., water animals are subjected to noise by submarines and big ships on the ocean, and chain-saw operations by timber companies also create extreme noise to animals in the forests
- Generally, noise is produced by household gadgets, big trucks, vehicles and motorbikes on the road, jet planes and helicopters hovering over cites, loud speakers etc.
- Noise (or sound) is measured in the units of decibels and is denoted by the dB. Noise which is more than 115 dB is tolerant. The industrial limit of sound in the industries must be 75 dB according to the World Health Organization.

**Sources of noise pollution**

**1. Household sources:-**

Gadgets like food mixer, grinder, vacuum cleaner, washing machine and dryer, cooler, air conditioners, can be very noisy and injurious to health.

**2. Social events:**

Places of worship, discos and gigs, parties and other social events also create a lot of noise for the people living in that area.

**3. Commercial and industrial activities:**

Printing presses, manufacturing industries, construction sites, contribute to noise pollutions in large cities.

**4. Transportation**

Aero planes, trains, vehicles on road—these are constantly making a lot of noise and people always struggle to cope with them.

**Effects of noise pollution**

- Generally, problems caused by noise pollution include stress related illnesses, speech interference, hearing loss, sleep disruption, and lost productivity.
- Most importantly, there are two major effects we can look at:

**1. Hearing**

- The immediate and acute effect of noise pollution to a person, over a period of time, is impairment of hearing.
- Prolonged exposure to impulsive noise to a person will damage their eardrum, which may result in a permanent hearing.

**2. Effects on general health**

- Health effects of noise include anxiety and stress reaction and in extreme cases fright. The physiological manifestations are headaches, irritability and nervousness, feeling of fatigue and decreases work efficiency. For example, being pounded by the siren of fire fighters, police or ambulance in your city all night everyday leave people (especially elderly people) stresses and tired in the morning.
- Its is worth noting that these effects may not sound troubling, but the truth is, with time, the consequences can be very worrying.

**Noise pollution prevention and control tips**

Below are a few things people and governments can do to make our communities and living laces quieter:

- Construction of soundproof rooms for noisy machines in industrial and manufacturing installations must be encouraged.
- This is also important for residential building — noisy machines should be installed far from sleeping and living rooms, like in a basement or garage.
- Use of horns with jarring sounds, motorbikes with damaged exhaust pipes, noisy trucks to be banned.
- Noise producing industries, airports, bus and transport terminals and railway stations to sighted far from where living places.
- Community law enforcers should check the misuse of loudspeakers, worshipers, outdoor parties and discos, as well as public announcements systems.
- Community laws must silence zones near schools / colleges, hospitals etc.
- Vegetation (trees) along roads and in residential areas is a good way to reduce noise pollution as they absorb sound

## THERMAL POLLUTION

- This is the rising air/water temperature so that it becomes harmful to human being and other organisms.

**Sources of thermal pollution**

- Thermal power station, Nuclear power plants, Petroleum refiners, Domestic sewage.

**Effects of Thermal pollution**

- Affects aquatic ecosystems in a variety of ways.
- Species composition changes as species tolerant of warmer waters replace those unable to adapt e.g. algae, fish
- Reduces dissolved oxygen (DO).
- The water properties changes
- Toxic chemical becomes soluble at high temperatures
- Disrupts natural reproductive cycle of water animals by premature hatching of eggs.

**Control measures for thermal pollution**

- Precooling the warm water prior to its discharge, e.g. use of cooling ponds and cooling towers

**Radioactive Pollution (Nuclear Hazards)**

- Radioactivity is produced by the spontaneous decay of the isotopes of some elements, whose nuclei are unstable**.**
- The radiation can take a number of different forms. In some cases it is as particles and in others it is electromagnetic.
- Five types of radiation may occur: alpha, beta particles, neutrons, gamma rays and x-rays.

**Sources of man-made Radiation**

- Nuclear reactors
- Commercial and military reactors both operate by the fission of uranium or plutonium atoms.
- The reaction create a range of new elements or radio nuclides and some all have different properties to the original element.
- Nuclear installations also result in atmospheric discharges

**Health Effects of Radiation**

- Disrupts molecules within cells, thus causing chemical changes
- At high doses, radiation causes burning, nausea and other rapidly produced symptoms due to extensive, immediate death of body cells
- At lower doses, radiation results in health problems such as cancer.
- Disruption of DNA, leading to the development of radionuclide exposure
- Detrimental damage to cells

**Effect of Radiation in the Environment**

- There is a very wide degree of response to radioactive substances by different plant and animal species.
- poses may long-term risks

## POLLUTION PREVENTION AND CONTROL STRATEGIES:

### Industrial prevention & control strategies

### 1. Waste minimization

Done through

- Source reduction - is activities designed to reduce the volume or toxicity of waste generated, including the design and manufacture of products with minimum toxic content, minimum volume of material, and/or a longer useful life e.g. bringing a reusable bag to the grocery store.
- Toxic chemical substitution
- Production process modification
- Production modernization
- Improvements in operations and maintenance
- Recycling-In-process recycling of production material
- Reuse

2. **Cleaner production**

- It is a preventive, company-specific environmental protection initiative.
- It is intended to minimize waste and emissions maximizing product output.

Examples for cleaner production options are:

- Documentation of consumption (as a basic analysis of material and energy flows.
- Use of indicators and controlling (to identify losses from poor planning, poor education and training, mistakes)
- Substitution of raw materials and auxiliary materials (especially renewable materials and energy)
- Increase of useful life of auxiliary materials and process liquids (by avoiding drag in, drag out, contamination)
- Improved control and automatisation
- Reuse of waste (internal or external)
- New, low waste processes and technologies

3. Capacity training and development
4. Improvement in operation and maintenance of plants e.g.

- Use of Pollution control devices
- Dust collection systems
- Vapor recovery systems
- Other devices e.g. to reduce noise, Scrubbers etc.

5. Treatment of waste to an acceptable levels before discharging

- Sewage treatment
  - Sedimentation (Primary treatment)
  - Activated sludge biotreaters (Secondary treatment; also used for industrial wastewater)
  - Aerated lagoons
- Industrial wastewater treatment
  - API oil-water separators
  - Biofilters
  - Dissolved air flotation
  - Powdered activated carbon treatment
  - Ultrafiltration

6. Enacting legislation to regulate various types of pollution as well as to mitigate the adverse effects of pollution.

7. Awareness

8. Environmental Statistics and Mapping

- For sound Environmental Management, reliable information base and the mapping of areas needing special attention for pollution prevention and control are a pre-requisite.
- As a step in the direction, projects and pilot studies should be initiated through various research institutions and organizations.

**Pollution Prevention and Control Strategies at home**

- Purchase products with less packaging.
- Recycle cardboard, glass, and plastic packaging.
- Recycle aluminum, tin cans, and newspapers.
- Purchase products made from recycled materials.
- Properly dispose of waste oil and fluids from vehicles.
- Maintain your septic tank in good condition.
- Fix leaking faucets and toilets.
- Run full loads of laundry. Install a low-flow shower head.
- Mulch or compost your yard waste and vegetable scraps.
- Apply herbicides and pesticides properly; more is not better.

**Pollution prevention strategies in agricultural activities**

- Apply pesticides and herbicides at the proper concentrations.
- Explore non-chemical methods of agricultural production.
- Use alternative fuels when possible.
- Maintain vehicles for maximum fuel efficiency.
- Consider protecting sensitive environmental areas by planting "timber crops" or native grasses.
- Mix and apply pesticides carefully, keeping in mind that they are potential contaminants.
- Get involved in a pesticide container recycling program.
- Manage animal wastes properly.
- Apply nutrients and fertilizers with care since high concentrations can cause problems in ground water and streams.

**Role of an individual in prevention of pollution**

- Reduce your dependency on fossil fuel especially coal or oil
- Use eco-friendly products e.g. do not use polystyrene cups that has CFCs molecules as they destroy the ozone layer
- Adopt and popularize renewable energy sources.
- Promote reuse and recycling whatever possible and reduce the production of wastes.
- Use mass transport system - decrease the use of automobiles.
- Plant more trees as trees can absorb many toxic gases and can purify the air.
- Use less hazardous chemicals wherever possible

**Emerging issues, policy and legislative framework**:

**Pollution emerging issues**

Environmental exposure is increasing and affecting human's environmental health all over the world and emerging risks are being identified everyday.

- Increasing industrialization
- explosive urban population growth
- lack of pollution control
- global climate change
- ozone depletion
- electromagnetic radiation
- unabated waste dumping
- non-sustainable consumption of natural resources
- unsafe use and contamination of chemicals
- Physical inactivity
- poor nutrition
- spread of the disease e.g. HIV/AIDS pandemic
- use of dangerous substances

All these contribute to affecting the environment and health of humans.

## Global Pollution Concerns:

**1. Global Warming:** Climate changes like global warming is the result of human practices like emission of Greenhouse gases. Global warming leads to rising temperatures of the oceans and the earth' surface causing melting of polar ice caps, rise in sea levels and also unnatural patterns of precipitation such as flash floods, excessive snow or desertification.

**2. Natural Resource Depletion:** Fossil fuel consumption results in emission of Greenhouse gases, which is responsible for global warming and climate change. Globally, people are taking efforts to shift to renewable sources of energy like solar, wind, biogas and geothermal energy.

**3. Waste Disposal:** The over consumption of resources and creation of plastics are creating a global crisis of waste disposal.

**4. Climate Change:** this is yet another environmental problem that has surfaced in last couple of decades. It occurs due to rise in global warming which occurs due to increase in temperature of atmosphere by burning of fossil fuels and release of harmful gases by industries. It has various harmful effects but not limited to melting of polar ice, change in seasons, occurrence of new diseases, frequent occurrence of floods and change in overall weather scenario.

**5. Loss of Biodiversity:** Human activity is leading to the extinction of species and habitats and loss of bio-diversity. Eco systems, which took millions of years to perfect, are in danger when any species population is decimating. Balance of natural processes like pollination is crucial to the survival of the eco-system and human activity threatens the same. There is also destruction of coral reefs in the various oceans, which support the rich marine life.

**6. Deforestation:** Our forests are natural sinks of carbon dioxide and produce fresh oxygen as well as helps in regulating temperature and rainfall. At present forests cover 30% of the land but every year tree cover is lost due to growing population demand for more food, shelter and cloth

**7. Ocean Acidification:** It is a direct impact of excessive production of CO2. 25% of CO2 produced by humans. The main impact is on shellfish and plankton in the same way as human osteoporosis.

**8. Ozone Layer Depletion:** The ozone layer is an invisible layer of protection around the planet that protects us from the sun's harmful rays. Depletion of the crucial Ozone layer of the atmosphere is attributed to pollution caused by Chlorine and Bromide found in Chloro-floro carbons (CFC's).

**9. Acid Rain**: It occurs due to the presence of certain pollutants in the atmosphere. Acid rain can be caused due to combustion of fossil fuels or erupting volcanoes or rotting vegetation which release sulfur dioxide and nitrogen oxides into the atmosphere.

**10. Urban Sprawl:** Refers to migration of population from high density urban areas to low density rural areas which results in spreading of city over more and more rural land. Results in land degradation, increased traffic, environmental & health issues

**11. Genetic Engineering:** This is genetic modification of food using biotechnology. Genetic modification of food results in increased toxins and diseases as genes from an allergic plant can transfer to target plant.

**12. Public Health Issues:** The current environmental problems pose a lot of risk to health of humans, and animals. Dirty water is the biggest health risk of the world and poses threat to the quality of life and public health.

**13. Water Pollution:** Clean drinking water is becoming a rare commodity. Water is becoming an economic and political issue as the human population fights for this resource.

**14. Overpopulation:** The population of the planet is reaching unsustainable levels as it faces shortage of resources like water, fuel and food.

**15. Pollution:** Pollution of air, water and soil require millions of years to recoup. Industry and motor vehicle exhaust are the number one pollutants. Heavy metals, nitrates and plastic are toxins responsible for pollution.

# PEST CONTROL