

OTBA
SUBJECT :SCIENCE
CLASS VII

1.THEME : WATER POLLUTION

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

Water pollution affects plants and organisms living in these bodies of water. In almost all cases the effect is damaging not only to individual species and populations, but also to the natural biological communities.

INTRODUCTION

Water pollution is a major global problem which requires ongoing evaluation and revision of water resource policy at all levels (international down to individual aquifers and wells). It has been suggested that it is the leading worldwide cause of deaths and diseases, and that it accounts for the deaths of more than 14,000 people daily. An estimated 580 people in India die of water pollution related illness every day. Around 90% the water in the cities of China is polluted, and as of 2007, half a billion Chinese had no access to safe drinking water. In addition to the acute problems of water pollution in developing countries, developed countries continue to struggle with pollution problems as well. In the most recent national report on water quality in the United States, 45 percent of assessed stream miles, 47% of assessed lake acres, and 32 percent of assessed bays and estuarine square miles were classified as polluted. The head of Chinas national development agency in 2007 said 1/4th the length of China's seven main rivers were so poisoned the water harmed the skin.

Water is typically referred to as polluted when it is impaired by anthropogenic contaminants and either does not support a human use, such as drinking water, or undergoes a marked shift in its ability to support its constituent biotic communities, such as fish. Natural phenomena such as volcanoes, algae blooms, storms, and earthquakes also cause major changes in water quality and the ecological status of water.

WASTE WATER

Wastewater, also written as **waste water**, is any water that has been adversely affected in quality by anthropogenic influence. Municipal wastewater is usually conveyed in a combined sewer or sanitary sewer, and treated at a wastewater treatment plant. Treated wastewater is discharged into receiving water via an effluent sewer. Wastewaters generated in areas without access to centralized sewer systems rely on on-site wastewater systems. These typically comprise a septic tank, drain field, and optionally anon-site treatment unit.

Sewage is the subset of wastewater that is contaminated with feces or urine, but is often used to mean any wastewater. Sewage includes domestic, municipal, or industrial liquid waste products disposed of, usually via a pipe or sewer (sanitary or combined), sometimes in a cesspool emptier.

Sewerage is the physical infrastructure, including pipes, pumps, and screens, channels etc. used to convey sewage from its origin to the point of eventual treatment or disposal. It is found in all types of sewage treatment, with the exception of septic systems, which treat sewage on site.

ORIGIN OF WASTE WATER

Wastewater or sewage can come from (text in brackets indicates likely inclusions or contaminants):

- Human waste (feces, used toilet paper or wipes, urine, or other bodily fluids), also known as black water, usually from lavatories;
- Sewage treatment plant discharge;
- Washing water (personal, clothes, floors, dishes, etc.), also known as greywater or sullage;
- Rainfall collected on roofs, yards, hard-standings, etc. (generally clean with traces of oils and fuel);
- Groundwater infiltrated into sewage;
- Urban rainfall runoff from roads, car parks, roofs, sidewalks/pavements (contains oils, animal feces, litter, gasoline/petrol, diesel or rubber residues, soap scum, metals from vehicle exhausts, etc.);
- Highway drainage (oil, de-icing agents, rubber residues);
- Black water (surface water contaminated by sewage);
- Industrial waste
- Industrial site drainage (silt, sand, alkali, oil, chemical residues);
 - Industrial cooling waters (biocides, heat, slimes, silt);
 - Industrial process waters;
 - Organic or biodegradable waste, including waste from abattoirs, creameries, and ice cream manufacture;
 - Organic or non bio-degradable/difficult-to-treat waste (pharmaceutical or pesticide manufacturing);
 - Agricultural drainage, direct and diffuse.
 - Hydraulic fracturing
 - Produced water from oil & natural gas production



WASTE WATER CONSTITUENTS

The composition of wastewater varies widely. This is a partial list of what it may contain:

- Water (more than 95 percent), which is often added during flushing to carry waste down a drain;

Pathogens such as bacteria, viruses, prions and parasitic worms;

- Organic particles such as feces, hairs, food, vomit, paper fibers, plant material, humus, etc.;
- Soluble organic material such as urea, fruit sugars, soluble proteins, drugs, pharmaceuticals, etc.;
- Animals such as protozoa, insects, arthropods, small fish, etc.;
- Gases such as hydrogen sulfide, carbon dioxide, methane, etc.;
- Emulsions such as paints, adhesives, mayonnaise, hair colorants, emulsified oils, etc.;
- Toxins such as pesticides, poisons, herbicides, etc.

WASTEWATER QUALITY INDICATORS

Any oxidizable material present in a natural waterway or in an industrial wastewater will be oxidized both by biochemical (bacterial) or chemical processes. The result is that the oxygen content of the water will be decreased.

Those biochemical reactions create what is measured in the laboratory as the biochemical oxygen demand (BOD). Such chemicals are also liable to be broken down using strong oxidizing agents and these chemical reactions create what is measured in the laboratory as the chemical oxygen demand (COD). Both the BOD and COD tests are a measure of the relative oxygen-depletion effect of a waste contaminant. Both have been widely adopted as a measure of pollution effect. The BOD test measures the oxygen demand of biodegradable pollutants whereas the COD test measures the oxygen demand of oxidizable pollutants.

WATER TREATMENT

Water treatment is, collectively, the industrial-scale processes that make water more acceptable for an end-use, which may be drinking, industry, or medicine. Water treatment is unlike small-scale water sterilization that campers and other people in wilderness areas practice.



Water treatment should remove existing water contaminants or so reduce their concentration that their water becomes fit for its desired end-use, which may be safely returning used water to the environment.

The processes involved in treating water for drinking purposes may be solids separation using physical processes such as settling and filtration, and chemical processes such as disinfection and coagulation.

Biological processes are employed in the treatment of wastewater and these processes may include, for example, aerated lagoons, activated sludge or slow sand filters.

A) PORTABLE WATER PURIFICATION

Water purification is the removal of contaminants from untreated water to produce drinking water that is pure enough for the most critical of its intended uses, usually for human consumption. Substances that are removed during the process of drinking water *treatment* include suspended, bacteria, algae, viruses, fungi, minerals such as iron, manganese and sulfur, and other chemical pollutants such as fertilizers.

B) PROCESSES FOR DRINKING WATER TREATMENT

A combination selected from the following processes is used for municipal drinking water treatment worldwide:

- Pre-chlorination - for algae control and arresting any biological growth
- Aeration - along with pre-chlorination for removal of dissolved iron and manganese
- Sedimentation - for solids separation, that is, removal of suspended solids trapped in the flock
- **Filtration** - removing particles from water
- Desalination - Process of removing salt from the water
- Disinfection - for killing bacteria.

Technologies for potable water treatment are well developed, and generalized designs are available that are used by many water utilities (public or private). In addition, a number of private companies provide patented technological solutions. Automation of water and waste-water treatment is common in the developed world. Capital costs, operating costs available quality monitoring technologies, locally available skills typically dictate the level of automation adopted.

SEWAGE TREATMENT

Sewage treatment is the process that removes the majority of the contaminants from wastewater or sewage and produces both a liquid effluent suitable for disposal to the natural environment and

a sludge. To be effective, sewage must be conveyed to a treatment plant by appropriate pipes and infrastructure and the process itself must be subject to regulation and controls. Some wastewaters require different and sometimes specialized treatment methods. At the simplest level, treatment of sewage and most wastewaters is carried out through separation of solids from liquids, usually by sedimentation. By progressively converting dissolved material into solids, usually a biological flock, which is then settled out, an effluent stream of increasing purity is produced.

WATER TREATMENT : DISINFECTANTS

Disinfectants: Ozone, as a very strong oxidant, is one of the main disinfectants when purifying water. As ozone breaks down in the water, a complex chain reaction mechanism occurs under the effect of the various solutes in the water are released during purification treatment. Its ability to inactivate living cells can be extended to the point of provoking their lyses.

Ultraviolet(UV) radiation is produced using ultraviolet lamps with quartz covers. UV produces a minimum of by-products when treating the water.

CLASS VII

SCIENCE

Theme 2: Forests - Friends forever

The forest is a complex ecosystem consisting mainly of trees that have formed a buffer for the earth to protect life forms. The trees which make up the main area of the forest create a special environment which, in turn, affects the kinds of animals and plants that can exist in the forest. The FAO (Food and Agriculture Organization) has defined forest as land with tree crown cover (or equivalent stocking level) of more than 10% and area of more than 0.5 hectare.

Forests can exist from the equator to near the Polar Regions, but the character of the forest differs greatly. Based on the regional biosphere and conditions, there are three major forest biomes:

Evergreen Forests



An evergreen forest is a forest consisting entirely or mainly of evergreen trees that retain green foliage all year round. Evergreen forests are usually found in areas receiving more than 200 cm of rainfall and having a temperature of 15 °C to 30 °C. They occupy about seven per cent of the Earth's surface and harbour more than half of the world's plants and animals. They are found mostly near the equator. These forests are dense, multi-layered and harbour many types of plants and animals. The trees in an evergreen forest have broad leaves that release excess water through transpiration.

Deciduous Forest



Forests where a majority of the trees lose their foliage at the end of the typical growing season are called deciduous forests. Deciduous forests are found in several parts of the world including North America, Europe, New- Zealand, Australia, and Asia. These forests go through a lot of seasonal changes and are specially adapted to withstand these environmental changes throughout the year. Trees found in a deciduous forest vary by region, but generally include species such as oak, beech, walnut, maple, chestnut and hickory. Deciduous forests grow in areas where rainfall is sufficient to support tree growth.

Deciduous forests are well suited to deal with extremes in temperatures. After losing leaves in winter, the trees enter a period of dormancy until the warmer weather returns and the growing season is once again underway.

Coniferous forest



Coniferous forests are made up mainly of cone-bearing or coniferous trees, such as spruces, hemlocks, pines and firs. The leaves of these trees are either small and needle-like or scale-like and most stay green all year around. Coniferous forests are found mainly in the northern hemisphere, although some are found in the southern hemisphere. Coniferous trees thrive where summers are short and cool and winters long and harsh. The needle-like leaves have a waxy outer coat which prevents water loss in freezing weather and the branches are soft and flexible and usually point downwards, so that snow slides off them.

The temperate coniferous rain forests sustain the highest levels of biomass in any terrestrial ecosystem and are notable for trees of massive proportions

Importance of Forests

Forests are key to all life forms. The richer the diversity of life, the greater the opportunity for medical discoveries, economic development and adaptive responses to such new challenges as climate change.

Forests serve as a watershed. This is because almost all water ultimately comes from rivers and lakes and from forest-derived water tables. Some rivers running through forests are also kept cool and from drying out.

Forests serve as a home (habitat) to millions of animals. Think of the many types of reptiles (snakes and lizards) wild animals, butterflies and insects, birds and tree-top animals as well as all those that live in the forest streams and rivers.

Animals form part of the food chain in the forests. All these different animals and plants are called biodiversity, and the interaction with one another and with their physical environment is what we call ecosystem. Healthy ecosystems can better withstand and recover from a variety of disasters such as floods and wildfires.

Forests are of immense economic importance to us. For example, plantation forests provide humans with timber and wood, which is exported and used in all parts of the world. They also provide tourism income to inhabitants (people living in or close to forests) when people visit to see the best of nature.

Climate control and atmosphere purification is key for human existence. Trees and soils help regulate atmospheric temperatures through a process called evapotranspiration. This helps to stabilize the climate. Additionally, they enrich the atmosphere by absorbing bad gases (example CO₂ and other greenhouse gases) and producing oxygen. Trees also help to remove air pollutants.

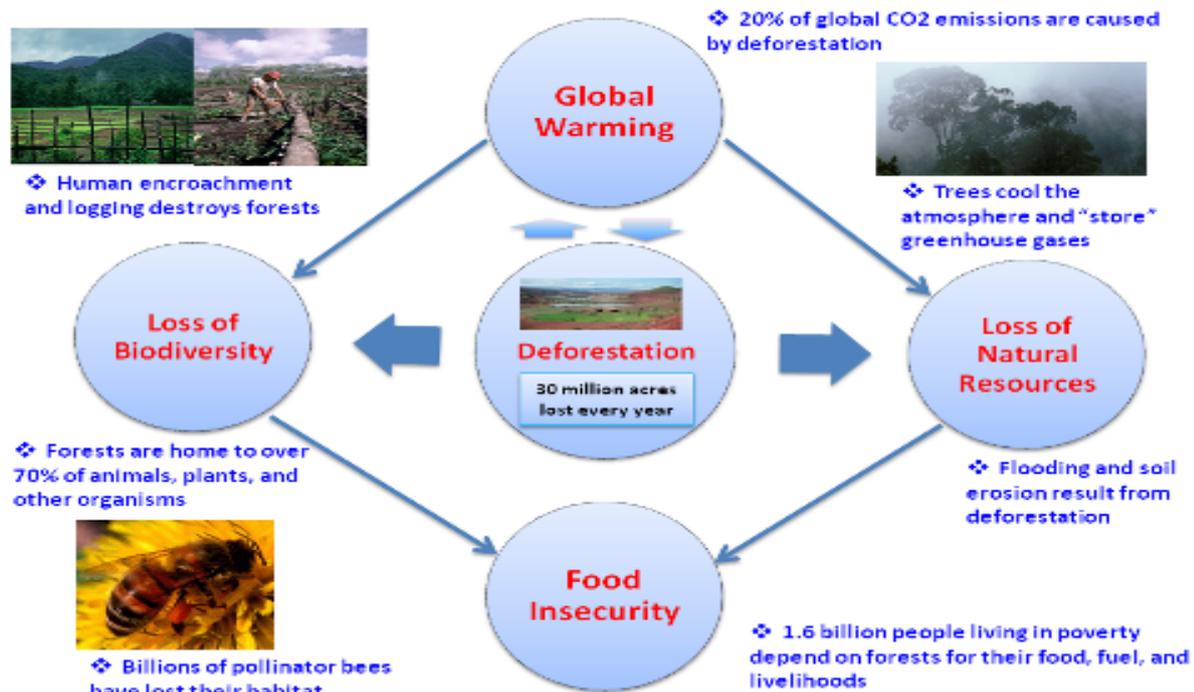
Deforestation is clearing Earth's forests on a massive scale, often resulting in damage to the quality of the land. Forests still cover about 30 percent of the world's land area, but swaths the size of Panama is lost each and every year. The world's rain forests could completely vanish in a hundred years at the current rate of deforestation.

Forests are cut down for many reasons, but most of them are related to money or to people's need to provide for their families. The biggest driver of deforestation is agriculture. Farmers cut forests to provide more room for planting crops or grazing livestock. Often many small farmers will each clear a few acres to feed their families by cutting down trees and burning them in a process known as "slash and burn" agriculture. Forests are also cut to make room for human settlement and urbanization (these include making space for shelter, industries and roads), and to make room for mining.

Logging operations, which provide the world's wood and paper products, also cut countless trees each year. Loggers, some of them acting illegally, also build roads to access more and more remote forests—which lead to further deforestation. Forests are also cut as a result of growing urban sprawl.

Not all deforestation is intentional. Some is caused by a combination of human and natural factors like wildfires, Climate Change, Pests and diseases, and subsequent overgrazing, which may prevent the growth of young trees.

Effects of deforestation



Looking at the importance of forests and trees in the previous pages, you can deduce the massive effects of deforestation and tree-cutting activities. Let us see a few below:

Soils (and the nutrients in them) are exposed to the sun's heat. Soil moisture is dried up, nutrients evaporate and bacteria that help break down organic matter are affected. Eventually, rain washes down the soil surfaces and erosion takes place. Soils never get their full potential back.

When forests are destroyed, the atmosphere, water bodies and the water table are all affected. Trees absorb and retain water in their roots. A large part of the water that circulates in the ecosystem of rainforests remains inside the plants. Some of this moisture is transpired into the atmosphere. When this process is broken, the atmosphere and water bodies begin to dry out. The watershed potential is compromised and less water will run through the rivers. Smaller lakes and streams that take water from these larger water bodies dry up.

Many wonderful species of plants and animals have been lost, and many others remain endangered. More than 80% of the world's species remain in the Tropical Rainforest. It is estimated that about 50 to 100 species of animals are being lost each day as a result of destruction of their habitats, and that is a tragedy.

Plants absorb Carbon Dioxide CO₂ (a greenhouse gas) from the atmosphere and use it to produce food (carbohydrates, fats, and proteins that make up trees). In return, it gives off Oxygen. Destroying the forests means CO₂ will remain in the atmosphere and in addition,

destroyed vegetation will give off more CO₂ stored in them as they decompose. This will alter the climate of that region. Cool climates may get a lot hotter and hot places may get a lot cooler.

What can I do to help preserve our forests?

The quickest solution to deforestation would be to simply stop cutting down trees. Though deforestation rates have slowed a bit in recent years, financial realities make this unlikely to occur.

A more workable solution is to carefully manage forest resources by eliminating clear-cutting to make sure that forest environments remain intact. The cutting that does occur should be balanced by the planting of enough young trees to replace the older ones felled in any given forest. The number of new tree plantations is growing each year, but their total still equals a tiny fraction of the Earth's forested land. Sometimes, we are overwhelmed by the extent of damage humans have caused, and we are not sure if an individual can make any impact.

Yes you can, there are millions of people just like you, who are learning about the issue and taking little steps to help. Additionally, many governments, organizations and societies are making great strides in helping reducing deforestation, and encouraging forest plantations.

But there is still a lot to do.

Due to the extent and nature of forest destruction, efforts to stop deforestation and preserve them are best achieved at government and organization levels. This means that laws countries can help to enforce the preservation of forests. Laws on farming, timber and wood, as well as land use must be encouraged and enforced.

Here are a few things you can also do to help.

Make a conscious effort to share information with others (friends at school and family members) on deforestation and its' effects. Some of your friends may laugh at you and say it is silly to think that you can solve problems like this. But that is OK, things work better when responsible people don't give up. Stand up for what you believe in.

Join organizations, forest-preservation societies and pressure groups that aim to help preserve the rest of our natural resources. When more people work together, the impact is greater.

Reduce the use of artificial items, recycle more and re-use items. Wood, paper, plastics and many other things we use every day at home can be linked to natural resources being destroyed. This means that if we all recycle more, there will be less dependence on the environment (and trees). It also means that companies and governments will import less raw-material from the forest regions of the world.

There is a fun way to remember the most important points in forest preservation called TREES which means...

- Teach others about the importance of the environment and how they can help save rainforests.

- **Restore damaged ecosystems by planting trees on land where forests have been cut down.**
- **Encourage people to live in a way that doesn't hurt the environment.**
- **Establish parks to protect rainforests and wildlife.**
- **Support companies that operate in ways that minimize damage to the environment.**