MOTHERLAND

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June 2018

Is Our Motherland beseeching for A National Patriot or A Nature Patriot?

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Mega Diversity Countries

WASTE WATER TREATMENT PLANT

GUHESHWORI

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SOLID WASTE MANAGEMENT

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World Environment Day

Publication of Rotaract Club of Mahabouddha

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World Environment Day

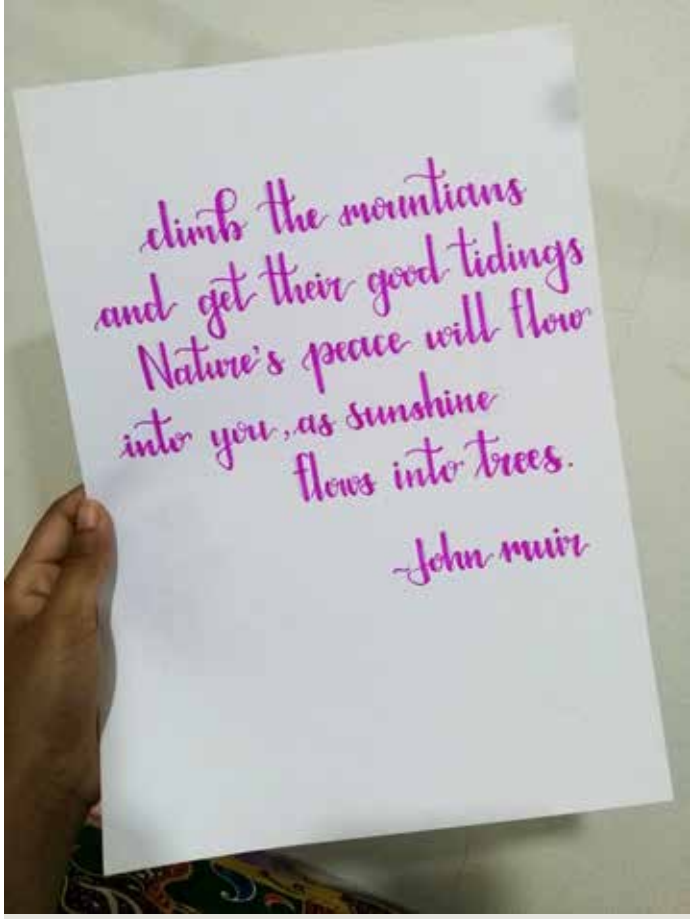
- By Piyali Das

ENVIRONMENT DAY celebrated worldwide on June 5th. The very first World Environment Day took place in 1973, inspired by the United Nations Conference on the Human Environment that took place the year before starting on June 5th. So, what according to you is an ENVIRONMENT DAY?. Isn't it pleasing to see greenery surrounding everywhere, no litter and oh, of course, that fresh smell of mother nature. I think I enjoy the rainy season more when the raindrops hit the grass and there is this sweet smell hovering the soil. I enjoy summer as well when you can just lay down on the fresh grass, maybe under some tree, you are fond of. I watched this movie named "FLIPPED", the girl, "JULI BAKER" enjoy most of her time on a tree called "SYCAMORE", no one else understands the bonded love. One day, it's cut down by a group of landscapers so a house can be built there, despite Juli's opposition. She becomes very depressed afterward, as the tree let her see the world in a more enlightened way. The movie is portrait so well but it is hard to ever believe someone's love, so deep for just a tree or say the environment. To be true, not to be deceiving but I cannot call myself a complete environmentalist. I may have done the litter myself and I'm sure most of us have.

Environment day is just not a day in the name of celebration, it is not a public holiday. But have you ever tried making a difference? Tried getting someone's attention towards the betterment of the environment? The topic is quite powerful because there's a room for everyone to question how we live and to what extent it affects our planet. It's more than just planting around trees on the particular occasion, trust me it is funny when you don't act throughout the year and save the luxury for the last. I'm talking about more that one can do than just planting the trees. The greenhouse effect, the main reason why there is a significant change in climate and so can be expected for few decades. I belong to a country, where a significant change in a growth of economy hurts to a wider extent. Vehicles and new buildings, no space for grassy and flourishing. Overpopulation with increasing demand for no eco-friendly oxygen. The way it is going, I see us moving sooner to another planet. A major part of India, the place I belong, receives increasing amount of "acid rain", the "TAJ MAHAL", that recently joined the race to be named one of the 'New Seven Wonders of the World' is well known affected by the acid rain.

So where does our fault lie? Is it just the environment itself to blame? Every time we dump the waste openly, especially the plastics we use turns the nature upside down, every time you let a tree to die, you are sacrificing your amount of precious oxygen. There is a lot to point out until an initial change made. Let's begin promising ourselves, how a single change makes this planet a better place to thrive. Starting with initials like saying no to plastic bottles and instead using the recyclable ones, using reusable lunch containers, banning all the plastic bags and saying yes to eco-friendly cloth bags, or maybe a jute bag, making sure the dump goes to the waste bins and not litter around. Conserve more of energy and reduce excess water consumption. "REDUCE, REUSE, RECYCLE", the three basic R's of waste management, easy to put in use and very affirmative to imply.

It is easy to plant a tree but all you need is to give it life. The things you do ensures the amount of effort you put to make this planet friendly not only to us human beings but the other biotic organisms as well.



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GARBAGE PILE AT
TEKU TRANSFER STATION

SOLID WASTE MANAGEMENT IN KATHMANDU METROPOLITAN CITY-TEKU TRANSFER STATION

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Kathmandu, the largest metropolitan city of Nepal with a population of around 1.4 million in the city includes densely populated valleys of Nepal. With the growing population, urbanization and industrialization of Kathmandu valley, the solid waste products produced from local households, industries, factories, hospitals and officials have increased posing health risks to the people of the municipality.

The responsibility of collecting waste from all the sources and safely transferring all of the waste to the Landfill site in Sisdol, Nuwakot is taken by Kathmandu Metropolitan City, Environment Division. Recently, Integrated Waste to Energy Plant too has started in the Teku Transfer Station where the wastes are converted to biogas and energy form; a sustainable approach to the Solid Waste Management.

Even with the Environment Division in function, the Solid Waste Management is not very efficient. Due to lacking management in the division and problems in transportation,

Waste Collection
from municipal areas

the collected wastes are piled up in the Transfer Station polluting the environment. So the problems of Solid Waste Management still is unfortunately prevalent. Further improvements can still be done in local and government levels to maintain sanitation by Solid Waste Management. Indeed, the conversion of such waste to the compost manure can be an agriculturally andeconomically sustained approach.

Solid Waste refers to the solid or semisolid nonsoluble materials (including gases and liquids in containers) such as agricultural refuse, demolition waste, industrial waste, mining residues, municipal garbage, and sewage sludge.

These wastes are harmful to the environment and human health. Therefore, proper management of solid waste is necessary to prevent pollution and outbreak of diseases.

Kathmandu Metropolitan City (KMC) comprises of twelve departments including the Environment Division. The Environment Department is further divided into three sectors: Solid Waste Management Section, Mechanical Section and Urban Environment Section. It was established in 1919 A.D. as a "Cleaning Office". Since then it has been working out plans and policies to manage solid wastes and maintaining sanitation within the municipal area. Some of the activities of KMC currently in action are: street sweeping, waste collection, transportation and final disposal to Landfill site.

Data show waste production rate in cities of the developing world is about 0.5 kg per person per day and 650 m3/day.

Collection of Waste

Major waste generation sites are houses, industries, factories, hospitals and other commercial areas. So waste from such sites must be collected properly and regularly.

KMC has been applying following process to collect waste from houses:

- Door to door collection
- Vehicle collection
- Road based collection

Other activities include sweeping, weed uprooting, waste collection from public places and removal of posters pasted without permission.

Trucks and manual carts are used for waste collection from various places within the municipal region. The available number of vehicles in not enough to collect waste from every place. It is a known fact within the KMC Environment Division but still a number of Self Discharging Vehicles remain unused in the Transfer Station.

The waste collected from industrial areas and hospitals contain toxic compounds which must be separated from the rest of the garbage. But seeing a pile of waste in the transfer station unmanaged and untransported, it can be assumed that the wastes are not segregated and all the garbage is mixed up in the same pile.

Transfer Station

The Teku Transfer Station is the site where waste collected from every household and commercial areas are dumped. It was initially constructed as a site to segregate the garbage into organic-inorganic waste, degradable-nondegradable waste and toxic-nontoxic waste. But due to lack of management all the garbages are piled up to form a garbage mountain.

The wastes are collected in the transfer site and treated with Effective Microorganisms to partially degrade the waste and reduce the foul smell. However, the place reeks of foul smell and makes it very difficult to breathe. The garbage pile creates a very unhealthy environment for people living in those areas. The smell and the pollution can cause respiratory diseases, allergies and other degrading health issues.

The garbage piled up are supposed to be transferred in large trucks to the Landfill site in Sisdol. However, lack of proper transportation to the site results in the piling up of the waste.

Transportation

The solid waste collected from the municipal areas are finally dumped into the Landfill site in Sisdol, Nuwakot. If not for transportation, the wastes would be left just as it is: polluting the environment and adversely affecting the health of people.

According to a Solid Waste Management rule, the vehicle used for transportation of solid waste should have following arrangements:

- The Solid waste should not be visible and should not fall out.
- No seepage of liquid materials.
- It must not reek foul odor along the way.
- Easy loading and unloading machinery.
- Conducive to road capacity and condition.

But the vehicles currently in use are old and do not fulfill the above listed arrangements.

Compost Bin

WASTE TO ENERGY PLANT

Other activities

KMC has also been working on spreading awareness about the management of waste. The waste produced from houses contain both degradable and non-degradable wastes. The organic degradable wastes can be sorted in individual houses and used to form compost manure. KMC arranges frequent training sessions to teach households about composting. They are actively promoting this venture by distributing compost bins to different localities and guiding them through its use and function.

Waste to Energy Plant

KMC has integrated a waste-to-energy plant in the Transfer Station. It was established as a one-year pilot project supported by the European Union in 2016. The plant was brought from Pune of Maharashtra, India on August. A five member inspection committee deals with the examination of plant from the feeding step to electricity generation process.

The plant is fed with waste products which gets utilized and generates electricity. The plant was expected to produce 14 kilowatts of electricity and up to 10 kilowatts of electricity had been generated. However, the plant is not functioning at the moment due to technical difficulties.

Recommendations

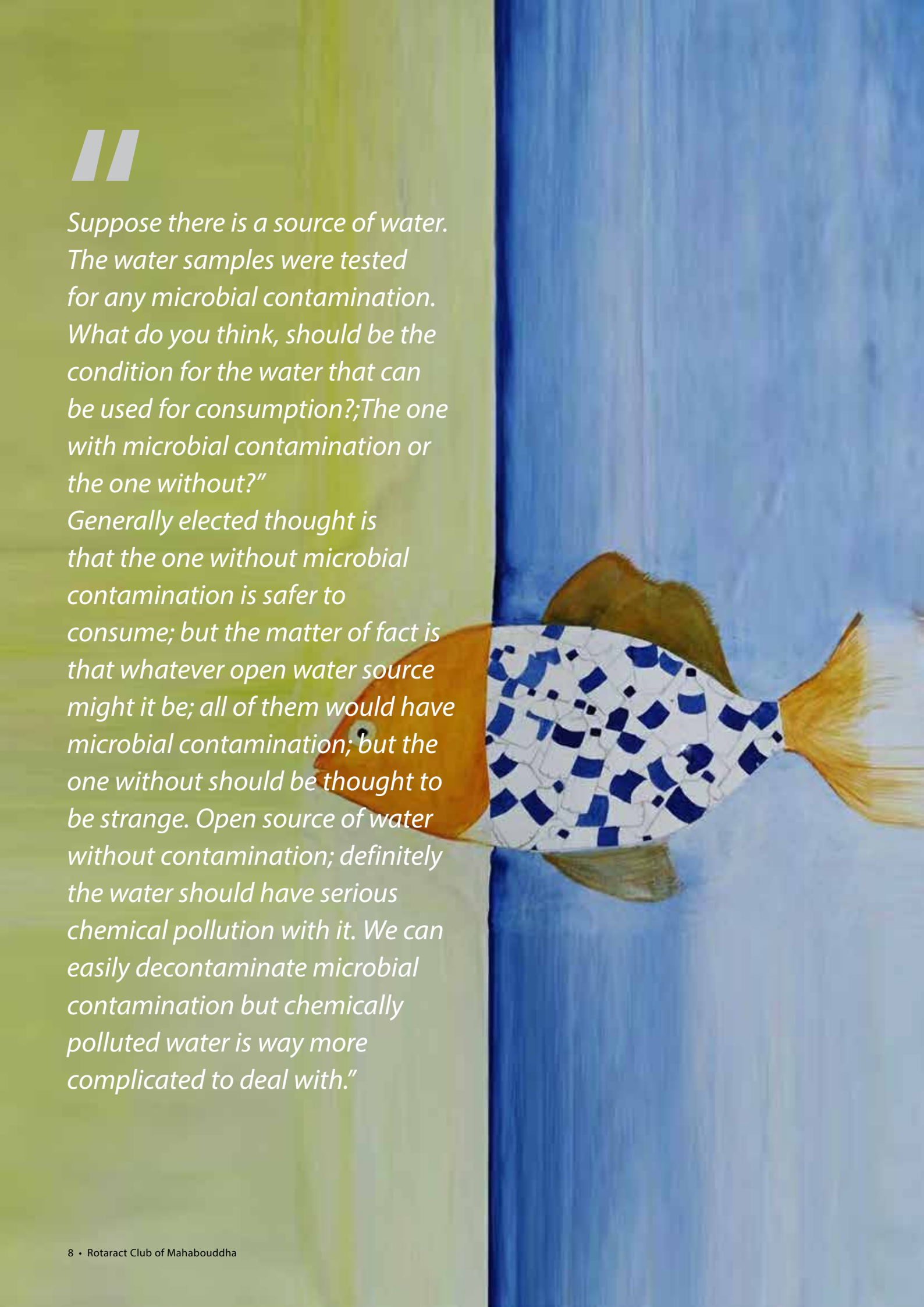
The Environment Division of the Kathmandu Metropolitan City is solely responsible for the management of solid waste produced from Kathmandu Municipality. The prevailing system is not so properly directed. Therefore, piles of waste just lie in the transfer station polluting the environment and risking health of people in that area.

Improvements are necessary and can be made in lot of areas of KMC Environment Division. Some of them are described below:

1. The system is well supplied with infrastructures for proper management of waste still its utilization is lagging far behind. Thereupon, it is the duty of the government officials in the Environment Department to make effective decisions regarding solid waste management.
2. Awareness programs must be conducted in various regions frequently to educate people about adverse effects of solid waste and ways to handle them. They must also be taught how to separate degradable waste and use it to form compost.
3. The workers must be given some incentives so they are encouraged to perform their work of collecting waste from houses and commercial areas regularly.
4. The wastes were treated with Effective Microorganisms but the result was not satisfying as the station was surrounded with foul smell. So the function of the microorganism must be optimized as well as other solution must be researched to deal with the smell.
5. The vehicles must be properly maintained for safe transportation. Any available vehicle must be put to good use and not left for rotting in the station.
6. The Department must recruit dignified scholars and work together to solve the waste management problems.
7. The waste-to-energy plant must be brought back to function and further research must be carried out to improve its efficiency.

"Suppose there is a source of water. The water samples were tested for any microbial contamination. What do you think, should be the condition for the water that can be used for consumption?;The one with microbial contamination or the one without?"

Generally elected thought is that the one without microbial contamination is safer to consume; but the matter of fact is that whatever open water source might it be; all of them would have microbial contamination; but the one without should be thought to be strange. Open source of water without contamination; definitely the water should have serious chemical pollution with it. We can easily decontaminate microbial contamination but chemically polluted water is way more complicated to deal with."



WASTE WATER TREATMENT PLANT AT GUHESHWORI

The lack of proper drainage, and waste treatment and collection system has forced people to dump their waste directly into the river. Bagmati River, which flows across the banks of holy sites like Pashupatinath, Gokernaswor, and Guheshwori, has been mis-used as dumping site by the inhabitants. This has resulted in serious pollution of the river, and the case is same with all rivers flowing across the valley. As an initiative to reduce the pollution of rivers, various waste water treatment plants have been established across the valley, one of which is the Guheshwori waste water treatment plant. This plant is fully functional and the treatment process used is extended aeration consisting of Deep Oxidation Ditch of Carrousel type.

Bagmati River originates from Baghdwar, bifurcates Kathmandu valley, and crosses the valley at Chovar to enter into the Terai region. It has been regarded as a holy river by both Hindus and Buddhists. Despite its cultural importances, pollution of Bagmati River has been a serious problem for some decades. Bagmati River has been misused as an outlet for drainage, solid waste and various household and liquid wastes. This has resulted in serious pollution of river, drawing attention of both private and governmental agencies. One initiative taken by the government to clean up the river was the formation of High Powered Committee, consisting of experts, for Implementation and Monitoring of Bagmati Area Sewerage Construction/ Rehabilitation Project (BASP) in 1995. One of the works done by the committee was the establishment of Guheshwori waste water treatment plant.

The treatment process used is Extended Aeration consisting of Deep Oxidation Ditch of Carrousel type. The treatment system is designed so as to reduce the BOD from 270 mg/l in influent to 25mg/l in the outlet. Similarly, COD and Suspended solids in influent and outlet are 1150 mg/l-250mg/l and 216mg/l-100mg/l respectively.

The treatment plant consists of three major components:

a. Primary Unit Operation
b. Biological Unit Operation
c. Secondary Clarifier

Primary Unit Operation

This unit consists of:

a) Mechanical Bar Screen
b) Sewage Pump
c) Mechanical Grit Removal System

a) Mechanical bar screen

The main function of mechanical bar screen is to remove bulky solid materials like plastics, papers, metals, etc. Here, the floating solid particles are removed by the use of mechanical filters. These materials might interfere with later processes of sewage treatment (biological treatment).

Hence, their removal enhances better treatment. Also, removal of bulky solids avoids the problem of damage and clogging of pipes, and other equipments.

b) Sewage Pump

Sewage pump pumps the sewage using motor to a certain height in order to supply water to the grid chamber along with mechanical filtration of coarse particles.

c) Mechanical Grit Removal System

This unit uses Detroiter and classifier mechanism in order to remove grit from waste water. The Detroiter is a continuous flow tank in which the grit settles due to gravity, and the water overflows on opposite site. The settled grid is then scrapped towards the openings on a classifier. The collection chamber works on a velocity principle so that only grit is settled down, and organic matter is overflowed. The classifier provides further washing, filters the grit to separate sand, for further disposal. Grit needs to be removed to protect moving equipments from abrasion, wear and tear, and also to prevent the deposition of grit on pipelines and equipment.

Biological Unit Operation

It consists of two units of Carrousel type oxidation ditch of dimension of 80m x 20m with a capacity of 10400 cubic meter, and three aerators. Here, the waste water coming from the mechanical grit system is aerated, so that the micro-organisms present in the water can oxidize the organic components present in the water. This biological treatment of waste water uses mixed liquor suspended solid (MLSS). Mixed liquor is the combination of waste water or pre-treated water with the activated sludge, while MLSS consists of micro-organisms with biodegradable solid matter. The pre-treated water is passed on to two ditches where they are rotated vigorously using impellers to facilitate aeration. It provides oxygen necessary for micro-organisms for oxidation of organics, hence speeding up the aerobic digestion. Here, total oxygen demand is 355 kg/hour, while MLSS concentration is 3500mg/l. Re-circulation ratio is 67-100%. Total power required for biological unit operation is about 375KWh.

Secondary Clarifier

The treated water from the oxidation ditch is then passed on to secondary clarifier, where settling down of solid takes place. The water is then passed on to the river through a tunnel/ pipeline. There are two secondary clarifiers, each of 27m diameter and capacity 1650 cubic meter each. The sludge is pumped from the clarifiers back to the oxidation ditches to be degraded by microorganisms and any excess sludge is wasted to the drying beds. The recycling is done to maintain the level of micro-organisms in the oxidation ditch. The treated water is not safe for drinking the water but can be used in agricultural processes. The sludge generated from the treatment is dried, and then used as fertilizers by farmers for agriculture.

The sludge generated from the clarifier is then dried in the dried beds, each of dimensions 27 x 74m for 2-3weeks to generate organic manure. The bi-products of the plant include: 40m3 of organic manure per day, 3m3 of grit and sand per day.

To conclude, Guheshwori treatment plant focuses on decomposition of degradable organic chemicals in the presence of biomass followed by the removal of solids and biomass from the water, and recycling of sludge to the reactor. Mechanical barrack and grit chamber are used for pre-treatment of waste water.

Recommendations

Guheshwori treatment plant is one of the few functional waste water treatment plants currently in Kathmandu valley. One of the reasons for it is regular maintenance of the plant. There was regular cleaning of treatment units viz. oxidation ditch and clarifiers. The treatment units were monitored and repaired in case of damage regularly. There was also a lab set up to analyze the content of the waste water. However, some areas of improvement for Guheshwori Treatment Plant can be discussed below:

a. The lack of a separate collection system for storm water and sewage water caused increase in volume of waste water in rainy seasons. Hence, the waste water overflowed, and bypassed treatment to be mixed directly into water. So, there should be separate pipeline for sewage water.

b. The system lacked a primary sedimentation tank, which would have enhanced further treatment processes.

c. The lack of tertiary treatment units make it difficult for the removal of nitrogen and phosphorous. Future of the plant may include the incorporation of tertiary treatment and labs so that water generated from the treatment can be used for drinking purpose.

d. The grid chamber was in an inappropriate position, as the influent water had to be pumped to higher level using power.

e. The wastes from the industries should be treated by the industries themselves by their own treatment plant. This can reduce the load on municipal treatment plant, and it can encompass greater areas.

If these recommendations are considered and implemented properly, Guheshwori Treatment Plant can serve for efficient treatment of waste from Bagmati River. These types of treatment plants should be established at several parts of the valley if the aim of clean and green Kathmandu is to be achieved.

DHULIKHEL WATER TREATMENT PLANT

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Dhulikhel Water Treatment Plant (DWTP) is located at about 30km east of the capital city of Nepal, Kathmandu. It is a Drinking Water Supply Project formed by the Government of Nepal with the help of German Co-operation Agency in 1987. It was handed over to local water users committee in 1992. The local water users committee is formed every year through election, and it is effectively managing the system and supplying the water to more than 10,000 populations. They supply the drinking water for three hours in the morning and in the evening.

Water Source

The drinking water is obtained from Khar Khola which lies at a distance of 14km from Dhulikhel at Phulchowki. The river is named 'Khar' because of presence of $CaCO_3$ which is called as 'Chuna' in Nepali.

The water in the river is affected by rain and landslides; therefore, it may contain leaves, twigs and some metals. The presence of such materials may block the flow of water through the pipes. So the water is treated at the site of the source. The three treatment processes carried out at the water intake site are:

1. Screening

It is the process of removal of tangible objects from the water. It may be leaves, branches of leaves, paper, plastics etc. The wastes may be reduced, retained or removed according to their size and complexity.

2. Grit separation

Grit removal is the process of removal of sand, silt and grit from water.

3. Plain sedimentation

It is the process in which water is kept in a tank or basin so that suspended particles present in water may settle under the action of gravity without addition of any chemicals.

After removal of the tangible materials from the water, it is supplied to the Dhulikhel Water Treatment Plant at a flow rate of 19 liters per second. The water received on the Plant is further treated to improve the quality of water.

In DWTP, two treatments are in operation. They are:

1. Gravel filter
2. Slow sand filter

1. Gravel filter:

- In gravel filter, water is drawn through the gravel as primary filter media.

Different sized gravels are in use. The size varies as: 40-20 mm, 20-10 mm, and 10-5 mm in diameters. The gravels are arranged on the basis of their size and water flows through the gravels horizontally.

- The gravel itself provides mechanical filtratio n by catching large non-floating particles. The gravel can also serve as a bed for bacteria, thus providing biological filtration too for some extent.
- The gravel filter is mainly applicable to reduce turbidity of the water and to reduce physical impurities.
- Two units are functional at DWTP, out of which one is working, and another is left stand-by which can be used when the prior one is not working (for cleaning and maintainence purposes).
- The gravel filtered water then flows into the slow sand filter.

2. Slow sand filter:

- The filter is 1.5 meter deep and has rectangular cross section. The water flows from top to bottom of the filter. The filter works by using a complex biological film that grows naturally on the surface of the sand. As water passes through the biofilm, particles of foreign matter are trapped in the mucilaginous matrix and soluble organic material is adsorbed. The sand is of size 0.35mm – 0.20mm.

Storage

The water obtained after slow sand filter is then sent to storage tank where it is treated with Chlorine. There is a chlorinator unit which consumes around 7.5 kg of bleaching powder per day. Chlorine is added on the basis of free residual chlorine measured in the water. As an oxidizing agent, chlorine kills by oxidation of organic molecules. It kills disease causing pathogens like bacteria, protozoans, etc. It has its own drawbacks in that the bi-products (bromoform, dibromochloromethane, etc.) may be toxic at some cases, and hazardous for human health. Thus, water needs to be tested for these hazardous chemicals prior to distribution. Although chlorine is volatile in nature, it affects the odour and taste of water.

Distribution

The water from the reservoir of Dhulikhel Water Treatment Plant is distributed to around 2400 houses in Dhulikhel upto Shrikhandapur. The demand of water in the housing areas in around 3.9 million liters of water per day but the facility only distributes around 1.8 million liters of water per day. In the Kathmandu University, the demand of water is 60,000 liters per day but the facility can only provide 30,000 liters of water per day.

Payment for Environment Service

The organization believes that environmental protection should go side by side with the project and hence pays the residents of Khare Khola to maintain sanitation around the river and water sources. About 11 lakhs Nepali currency is given to the villagers to cultivate plants and trees in those areas.

In this way, the Water Treatment Plant has been working to clean and improve the quality of drinking water for the residents of Dhulikhel.

Bugdeting and tarrifs:

Budget (of about 1 lakh rupees monthly) is approved by the General Assembly and Consumers Board every year. This is not a governmental organization, but rather a social enterprise. Hence, tarrifs for water usage is decided by the consumers board, and members of the water users committee. Progressive tarrifs rate are collected from consumers, i.e. higher the amount of water you consume, more you have to pay. . The payment system is based on monthly usage of water as:

Upto 10 units:- 60 rupees
11-25 units:- Rs. 22 per unit
26-50 units:- Rs. 37 per unit
>50 units:- Rs. 76 per unit

Characteristics of Drinking Water:

According to WHO 1993 and 1996 the acceptable aspects of drinking water are:

Physical Characteristics:

Turbidity< 5NTU,
Colour <15 TCU,
Taste / odour free
Cool temperature

Inorganic compounds:

Chloride = 250 mg/l
Ammonia = 1.5 mg/l
pH = 6.5-8.5
Hardness = moderate
Zn < 3mg/l
Hydrogen Sulphide = 0.05-0.1mg/l
Na = 200 mg/l
TDS = 1000 mg/l

Microbial Aspects:

The microorganism E.coli should be detected in 100ml of water sample. In case of large supply E.coli must not be detected in 95% of sample taken through out 12 months period.

Fecal Streptococci and Clostridium perfringens, virus, protozoan, helminthes and free living organisms should be nil.

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PLASTIC POLLUTION

S. SHRESTHA

Plastic pollution is when plastic has gathered in an area and has begun to negatively impact the natural environment and create problems for plants, wildlife and even human population. The overuse of plastics in today's society has become major environmental issue as plastics keeps accumulating in landfills and also ends up in oceans. Plastics are meant for durability, it is not biodegradable and even the most degraded plastic down to polymers cannot be digested by bacteria (Laist, 1997) which leads tones of plastic debris floating in the world's oceans or piled up in landfills."Plastic" entered the world through chemistry in 1909 and was originally coined to describe Bakelite, the first fully synthetic resin. Later in 1933 polyethylene synthesis were discovered which ruled the industrial revolution. The toxic nature of synthetic plastic has been highly overlooked for decades, the majority of the world's population has not been properly educated on the nature of plastic and the potential harm it can do to our environment and our physical health. The plastic releases toxins that get seeped into the soil which pollutes groundwater and oceans.

Hundreds of campaigns are held to reduce the impact of plastic pollution. And among the hundreds of 'reduce, reuse, recycle' campaigns all around the world, somehow nearly one third of the plastic we use escapes collection system.

Plastic debris pollution in the marine environment is greatest in oceanographic convergences and eddies, where plastic bits accumulate (Day 1986). A wide variety of marine species like seabirds, whales, sea turtles and other marine life are eating marine plastic pollution and dying from choking, intestinal blockage and starvation is known to be harmed by plastic debris along with different bird species. This could threaten the survival of certain species, especially since many are sadly endangered by other types of anthropogenic actions. Plastic that pollutes our oceans and waterways has severe impacts on our environment and our economy.

And this year with "Beat Plastic Pollution" as the theme for this year, the world is coming together to combat single-use plastic pollution. India is the global host of 2018 World Environment Day.

Today we use plastic- a material designed to last forever for products designed to last minutes. So, if you can't reduce the use of plastic products, refuse it overall use.

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MEGA DIVERSITY COUNTRIES

Mega diversity

The label "Mega diversity" was first introduced at the 1998 Conference on Biodiversity at the Smithsonian Institution in Washington D.C. Similar to the concept of "biodiversity hotspots," the term refers to any one of a group of nations that harbor the majority of Earth's species and high numbers of endemic species. This country-focused method raises national awareness for biodiversity conservation in nations with high biological diversity, with many species unique to a specific country. This concept complements that of Biodiversity Hotspots and High-Biodiversity Wilderness Areas to achieve significant coverage of the world's biological resources and was first proposed in 1988. Together, the Mega diversity Countries account for at least two thirds of all non-fish vertebrate species and three quarters of all higher plant species. This classification primarily aims to demonstrate how a small number of countries hold a large portion of global diversity and therefore have a disproportionate political responsibility for conservation and biodiversity management. The Mega diversity Country concept is based on four premises:

1. The biodiversity of each and every nation is critically important to that nation's survival, and must be a fundamental component of any national or regional development strategy;
2. Biodiversity is by no means evenly distributed on our planet, and some countries, especially in the tropics, harbor far greater concentrations of biodiversity than others;
3. Some of the most species rich and biodiverse nations also have ecosystems that are under the most severe threat;
4. To achieve maximum impact with limited resources, conservation efforts must concentrate heavily (but not exclusively) on those countries richest in diversity and endemism and most severely threatened; resources invested in them for conservation

The principle criteria for mega diversity countries are endemism, first at the species level and then at higher taxonomic levels such as genus and family. To qualify as a Mega diverse Country, a country must:

1. Have at least 5000 of the world's plants as endemics
2. Have marine ecosystems within its borders.

The focus on endemism is in line with the IUCN's "doctrine of ultimate responsibility", which holds that a country with the only populations of an endangered species has ultimate responsibility for ensuring the survival of that particular species. Other secondary criteria have also been taken into consideration, such as animal and invertebrate endemism, species diversity, higher-level diversity, ecosystem diversity and presence of tropical rainforest ecosystems. Despite endemism being the main criterion, thresholds for the criteria are flexible and countries have been considered individually based on all criteria.

(Source: Mittermeier, R. A., Robles Gil, P. & Mittermeier, C. G. (1999))

Mega diversity countries in the world

Conservation International identified 17 mega diverse countries in 1998.Many of mega diversity countries are located in, or partially in, tropical or subtropical regions.

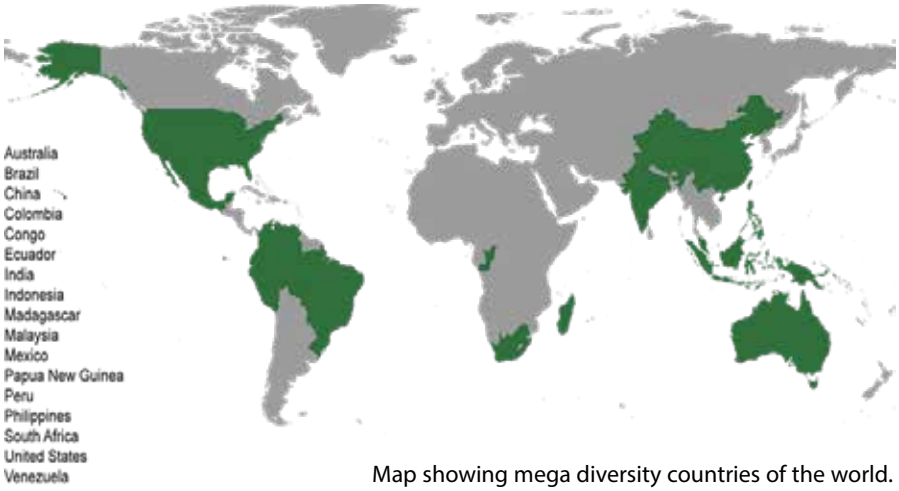
Ecuador

Ecuador is one of the 17 megadiverse countries of the world. This diversity is due to the location of the country in the neotropics, the presence of the Andes and the influence of the ocean's currents on its coasts.

It is divided into 4 well-defined natural geographical zones: coast, mountain range, the Amazon and the Galapagos Islands. In terms of conservation, it is divided into continental Ecuador and the Galapagos Islands, although such efforts are not homogeneously divided in the country. Ecuador possesses 26 distinguished habitat types, each one with characteristic flora related to altitude and precipitation levels. Among them are three of the world's 10 biodiversity "hot spots", namely, the humid forests of the northwest, outside faces of the mountain range and the Amazon forests of the northeast. Ecuador is recognized globally for its vast floristic richness, which is still not very well known and often under threat. It is estimated that the country has more plant species per unit area than any other country in South America. Ecuador is also home to the Galapagos Islands, a UNESCO World Heritage site, famous for its unique plant and animal species, and for being the birthplace of Charles Darwin's theory of evolution. However, the Galapagos National Park and the Marine Reserve, declared UNESCO World Heritage Sites, are presently in danger. In response, the Government has undertaken a series of actions aimed at strengthening the institutional processes in the region.

The total forest cover is about 11.6 million ha, of which 11.5 million ha constitute natural forest and 78,000 ha plantations, representing 42% of the total national surface area. Ecuador has red-listed vertebrates, birds and reptiles. Although a Red List does not exist for Ecuador's amphibians, their conservation status has been categorized by the Global Amphibian Assessment (GAA) which has been an effective tool for taking management and conservation decisions. No documentation exists to clarify the conservation status of fish species.

The Galapagos Islands are unique in the world in that they are a self-contained ecological system and an ecoregion with



Map showing mega diversity countries of the world.

a high level of biological endemism. These islands constitute the last undisturbed ecosystem of insects in the world where it is possible to identify patterns that existed before homogeni zation by introduced species of insects. Notably, it is estimated that 50% of vertebrates could become extinct if conservation efforts are not successful. Bird species appear to have a greater potential risk of extinction. In the last few years, there has been no evidence of biodiversity loss. To this day, 95% of the original biodiversity has been maintained. The Galapagos could represent one of the largest conservation challenges and opportunities for Ecuador.

Threats

The main threat to biodiversity conservation in Ecuador is deforestation, with Ecuador ranked second among Latin American countries in terms of highest levels of deforestation losing 2,964 square-kilometers yearly.

Firewood collection, urban expansion, petroleum exploration and exploitation, agriculture, mining, fishing, overexploitation of natural resources, poverty, human migrations, tourism development, and introduced species are other important aspects contributing to the deterioration of the country's biological richness in both continental and island areas. .

One of the biggest current threats in Ecuador is in Yasuni National Park, located in the Amazon Rainforest region of the country, and one of the biologically richest areas in the world, as well as home to multiple indigenous tribes. However, an oil reserve worth over seven billion dollars was discovered in the park, and while the government proposed an innovative plan to ban oil extraction, that plan has fallen short; the area is under threat, and is currently being explored by oil companies.

Conservation Efforts

Ecuador is the first country in the world to recognize the Rights of Nature, enforceable by law, in its 2008 constitution.

The National Biodiversity Policy and Strategy (Política y Estrategia Nacional de Biodiversidad del Ecuador (2001-2010)) addresses five main themes: fragile ecosystems (with a particular emphasis in pàramo, wetlands, mangroves, marine ecosystems and dry forest), strengthening of the protected areas national system and protection of threatened species, sustainable agriculture and the rehabilitation of degraded areas (emphasizing food security and sovereignty), biocommerce, biosafety and genetic resources.

The document proposes 4 main strategic axes, as well as management measures, areas of priority and actions:

(1) Consolidate and strengthen the sustainability of production activities based on native biodiversity;

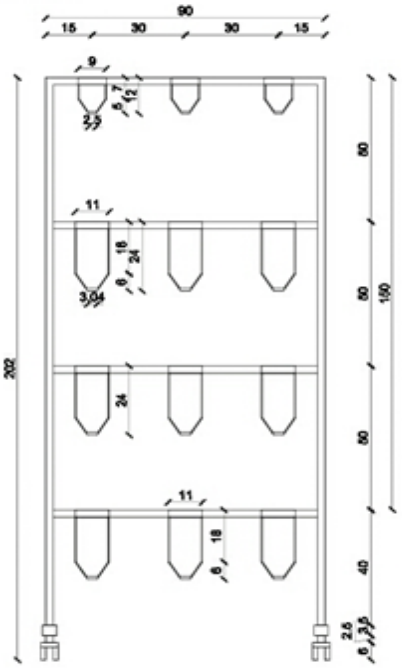
(2) Ensure the existence, integrity and functionality of all biodiversity components (ecosystems, species, and genes);

3) Balance pressures from conservation and sustainable use on biodiversity; and

(4) Guarantee the respect and exercise of individual and collective rights to participate in decisions related to access and control of resources, and ensure that the benefits derived from the conservation and sustainable use of biodiversity, as well as from the use of knowledge, innovations and practices of the indigenous communities and local populations, are justly and equitably distributed. It is recognized that, in spite of the existence of EIA legislation, the State has often failed to comply with the constitutional mandate to consult affected populations. Other sectors that have also not complied with this mandate are agribusiness, mining, manufacturing, timber and fisheries.

To date, the NBSAP has not been properly implemented due to its many limitations (e.g. the scope of competencies of different government levels is unclear, mainstreaming strategies are limited). Also, the legal framework for the NBSAP is incomplete and one of the main obstacles to its implementation. Moreover, initiatives in Ecuador are not necessarily linked to the NBSAP which was created in 2000 and only approved in 2007. Consequently, initiatives have followed a "common sense" approach and considered the experiences gained by different private, public and international organizations.

Ecuador is currently in the process of updating its NBSAP (National Biodiversity Strategy and Action Plan).



DRIP BIO-SCREEN

MR. AMITAB BAJRA BAJRACHARYA, MS. SHREEYA MANANDHAR

MR. ESSENCE SHRESTHA, MS. SHREEYA SHRESTHA, MS. BHINTUNA VAIDYA

Drip Bio-screen is the cost-effective irrigation system suitable for application of water and nutrients directly to the root zone of the plants. It involves dripping water onto the soil at very low rates (0.5 liters/hour) from a system of small diameter plastic pipes fitted with outlets called emitters or drippers. Water is applied close to plants so that only part of the soil in which the roots grow is wetted, unlike surface and sprinkler irrigation, which involves wetting the whole soil profile. Water applications are more frequent (usually every 1-3 days) than with other methods and this provides a very favorable high moisture level in the soil which is favorable for plant growth and development.

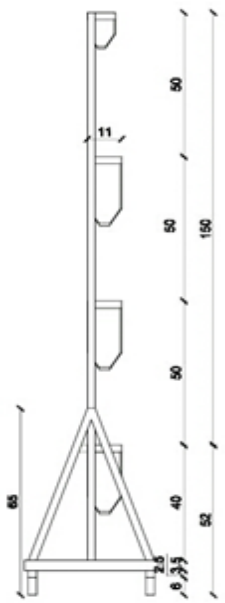
Drip Bio-Screen can be a very technical irrigation system for kitchen herbs or ornamental plants. Drip Bio-Screen required less space for installation which also helped in having greenery in small areas like balconies of the urban buildings. The main objective of our project was to design and build a drip bio-screen system and comparing the benefits and economic suitability of drip bio-screen to that of traditional gardening methods. Kitchen herbs and ornamental plants are grown very easily with low labor and maintenance. Thus, this form of irrigation reduced dependency of people's on market crops up to certain extent. But compared to other technical systems (e.g. sprinkler irrigation) it is a low-technique solution. Furthermore it is possible to combine this system with a water treatment plant (e.g. non-planted filter or constructed wetlands (horizontal flow or vertical flow) and use the treated water as irrigation water. Drip Bio-Screen requires little water compared to other irrigation methods .The small amount of water reduces weed growth and limits the leaching of plant nutrients down in the soil.

The drip bio screen system consists of two main parts which include emitters and plant holders for growing plants.

- Emitters: A unit for supplying water which is placed generally at the top. The water flows down from it due to gravity.
- Plant holder: It is used to grow plants. They are usually containers which are used to retain soil in cases when plants aren't grown in fields.
- Stand: A unit for providing support to the plant holder. They are not always necessary and used only when the system requires plant holders.

Drip bio screen can become a method of choice of growing crops (Kitchen herbs) and also ornamental plants because it prevents the unnecessary loss of water due to vaporization and doesn't require a large area to operate. It can be applied in large scale as well as small scale. It offers improvements over traditional methods of growing crops which often requires excess water supply and high maintenance cost and time. It also adds to the beauty of one's home as the system can be installed in balconies. They also act as a filter for air as the plants take in carbon dioxide and provide fresh oxygen.

The irrigated area occupies worldwide about 16% of the total agricultural area and productivity of irrigated land is 3.6 times more than that of unirrigated land. In a farm in the state of Tamil Nadu, drip irrigated field's yielded 22% more rice per hectare and required only a third as much water.(Sundquist, 2007)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KEEP ENVIRONMENT CLEAN

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