



Urgency to go back to traditional eco-friendly toilet culture: a case of Nepal

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ABSTRACT

Human faeces rather than the industrial waste is more accountable for polluting the rivers running in and around the Kathmandu city and urban Nepal. Rivers running in Kathmandu, the capital city of Nepal, despite of being densely populated since 500 years before, were serene and free from humane pollution until 1960s. Recycling the human faeces from house to farm for crop nutrients with no draining to rivers, eco-friendly toilet culture, was the main *ipso facto* behind. The eco-friendly toilet culture has been withered away due to intervention of the so-called modern toilet system that connects the human waste directly to the river system from then on. As a result, the condition of the river system in Kathmandu valley is not less bad than that of Thames River before 1864. Eco-friendly natural recycling system made by tuning the traditional toilet practice has been inevitable in Kathmandu for human living.

This paper makes a review of eco-friendly toilet culture practiced from time immemorial and the adverse impact of modern toilet system to the river environment and to human health, especially in Capital city of Nepal, with pictorial illustrations. Moreover, the paper also makes a review of the meagre efforts being made to clean the Bagmati, the main river system of Kathmandu city, and the conceptual flaws in the efforts are also dealt with. The paper also includes a brief discussion on shortage of water in Kathmandu valley for flushing the modern toilet system, despite of its negatives to the river system. Economic implication to meet the water needs is also outlined. Finally, the paper makes suggestions for replication of traditional toilet culture for making the river system clean with pictorial illustrations. Improvement required over the traditional toilet culture in order to match with the changing habits and emerging needs of people in Kathmandu, in particular, and other parts of Nepal, in general, are suggested.



INTRODUCTION

Rivers running in Kathmandu, the capital city of Nepal, despite being densely populated since 500 years before, were serene and free from humane pollution till 1960s. Increase in level of pollutants entering the water regime due to growing urbanization and population concentration in Kathmandu valley has been alarming. As a result, the condition of the river system in Kathmandu valley is no less bad than that of Thames River before 1864. The health of Bagmati River and its tributaries is alarmly poor. Bagmati passing through the urban settlements has become no more than an open sewer. It is dying due to untreated household solid sewage and toxic chemical waste, which wiped out aquatic life and traditional cherished religious practices. With rapidly increasing volumes of sewerage, the situation can get further worse.

OBJECTIVES AND METHODOLOGY OF STUDY

Objectives

Overall, the objective of the study is to find out the ways to revive the health of Bagmati riverine system to its natural form. The specific objectives of the study are to:

- i) Identify the existing condition and factors of pollution in Bagmati riverine system;
- ii) Find out the major efforts made to improve the environment of Bagmati;
- iii) Make an analysis of advantages and problems inherent with the traditional toilet system practiced in the past in Kathmandu valley;
- iv) Assess the recent approach of toilet system aimed at managing the human excreta at the source itself;
- v) Based on the findings made, suggest the appropriate measures to improve the health of Bagmati riverine system.

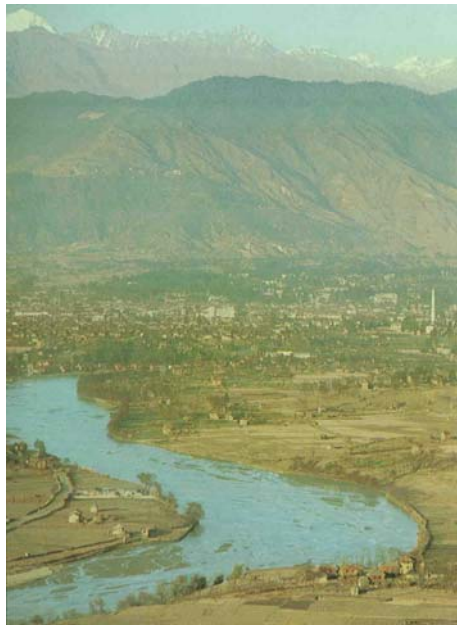
Methodology

Existing literature and studies done on Bagmati river system were reviewed and reconnaissance visit of upstream catchments to the tail of Bagmati in Kathmandu valley were done. Efforts made in the past to improve the Bagmati environment were assessed. A case study on new approach of sanitation system (ECOSAN) promoted by a NGO in village located at the tail of Bagmati in the outskirts of Kathmandu city was also carried. Finally, based on the findings made, measures to revive the health if not improve the environment of Bagmati river system have been suggested.

DISCUSSION ON FINDINGS

Bagmati River Till 1960

The Bagmati is the main river in the valley of Kathmandu, the capital city of Nepal. It originates from Bagdwar in Shivapuri hill at an altitude of 2,650 m. Running down rocky mountains, it descends to the plains of Nepal and ends in India by joining the Ganges. The total watercourse length from its origin to the border with India is 190 km, covering a catchment area of 662 km² in Kathmandu valley. Thirteen tributaries originating in the Mahabharata hill ranges feed the Bagmati River in Kathmandu valley.



Picture 1. Clean Bagmati River at central Kathmandu in the past time.

Until 1960 water in Bagmati was clean, unpolluted and flowing naturally. Therefore, it's Ghat (banks), Satalls (resting places), temples, shrines and other related monuments and structures were lively and well maintained [1]. People used water without hesitation. Stone paved Ghats looked clean and well maintained. Banks without stone Ghats were protected by bio-engineering technique using Baiesh (willow) and Narkat (reed). There are still some such sites in Bhaktapur and Kirtipur, two of the three principal cities of Kathmandu valley. These green belts served as the dens for jackals. Taller trees gave good nests and perches for vultures and eagles. The howling of jacks would resemble the biological tunes much better than the mechanical of the present day horrific traffic. Scavenger birds would circle and circle the sky searching for dead animal on the river banks. There used to be fishes, crabs and other aquatic lives [2].



Picture 2. Clean Bagmati River at Pashupati temple is a history past time.

The main factors behind the Bagmati to be clean include the religious importance and values accorded by many religious sects. Water is regarded as one of the five elements of life; earth, fire, air, water and ether in Hinduism [3]. Taking bath and dipping hands and legs into the river before the vow to the deities is a religiously cherished practice in Nepal. Cremation of dead body along the riverside is still being practiced on the religious ground. Dipping the legs and giving a handful of water into the mouth of the dead body is conceived as way to heaven to the deceased person. Accordingly, the rituals after the death of person are performed along the riverside. There are religious mores and practices “pissing and defecation is a sin” being preached to a person during the conformation time. Because of these among the other factors, drainage connecting household solid waste to the river system was not practiced then. On-site management of human solid waste was common. Household solid wastes were not connected to the Bagmati river system.

Traditional Toilet Culture and Bagmati

Traditional toilet system based on the management of human excreta at household with no connection of the sewer to the natural river system was the main ipso facto behind the sound health of Bagmati riverine system till 1960 from the time immemorial. The solid waste used to be drawn out from the septic pit at household level and taken out to the farmland for manure purpose. Recycling the human faeces from house to farm for crop nutrients with no draining to rivers used to be the main toilet culture in Kathmandu valley. It was the best eco-friendly toilet culture.



Picture 3. Traditional recycling of sewer from household level in Kathmandu valley.



Picture 4. Traditional recycling sewer to the agricultural field.

The eco-friendly toilet culture has been withered away after invention of the so-called modern toilet system that connects the human waste directly to the river system from then on.

Bagmati River After 1960

The serenity of the Bagmati River is in rapid deterioration after introduction of the so called modern toilet system in 1960. In addition, Kathmandu the centre of power polity, wealth and opportunity, has been experiencing tremendous increase in population in unbearable extent. This trend affected many aspects of life in Kathmandu and the Bagmati became a more vulnerable system. In course of time, it resulted to turn the serene Bagmati into a big open sewer.



Picture 5. Bagmati River now as open sewer.



Picture 6. Municipal waste dumping on the bank of Bagmati River.

With the passing of settlement from the upstream of Bagmati, there are sewerage connections in every 15 minutes walk [4]. Kathmandu is standing over huge heap of stinking solid waste, intersected by foul smelling highly polluted river Bagmati and its tributaries. By 1986, about 100 drainpipes of various sizes were connected to Bagmati and its tributaries along the start of settlements to the end of the Kathmandu city [5]. Untreated effluents from government buildings, industrial districts, hospitals, school, municipalities and factories are all directly discharged into the Bagmati river system at various points.



Picture 7. Entering household sewer to Bagmati.



Picture 8. Household sewer entering into Manahara, one of the major tributaries of Bagmati.

Carpet washing and dyeing industries pollute the rivers system at various points mainly the carpet making areas (Bouddha, Jorpati, Gokarna and Jawalakhel). In addition, the volume of solid waste has been increasing at an alarming rate. The solid wastes are dumped on river banks. Some of these wastes are bio-degradable and produce very powerful foul smell. Others are non-degradable like readymade garment factory waste of synthetic materials, plastic bottles, and plastic bags, broken glasses, bottles, food cans, used motor oil, broken crockeries and many more. Estimate indicates that the volume of such waste has increase to 350 cubic metres in 1993 from 80 cubic metres in 1983. By now, Kathmandu seems to have been standing above the heap of solid waste. In addition, large herds of buffaloes wallowing in the Bagmati are another factor for polluting the Bagmati river system. Nearby river water serves as convenient wallowing spot. Most slaughter houses are located by river sites, which make the water more contaminated due to slaughter house waste. Heaves of bones and legs with hooves are left on the banks for drying. All these are the prime generators of pollution and destroyers of Bagmati river ecosystem.

Water Quality

Study findings on water quality of Bagmati confirm that the solid waste sewerage is the main cause of polluting Bagmati. A study done by Stanley International et al. in 1994 revealed that of the total pollutants, 95 % accounts for municipal sewerage, 1 % Industrial waste, carpet washing carding 3 % and 1 % by others. The study results on the water quality confirmed that the municipal sewerage is the main source of pollution resulting in very low dissolved oxygen (sometimes zero) and high BOD and high ammoniacal nitrogen concentrations [6]. Heavy metal concentration in Bagmati and its tributaries are extremely low; therefore, this does not seem to be a major problem at the moment. However, in many cases the Bagmati is receiving certain amounts of heavy metals from industrial discharges. Accumulation of these metals is prone to produce some cumulative effects in the future. Chromium in Dhobikhola, one of the main

tributaries from the tannery is the main concern, but dyeing operations also have been causing some chromium contamination. The results of the study indicate large numbers of faecal coli forms bacteria, varying greatly according to season but always greatly exceeding the international standard (1000 FC/100ml for swimming) and even in upstream (rural areas) reaches 2000 FC/100ml. The concentrations were exceptionally high in urban areas (2000 million FC/100 ml) in Tukucha, one of the main tributaries, which is effectively a sewer now: 9 million FC/100 ml in downstream Bagmati and Bishnumati and 5 million FC/100ml even at Pashupati where treatment plant is established.

As the river enters the highly populated area, Bagmati is subjected to catastrophic disturbances arising from anthropogenic activities consequently worsening the water quality. Downstream more domestic sewage and industrial sewage are added to the river, the river is gravely degraded and a near anaerobic condition persists. Further to the downstream, where many other tributaries such as Bishnumati, Manohara, Dhobikhola and more sewage lines join the Bagmati. The river is gravely polluted with excessively high organic and nutrient load and oxygen level is noxiously low.



Picture 9. Polluted Bagmati River at Chobhar, the tail of Kathmandu valley.

As the Bagmati River leaves dense settlement and passes through the Chobhar gorge leaving Kathmandu valley, the oxygen level is improved; however other parameters such phosphate, ammonia and chemical oxygen demand (COD) are extremely above the risk of threshold level. The traditional practice of irrigating the farm from Bagmati river system has been resulting in adverse impacts on human health. A study done in one of the site of Bagmati river system indicated that irrigation with the polluted water was causing skin problems, intestinal parasites and other problems due to contact with polluted water [7]. In addition, frequent flooding of the highly polluted water has been physically damaging the crops as well as leading to over fertilization. Washing the vegetables to supply to the city centres by river water is a common practice in Kathmandu and has been the main source of water borne diseases to the Kathmandu population. Therefore, Bagmati, which used to be one of the main sources of water for human and animals till 1960, is a myth by now.



Modern Toilet System and Water Supply Situation

The introduction of modern toilet system is not only affecting the river system with agricultural system and human health, it has proved to be a hard luck to the Kathmanduites. The modern toilet in Nepal has proved to be a system that does not care for the need of maintaining environment and river system clean. It is a system that helps to maintain cleanliness within the house but affects the society as a whole.

Estimate indicates that modern toilet system needs 15, 000 litre/person/year [8]. There is an outcry for drinking water for most of the months in year in Kathmandu valley, consisting of 3 districts namely Kathmandu, Lalitpur and Bhaktapur which is inhabited by about 1.7 million people including 1.05 million populations in municipal areas, excluding migrating and floating population [9]. Assuming 90 % of the municipal population own modern toilet, the water need for sanitation purpose alone would amount to 38 MLD which is 35 % of the daily water supply in Kathmandu valley itself. Lifting the ground water is an option but geologists fear the worst. Lifting of the ground water might necessitate to sinking of the city due to Kathmandu valley's geomorphology and lack of recharge. Mega project like Melamchi with 35 kilometre of tunnel would suffice the needs of the people; however, the project has proved to be a far cry due to complex management and shortage of fund resources. Even if the Melamchi mega project is materialised, the waste water trend will synchronically increase if the people are not informed of managing their waste water and water optimisation techniques from the beginning. If not so, there will be a need to allot mega million budget to treat and manage the city waste water. The allocation made of 3 % of the mega million Melamchi project will be a drop of water in big pot.

Efforts made in the recent past to revive the Bagmati river system

Bagmati Area Sewerage Construction/Rehabilitation Project (BASP)

Concern about the deteriorating Bagmati river system was indicated with the ushering of importance of clean environment at global level. A few patch works were initiated however, with no or dismal impact in the system.

A project called Bagmati Area Sewerage Construction/Rehabilitation implemented by a high power committee of the government to curb the environmental degradation of Bagmati River and adjoining areas to restore the condition once pristine Bagmati river at upstream of Pashupati temple, one of the world heritage in 1994. All the drainage at the upstream of the Pashupati is collected and plant is constructed to treat waste water. It has capacity to treat 190 litres per second flow and the rest is diverted at the downstream. The plant collects the sewers of upstream Pashupati through trunk pipe of 14.75 km and flushes both the treated and untreated sewage with diversion at the lower

stream of Pashupati (BASP, 2002). It just sediments the solid and the water is not safe for human use.



Picture 10. Sewer treatment plant of BASP, just upstream Pashupati temple.



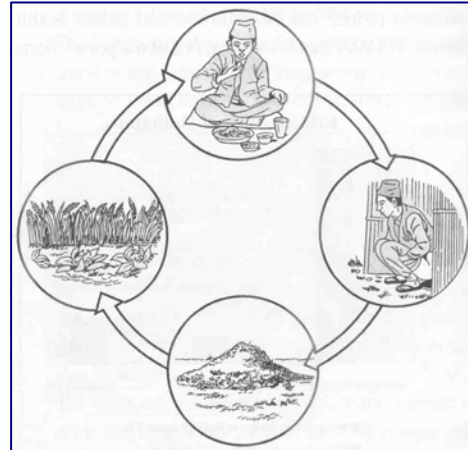
Picture 11. Treated and untreated sewer bypassed below Pashupati temple through BASP treatment plant.

UN Park Project

UN Park (Plantation) is a utopian concept to establish park by plantation around the both banks of the Bagmati and its main 13 tributaries with sewer management and treatment plant along the 40 kilometre span of the river, with budget estimate of 13 billion Nepali rupees (US\$ 185 million). The plantation is meant to treat the polluted river water through plantation (RB method) to revive the water health. However, this ambitious integrated Plan has been the subject to severe criticism right from its inception by the environmental experts who state that the plan is not based on scientific and social studies. No significant achievement has been noticed so far except for some trees in some patches along the Bagmati embankments.

Case Study of ECOSAN Project in Khokana Village

With the aim to address the need for sustainable and ecological onsite waste management system to reduce the waste volume, to ease the management, to conserve the resources and ultimately for clean, green, healthy and productive human civilization, a ECOSAN Project has been initiated by a national NGO called ENPHO, a national NGO founded for improvement of environment public health, in rural villages at the outskirts of the Kathmandu city since 2003. This project is a rejuvenated approach on sanitation that helps in managing the human excreta at the source and also helps in refurbishing the agricultural practices. It blends the historical sanitation and agriculture systems in scientific ways to respect ecological integrity, conserve and protect fresh water, promote dignified and healthy living, recycle nutrients from human excreta for use in agriculture.



Picture 12. Recycle of nutrition in the nature. (Source: ENPHO Magazine 2004)

This new approach closes the loop on sanitation by recycle and reuse. Featured with waste collection treatment system at the source itself, it reduces the load of waste water and cost of waste water treatment. Recycling and reuse of waste from the system helps to substitute the chemical fertilizers. So far, 65 toilets have been constructed in the village with the support WaterAid.



Picture 13. Double pan for alternate use, ECOSAN Toilet at Khokana.



Picture 14. Villagers at Khokana are happy having ECOSAN latrine in their homes for the saved expenses on chemical fertilizers.

This approach suits to the rural setting, however, the initial investment cost for construction and establishment of such toilet is high when considered the economic condition of the rural people with the average per capita income of US \$ 237. The average initial investment cost is estimated at Rs. 16,000 (US \$ 228). At present, the



project is subsidizing 75% of the investment cost and the rest 25 %, which include construction of superstructures from the household. However, this technology is likely to be adapted to the city areas where the income of the people is high than the national average. The ECOSAN toilet promoted by ENPHO needs improvement in design and management of waste for adapting in city area in Kathmandu in order to match with the compact settlements with no land around house for toilet construction.

SUMMARY AND CONCLUSIONS

The present state of Bagmati and its tributaries is open sewers with the level of pollution in ever-increasing trend after the introduction of modern toilet system in Nepal after 1960. Human faeces rather than the industrial wastes are more accountable for polluting the rivers running in and round the city and urban Nepal. Findings of the study reveal that about 95 % of the pollution in Bagmati river system is from household/municipal sewerage originated after the introduction of modern toilet system.

The main factors behind severely deteriorating condition of Bagmati riverine system is the faulty sanitation approaches with a lot of loopholes. No attention was paid at policy and program level about the consequence of connecting the household sewerage and industrial waste into the Bagmati river system without treatment which has become an open sewer for more than 8 months a year. The cherished eco-friendly sanitation technology and sanitation practice from the time immemorial was bluntly overlooked. The entire population settled in Kathmandu valley is at risk despite having so called modern borrowed concept of sanitation, which may be considered throwing the household waste to roadside without caring the hazard to the neighbours and society at large. Ultimately, the unplanned and haphazard sewer networks all around stand out as an entrapment to the Kathmanduites with significant public health nuisances, which at present is very much under developed.

It has been of utmost necessity to address the need of sustainable and ecological onsite waste management system to reduce the waste volume, to ease the management, to conserve the resources and ultimately for clean and healthy Bagmati civilization and its cherished culture. This calls for a traditional eco-friendly toilet system based on management of human excreta at the household level itself and refurbishing the agricultural practices with some changes in the technology to suit the present need of the present day people. It is because the traditional sanitation practice originated in the habitation with less population and with adequate open agricultural field in the close vicinity with the recycling of solid waste from household to the field; for manure calls for improvement to match with city people living in tight compact settlement with no land around it. The design to match such settlements calls for technology to match and manage the human excreta with in house. This calls for a well-managed system of collecting the excreta from the city and disposing from the filled-in pit and use for manure.



The recommendations made by various studies and scientists call for huge investments for construction of treatment plants and very complex and costly operation and management, which is not likely to be implemented in the immediate future when viewed to the state of economy of Nepal and management capacity. Therefore, the eco-friendly natural recycling system by tuning the traditional toilet practice has been inevitable in order to make Kathmandu for worth human living.

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