

THE BAGMATI: Issues, Challenges and Prospects

You don't have to be a trained ecologist to know the river is polluted.

The context

The quality of the Bagmati River and its surroundings in Kathmandu has degraded substantially over the last two decades. More particularly, water quality near the shrines of Pashupati, Sankhamul and Teku, places where people offer prayers and carry out rituals like funerals and bathing, has deteriorated. The degraded state of the river and its tributaries is attributable to rapid changes in lifestyle and drastic increases in population. As the number of buildings has increased and modernisation take hold, the installation of flush toilets, washing machines and solar water heaters has dramatically increased water use. A typical three-story modern building in Kathmandu has a minimum of four to five flush toilets. All three technologies contribute to individual comfort, it is true, but they also increase the volume of non-consumptive and sanitary water used within a household. Almost all of this water is converted to grey and black waters.

- 1 Washing Machine
- 2 Flush Toilet
- 3 Solar Water Heater

Use of modern artifacts such as these increases the need for sanitary water and contributes to generation of grey and black waters



Box 1: The Changing Urban Context of Kathmandu

Each of the three cities of the Kathmandu valley—Kathmandu, Lalitpur, and Bhaktapur—was originally located at a distance from any river. According to Tiwari (1988), early settlers made their homes on the lower slopes of the mountains surrounding the valley. They made use of the sub-surface water available at shallow depths in mountain springs as well as the water in the upper reaches of rivers. When they moved to the valley floor, they built stone water spout (*dhungey dhara*). These stone taps were fed by unconfined aquifers and delivered through surface channels. For irrigation purposes, the state built canals, or *raj kulo*, which tapped the upper stretches of rivers close to the mountains. At that time, a buffer strip of land separated rivers and settlements. The rivers were clean, and irrigation helped recharge valley aquifers.

The capital of Kathmandu began to witness a population influx during the 1950s, and the rate increasing exponentially after 1980. Three decades ago, only the core area of the valley was densely populated, but today, with immigrants coming from right across the nation, outlying suburbs have also been thickly settled. During the Maoist insurgency, as security in rural Nepal deteriorated, the rate of migration into Kathmandu soared. According to the 2001 census, the population of all three valley districts—Kathmandu, Lalitpur, and Bhaktapur—was 1,645,091. Subtracting the population in the hills of Lalitpur lying outside the valley—42,826—gives a total population in the valley of 1,602,265.

The five valley municipalities—the three districts and Kirtipur and Thimi—registered a population of 995,966.

As it has expanded from its central core in the last few decades, Kathmandu has witnessed an expansion in its road networks and a concomitant increase in the price of land adjacent to roads. Many stretches along river banks have also been used for road construction. In fact, today all major tributaries of the Bagmati River have roads on both banks. As the agricultural land along river banks is rapidly converted into residential areas, private houses, too, have steadily encroached upon rivers. Indeed, the upper stretches of the Ichhumati (also known as the Tukucha because the river water is so filthy) around Baluwatar have been covered and are used as a road. This tributary passes through the grounds of the Narayanhiti National Museum (the ex-Royal Palace) in a sewer pipe.

Urban Kathmandu has seen significant changes in the last four decades, as three documents written by three different generations demonstrate. In 1969 the government prepared a master plan for Kathmandu valley. The report suggested that

Kathmandu-Patan as the primary urban concentration of the country will continue to attract population. This, growth, however, must be controlled and directed on the one hand, and ultimately be balanced by areas of counter attraction on the other.

More than two decades later, in 1993, *Himal* magazine bought out a special issue on the stresses associated with

Because the Bagmati is a seasonal river fed by monsoon rains, which provide 80% of annual rainfall, there is wide seasonal variation in flow and quality (see Box 2). River flow begins to decline considerably after the monsoon rains end, but untreated solid and liquid wastes continue to be dumped into the Bagmati and its tributaries under the assumption that the water would carry them away. With the number and size of settlements having grown substantially, the volume of this waste has also increased. The low flow of the river in the non-monsoon months can no longer flush away the waste. In fact, the dilution capacity today is so low that the flow is predominantly grey and black waters. Till the mid 1970s, however, grey water and the mostly organic municipal wastes were indeed transported downstream. Even so, “out of sight out of mind” is an inappropriate notion that disrespects the hydrological cycle.

Rivers have been diverted and water withdrawn from underground aquifers using pumps to meet the increasing need. The use of pumps in the Valley which began as early as 1960, increased sharply after 1980. Private households, corporate houses, hotels, industries, embassies, and even the water supply utility itself are the major users of groundwater. Industries, corporate houses and the utility pumps deep groundwater, and private households draw shallow aquifers. The rate at which water from underground aquifers is pumped out is much higher than the rate at which recharge occurs. The result is lowered

Kathmandu's expansion. One of the articles highlighted the challenge of urbanisation as:

*"The traditional settlement pattern which was once in harmony with the environment has lost ground to the urban octopus."*¹

Almost 18 years later, another article in 2008, reflected on the Valley's relentless growth, thus:

*As long as homes are built in uninviting and severe compounds, without regard for parking, roads or neighbours, the sense of community necessary for the dynamism that characterises healthy urban life will remain absent from Kathmandu.*²

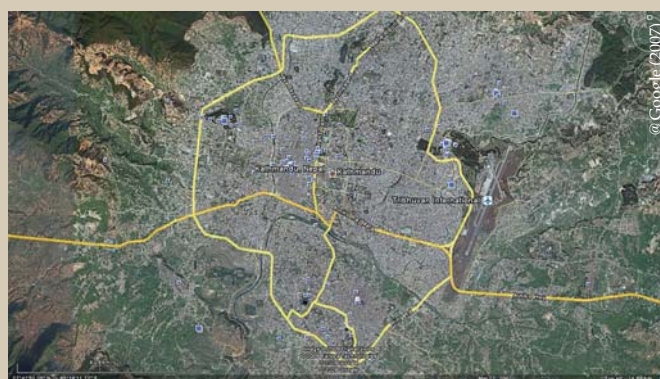
Referring to the ecological degradation of the Bagmati River, Rademacher (2007) has argued that people attribute environmental degradation in the valley to a failure of good governance. The author further suggests that Nepal's new political order must accommodate plural voices and representation while at the same time also deliver basic services to the people.



Traditional settlement pattern



Urban octopus 1990s

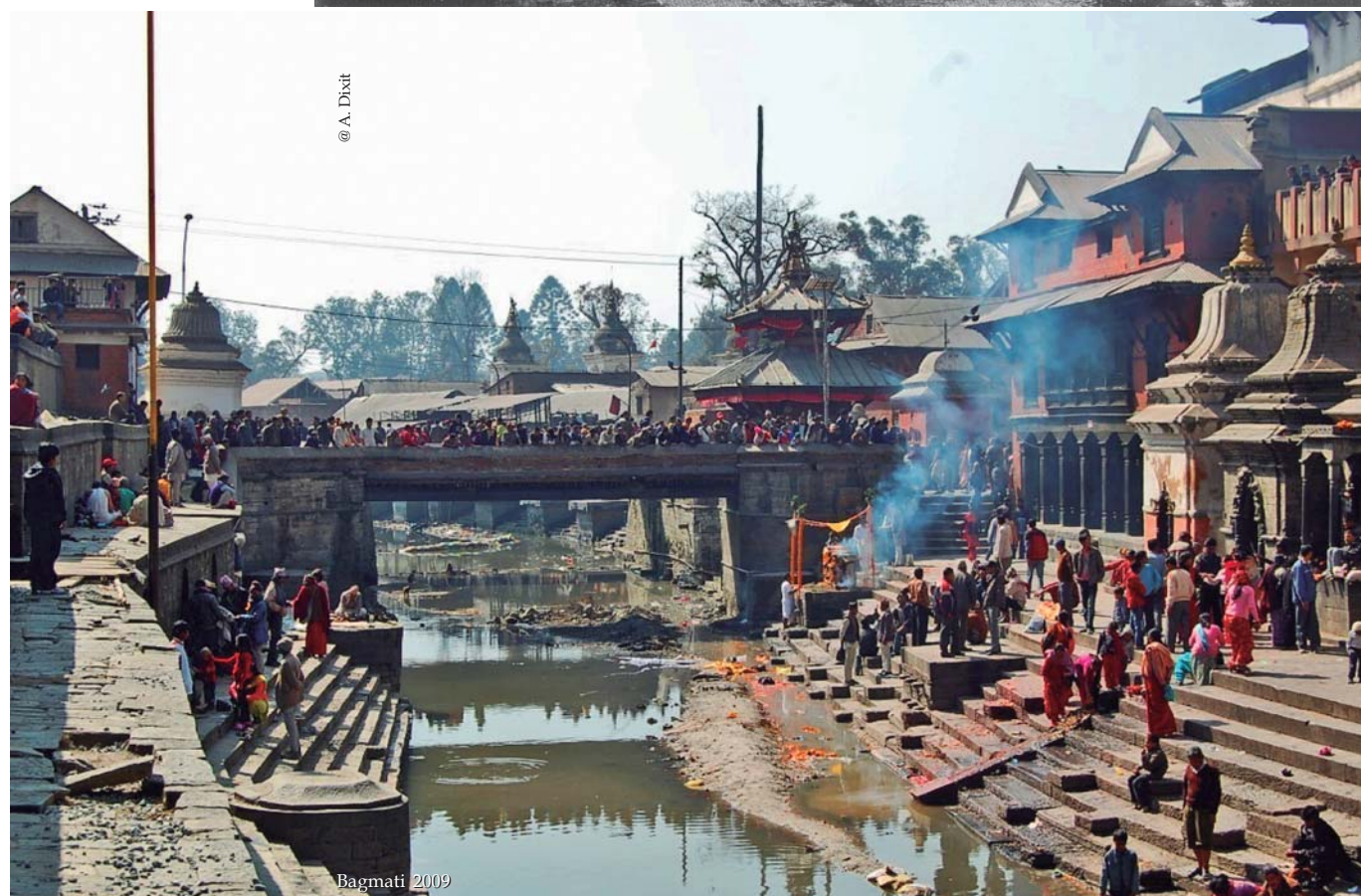


Urbanising Kathmandu in 2007

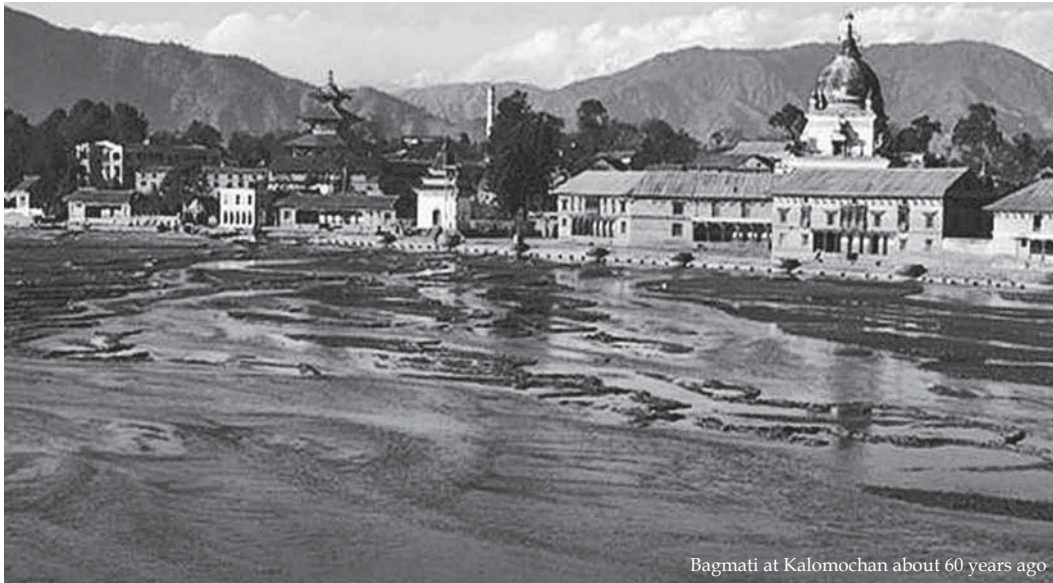
groundwater tables and overexploiting the aquifers. In many cases, groundwater hydraulics is connected to river hydrology: though the science of this connectivity is very poorly understood, as the water table is lowered, river water begins to seep into underground aquifers.

The housing boom and the expansion of urban areas in recent times have had other indirect impacts on the Bagmati as well. New buildings, roads, and other pavements seal the permeable surface and restrict the water infiltration needed to recharge upper aquifers. There is little understanding of how such processes have altered water availability for shallow pumps and for users of traditional wells and stone taps. The growing urbanisation of the Valley has resulted in encroachment upon these traditional sources in both a physical and in an institutional sense. Another impact of urbanisation is the extraction of sand from the river bed for construction of buildings. Both encroachment and sand mining continue unabated, the latter serving as a source of income for some.

Mining sand from the river bed has had a negative impact on groundwater. By deepening the Bagmati and its tributaries so much that they flow at least two to three meters below their original levels, sand mining has reduced the groundwater table in the surrounding areas. This is because groundwater in the upper aquifer begins to replenish water in the



The physical state of Arya Ghat along Bagmati River has not changed much in 89 years.



Bagmati at Kalomochan about 60 years ago



@ A. Dhakal

Bagmati at Kalomochan in 2008

The river bed is full of sand. In the next photograph the river bed has deepened and the overall environment has degraded. Trees have been planted but they have no impact on the river quality.

Box 2: The Hydrology of the Upper Bagmati Basin

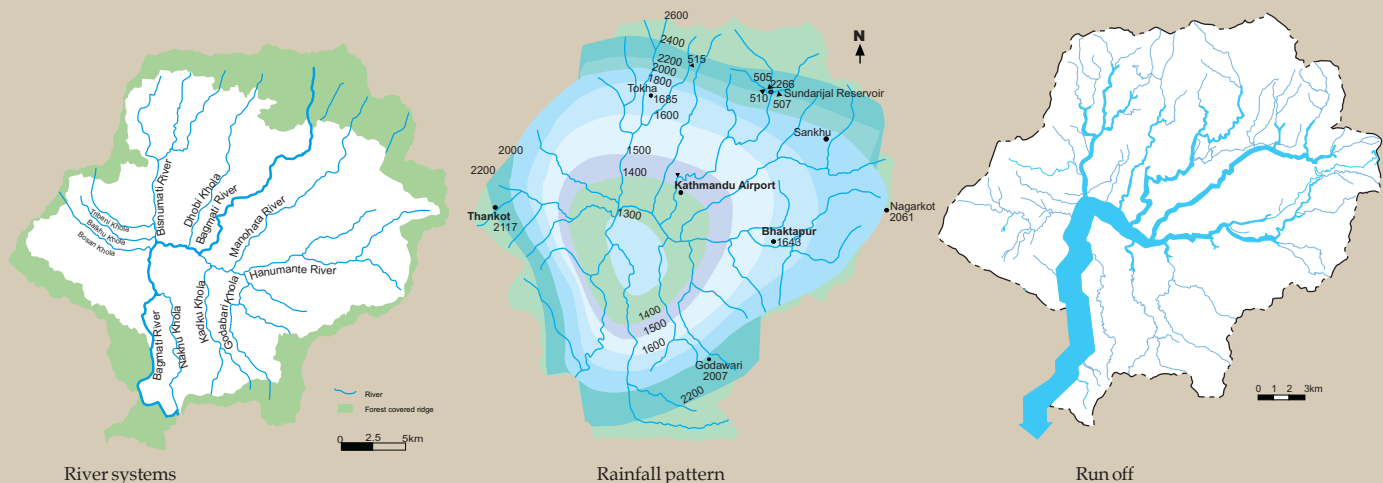
The Bagmati River originates in the Shivapuri mountains to the north of Kathmandu Valley. It flows southwest, cutting through the valley at Chovar and dissecting the Mahabharat range at Katuwaldaha before flowing into the Kosi in Bihar. The Bagmati's upper catchment constitutes 15% of the total area of the Kosi basin in Nepal. Its total area in Nepal is 3,700 km².

The Bagmati has nine major tributaries in Kathmandu Valley: Nakhu, Kodku, Godavari, Balkhu, Bishnumati, Dhobi, Manohara, Hanumante, and Manamati. The Bishnumati, the Bagmati and the Manohara originate in the northern and northeastern watersheds and flow southwest to join in the valley floor. The Hanumante River flows west, joining the Manohara, while the Balkhu flows east, joining the Bagmati in the central region of the Valley. The tributaries of these latter three rivers, which originate in the south of the watershed, are the Godavari, the Kodku and the Nakhu. All

three flow from the south to the north to join the Bagmati in the central part of the Valley.

Monsoon rainfall in the basin is not uniform: there are marked spatial and temporal variations. The central valley receives around 1,400 mm of rainfall annual; the adjoining hills, more than 2,000 mm. Flow in the Bagmati and other rivers is determined by the pattern of rainfall, with almost 90% occurring during the monsoon.

The mean annual flow at Chovar is 15.5 m³/s. The flow is at a minimum in the months of April and May and begins to rise with the onset of the monsoon. It peaks in July or August, after which it starts to decrease. The maximum monthly average discharge of 195 m³/s occurs in July, while the minimum monthly average flow of 0.51 m³/s occurs in April. The maximum ever recorded was 417 m³/s, in August 1966; the minimum, 0.04 m³/s in June 1965.



river when its level drops. In areas where groundwater is depleted, in contrast, it is river water which recharges the aquifer. In either case, the micro hydrology of the area is changed and surface flows are negatively impacted.

Existing Knowledge

Since the 1990s many academic studies and journalistic writings have highlighted the degrading state of the Bagmati River. They have assessed the nature of the problem, identified possible solutions to improving river quality and provided useful insights into river management. According to a 1993 study, 70% of the river flow downstream of Teku was highly polluted and groundwater levels were declining.¹ A fish survey conducted the same year recorded 13 species. A decade earlier, in 1979-80, there were twice as many. The main cause of pollution was identified as the discharge of untreated sewage and the dumping of

solid waste into the river and onto its banks, but all the various contributing factors and their interrelationships have not been analysed in sufficient detail. One analysis of people's attitudes towards waste disposal revealed that many did not consider safe waste disposal to be their responsibility. Technical and institutional issues were assessed in great detail but little was done to investigate the implications of the problem for community lives. These same studies suggested that the concentration of population and unchecked human activity in Kathmandu Valley are the major causes of the problem. The overall impact of the increased population and the existing state of institutional capacity to manage solid and liquid wastes has offset, and in some cases reversed, the natural hydrological processes of the Bagmati and its tributaries within the valley. Restoring the natural state is now one of the major challenges technicians, environmentalists, bureaucrats, and politicians face. Simply understanding of the problem and proposing changes is a tremendous hurdle.

Most of these studies pointed out that Nepal's laws regarding river use are weak and had to be reformulated before they were implemented. At the same time, said researchers, good laws in and of themselves were not enough. They recommended that the institutions responsible for addressing water problems also work much more collaboratively than they had in the past. In their view, however, there was very little that even the best laws and the best institutions could achieve if the number of river users continued to increase and if the practice of dumping solid and liquid waste in rivers remained unchanged. It is imperative, these studies assert, that we raise awareness about the need to reduce the amount of waste we generate and to promote the recycling of waste materials at their origin. According to them, there is no escaping the fact that sewage must be treated before it is dumped in rivers and that the Valley must start by rehabilitating its existing treatment plants. It is also essential, the studies claim, that the implementation and monitoring of the law requiring industries to treat effluents before releasing them into rivers be strengthened. Most studies also recommended that sand mining, which at that time was continuing to take place even in forbidden stretches of the river, like those close to the foundations and piers of bridges, be stopped immediately.

Some of these critical recommendations were addressed by the government. Mining rivers for sand, for example, was banned in 1991 after the bridge at Thapathali, suffering from damage to its foundation caused by sand extraction, collapsed. Despite the ban, other bridges over the Bagmati and its tributaries continue to be weakened by illegal sand mining. The latest disaster occurred during the 2008: the bridge over the Bagmati at Sinamangal tilted as its foundation subsided. While understanding of the Valley's water problems has increased in the last decade and a half, practical solutions have not been forthcoming. This study describes the evolution of people's understanding of the nature of the problems and their solutions, as well as their willingness to participate in restoration and conservation activities.

Collective Concerns

A river is a source of livelihoods and a nurturer of ecosystems. Clean and free-flowing rivers can inspire poets and writers. In 1997, Imtiaz Ahmed of Bangladesh, Ajaya Dixit of Nepal and Ashish Nandy of India jointly wrote a water manifesto. In the section entitled "Rivers Rights," they write "Rivers also have their right, including the rights to be relatively pollution free, to be safe habitat for riverine forms of life and, within limits, to flow freely." In many places rivers sustain the livelihoods of marginalised communities and when water is diverted upstream or polluted, these communities pay with their very existence.

Box 3: Changing Water Quality

The once clean Bagmati River is now highly polluted. Its quality deteriorated sharply from the late 1970s. Many individuals and institutions have monitored the quality of the river at different times over the last three decades. Amatya's analysis (1977) of 12 water samples from the Bagmati, Bishnumati and Ichhumati rivers at selected locations indicated that the river water contained high fecal contamination (the concentration of coliform bacteria was 120,000/100 ml; the international bathing standard is 1,000/100ml). Three years later, Shrestha (1980) found that the river water was characterised by high turbidity, eutrophication and growth of pathogens. Gubhaju (1982) found that water of the Ichhumati did not support any fish or other fauna. Subsequent studies showed similar results. After analysing the water quality at seven different sites, Pradhananga *et al.*

(1990) concluded that the river maintained its quality until it entered the urban core. According to them, the main cause of water deterioration was the disposal in the river of untreated industrial effluents and sewage from households. ENPHO (1991) analysed the water quality at seven stations along the Bagmati River and three along its tributaries and found that as the river approached the urban center (from Sundarijal to Sundarighat) the quality of physico-chemical parameters decreased (Figure a). Another study, conducted by Dixit (1998), found that the main source of pollution was organic municipal and industrial wastes. The self-cleaning capacity of the Bagmati at each of the seven sites was severely impaired, and began to recover only 7 km downstream, outside the valley around Katuwalidaha. Dixit's analysis confirmed that as the river approached the urban core, the severity of pollution increased (Figure b).

FIGURE a:

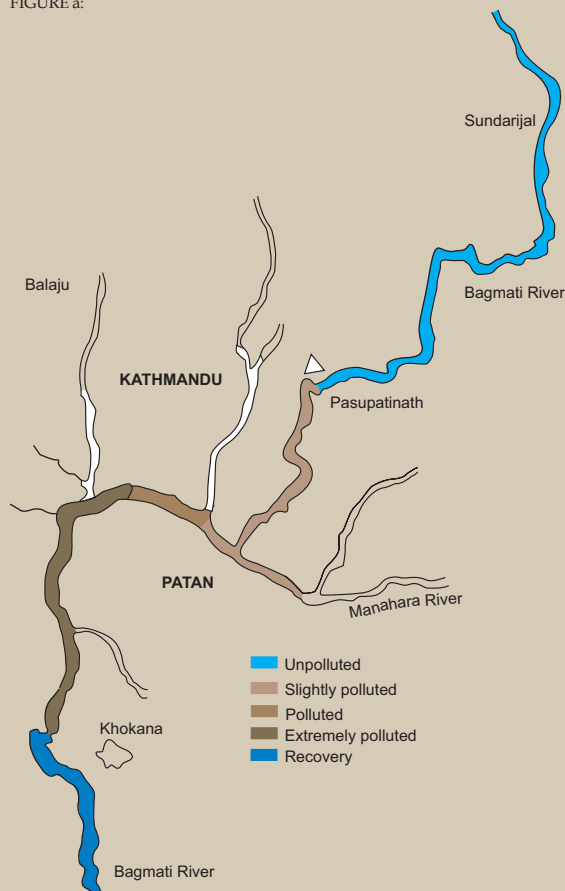


FIGURE b:



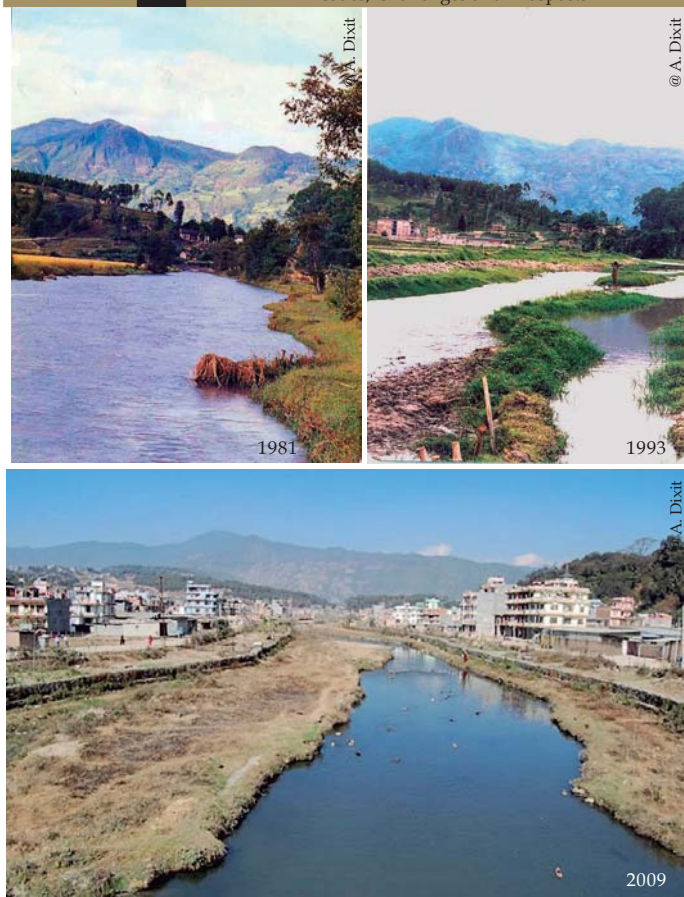
In the past the risks of poor river management were externalised to the future and to marginalised people. Today, this practice is condemned by social and activist groups in many countries of the world: they challenge the disproportionate allocation of the benefits and risks associated with a government's river policy and practices. Isolated challenges have evolved into social movements, some enduring, others ephemeral. Some have metamorphosed or mutated into new forms, espousing values different from those they began with. Some have forced governments to mend their ways and restore rivers, reduce pollution and/or ensure social justice for the disadvantaged when water projects are implemented.

The degradation of the Bagmati River has fostered just such a protest in Kathmandu. After multi-party democracy was restored in 1990, concern found a concrete manifestation in the form of the Bagmati Bachau Abhiyan (BBA) (Save the Bagmati Campaign). Emerging on the crest of an open political environment, the BBA organised walkathons, awareness-raising events and public campaigns. In a limited sense, the BBA helped bring the environmental agenda to the center stage of public discourse as Nepal's democratic order moved forward.² After a few years, however, the energy of the BBA dissipated and after a few more years, it ceased to exist altogether. Still, one of its founding members, Huta Ram Baidya, continues to advocate for what he calls "preservation of the Bagmati civilisation". His devotion, however, is dwarfed in the face of continued encroachment on, pollution of and decline in the quality of the Bagmati and other rivers in the Valley.

In 1997, fifty Nepalis representing different walks of life and professions, assembled at Kalmochan Ghat on the banks of the Bagmati River and signed a declaration highlighting the poor state of the river: "When we are dead let our dead bodies not be cremated by the Bagmati." According to one of the signatories, who wishes to remain anonymous, "It was an outrageous thing to do but done to trigger societal indignation hoping that some corrective course of action would emerge."

There have been many more expressions of dissatisfaction. In May 2000, when the Bagmati was at its lowest, renowned industrialist Binod Chaudhary was faced with a difficult decision: whether to offer his mother's ashes to the highly polluted river. Even though he was in his mourning, Mr. Chaudhary wrote an appeal to Nepal's Prime Minister to take immediate action to mitigate pollution at Arya Ghat. He suggested that if the government did nothing, he would be compelled to do something himself. His appeal was emotional and powerful. He even floated a proposal to clean the stretch along the Arya Ghat by bringing water in pipes from upstream or tapping into groundwater and release it in the river to flush the wastes. The proposal was named Ganga-Arya Ghat restoration project. This proposal, however, did not receive public approval and move forward.

Such expressions of concerns did, however, draw the attention of the government. On 5 November, 1995, the government had constituted a high-powered committee to improve the condition of the Bagmati under the chairmanship of Bidur Poudel, then a Member of Parliament. This committee proposed digging a tunnel at east of the temple of Guheswari – to divert the river, then treating the diverted water at a plant in Guheswari, and finally discharging it downstream of Arya Ghat, east of the holy temple of Pasupatinath. The aim was to see only treated water flowing in the stretch in front of the temple. The treatment plant was completed seven years later, in 2001. According to Dixit *et al.* (2003) questions about the operation and sustainability of the treatment plant have emerged. These troubles, however, do not belittle

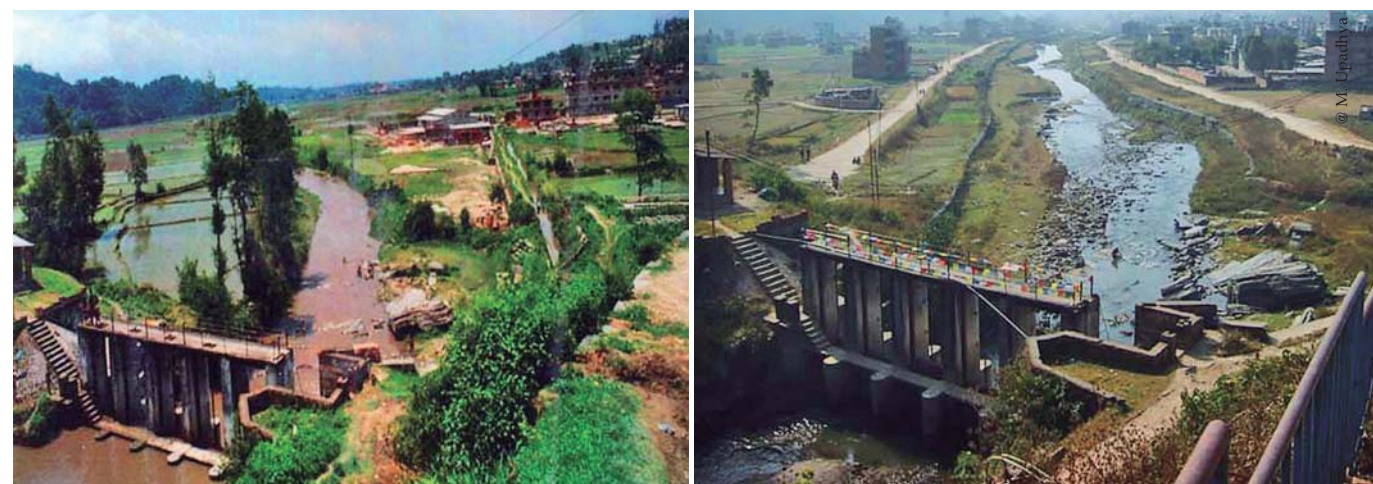


The changing landscape of Bagmati upstream of Gokarna bridge.

the significance of the fact that the government was forced to respond to concerns about the poor condition of the river in a concrete, very public manner.

The Friends of the Bagmati (FOB) was launched by a group of concerned individuals from all walks of life during His Royal Highness Prince Philip's trip to Kathmandu in 2000. This organisation is dedicated to the cause of the Bagmati and its environment and to spreading the message that its degradation needs to be reversed. Nepal River Conservation Trust (NRCT) held the first annual Bagmati River Festival on Saturday August 11, 2001. Participants, who included celebrities, schoolchildren, environmentalists and policy-makers, rafted from Tilganga to Shankhamul and the first ever kayak descent was made from Sundarijal to Pashupati. Since 2004, NRCT has been holding a two-and-a-half-month festival called "The Festival of the 21st Century" beginning on World Environment Day on 5 June and ending in the third week of August. Every weekend during the festival, schools, colleges, corporate houses, media and environmental groups undertake activities to raise awareness about the degrading state of the river.

The Gokarna Barrage built in 1960 irrigated land on both sides. The once agricultural land has been turned into houses and river has been embanked on both banks. The barrage serves no purpose. Recharge to groundwater is reduced. Other impacts are unknown.



Source: Stanley (1993)

Despite these expressions of public concern, no significant measures from the government have been forthcoming. Individual households have adopted local waste treatment systems such as reed beds and Ecosan toilets, rainwater harvesting and other water conservation measures, but replicating these efforts at scale remains a major challenge.

The Synthesis

Academic studies of the problems of the Bagmati have been done and will continue to be done, and individuals, government organisations, non-governmental organisations and the private sector have and will continue to propose various solutions. Unfortunately, earlier suggestions are not considered when new plans are proposed, and though each study is valuable in and of itself they rarely recognize the salience of the works done (or planned) by other actors and organisations. Analysing and synthesising this vast body of academic discourse and grey literature on the restoration and rehabilitation of the Bagmati River was the aim of the present study. In agreement with the National Trust for Nature Conservation (NTNC), NWCF began its research into the issues and challenges associated with and the prospects of rehabilitating the Bagmati. The outcome of the study will be the Bagmati Action Plan (BAP), a plan which will cover both challenges and prospects.

NWCF adopted a three-pronged approach to understanding the various dimensions of the problem: 1) interaction with experts and professionals in a one-day workshop after a brief introduction to the BAP; 2) field observation and interaction with the community living along the river, and 3) desk work, including an review of past studies on restoring the Bagmati River, a comparison of historical photographs and a review of global urban river management case studies. The methodology is described in more detail below.

Stakeholder and expert workshop

A meeting was organised on 16 November, 2008, to solicit views from about 40 selected experts, students, journalists, activists, and community leaders

Box 4: Water-carried waste disposal system; Is there an alternative?³

The households of Kathmandu, like those of any other city, produce three fluxes of waste materials: yellow water, which is essentially urine, or what has euphemistically been referred to as anthropogenic nutrient solution (ANS); black water or feces, or, euphemistically, anthropogenic humus precursor (AHP); and grey water from other household activities. In the current approach to waste treatment, all three fluxes are thoroughly mixed and disposed of in flowing water. This method of waste disposal, which has its roots in Victorian engineering, has led to a technological lock-in.

Restoring the Bagmati River requires, among others changes, a shift in paradigm. Yellow water flux needs to be separated from black-grey flux, or grey water from a yellow-black mix, and all three need to be separated from fresh water.

Such a shift calls for rethinking water and wastewater plumbing systems from the household to the city scale. In accomplishing the difficult task of overturning our technological inheritance, we need to ask three key questions:

How can Kathmandu's water infrastructure in particular and urban infrastructure in general be re-engineered to restore the natural capital and ecosystem services of the Valley to the condition they were in before the city began experiencing environmental degradation?

How can Kathmandu's urban infrastructure be re-engineered to make it a space for 'good' living?

How feasible is it to conceive of a Kathmandu cityscape from such a perspective?

To answer these questions we need to ask what trajectories of innovations towards alternative, future water infrastructures might accomplish the following objectives:

- (a) Improve the public health system in Kathmandu;
- (b) End the mixing of water and wastewater;
- (c) Enable the city infrastructure to become a net contributor to ecosystem services;
- (d) Uncouple human/economic development from a fixation with water-carried waste system; and
- (e) Be robust and resilient under a changed climate future.

To accomplish such a shift requires a policy space in which the state regulates, the market focuses on innovation and the incubation of new technologies, and the egalitarian civic movements critique both. Verweij and Thompson (2006) call such a pluralistic institutional arrangement "clumsy" and believe it can help arrive at alternatives.

Adapted from Beck et al

regarding the rehabilitation of the Bagmati River. Participants were asked to provide their perspectives on the following questions.

1. Is the present situation of the Bagmati really a problem?
2. If it is, why it is it a problem?
3. Is there anything that they as individuals can do to solve the problem?

Field observation

A similar set of questions was asked to people who live along the banks of the river from Sundarijal to Khokana. Respondents were people from all walks of life, including squatters, elites, women and students. The objective was to discover how the general public views the problem and what solutions they have to offer.

Desk study

The NWCF team compared current photographs of key locations with historical ones to assess the impact of development efforts and interventions made to manage land and other resources along the Bagmati. It also examined how problems with urban rivers elsewhere have been dealt with, focusing in particular on how Europeans addressed the pollution of the Rhine River and how Pakistanis in a city similar to Kathmandu addressed the flooding of the Lai. The third focus of desk study was to review past studies, in particular to compare people's views across time and to assess the gravity of the problem in the changed context.

While the state of the Bagmati has impacted many areas, from water quality to water quantity, people focus primarily on pollution, not on its use for household purposes or irrigation. People want to save the river primarily because of its aesthetic and cultural values. Water from the Bagmati and its tributaries is tapped near their head water to provide water to urban settlements in Kathmandu and Patan. For drinking water and other household uses people depend on sources other than the river. A large number (57%) have a municipal water supply connection and many depend on groundwater or stone spouts. Only about 5% use river water directly.

What flows in the river close to urban centers is mostly sewage. Human encroachment upon the river bank has resulted in a drastic increase in the amounts of sewage dumped into the river, and, in consequence, in its levels of pollution. Most of the valley's septic tanks drain directly into the river. Understandably, rivers of the valley are not suitable to be used as a water source for any purposes. Since only a very few households (just 2.6% along the Dhobi Khola) are engaged in agriculture, water quality in the river is not of a great concern for the majority of the people. The water is so polluted that it is unsuitable even for irrigation, though past Chovar, where other small streams join the Bagmati, people do occasionally do use it in their fields. Tributaries such as the Godawari are still relatively clean and do serve as a source of water for washing and bathing for hundreds of people. If the current trend continues, however, the fate of the Godawari, as well as all of the rivers in the Kathmandu valley, will be no different from that of the Bagmati.

In all our interaction across the valley, people suggested that the Bagmati has to be revived because it is our heritage. Despite their concern about its degradation, people are not clear how and where the process of reviving the river system should begin. Should we start by improving the improving water quality, or the cultural heritage along its banks, or both? A third key but often ignored concern—and a concern that flooding impact will rise as flood

plains are increasingly encroached upon. In the consultation not one person who came to live along the flood plain mentioned this issue, but it is the subject of the next section.

Floods

Floods in the Bagmati are an important but neglected problem. Records show that notable floods occurred in 1948, 1950, 1961, 1978, 1983, 1986, 1987, 1993, 1999, 2002, 2004, and 2006. They have caused and will continue to cause damage to houses and land. Senior citizens recall the 1954 flood, when the Bagmati caused heavy property damage, especially in Balkhu. They claimed that two people died, cowsheds were damaged, and farmland was lost because of river cutting. In the flood of 2002, a garment factory in the Balkhu corridor was washed away.

Most newcomers to the river banks are unaware of past floods and have faced no floods in recent times. A 2004 study of the Dhobi Khola catchment revealed that about 68% of the residents are from outside the valley and settled along the river in the last 10-15 years. Only about 28% were from within the valley and had actually seen and experienced floods and suffered damages. Others who are unaware of the seriousness of the floods have occupied land close to the river and some squatters live close to or even in the river bed. These people are at risk of being affected by floods.

The 2004 study revealed that the yards of almost all households were inundated when it rained continuously. About 36% of the households reported that their land was heavily flooded and partially washed away and that their houses are frequently damaged. Only about a tenth of the houses reported never experiencing flooding. The new houses being built often include walls designed to protect them against flooding.

When floods inundate an area, those who get drinking water from groundwater sources face massive problems. The malfunctioning of drainage systems is also a major problem: not only do drains not function but they actually bring dirty water into yards as septic tanks back home. The levels of black water can rise to as high as 4 feet. Compound walls are also damaged. During periods of high flow, people move away from areas likely to be affected. Though they are aware that the narrowing of the river upstream by building stone walls downstream causes flooding upstream, they feel that can do nothing to stop it and have made no coordinated effort to correct the situation.

Though precipitation is a major cause of flooding, floods in the Bagmati are exacerbated by the drainage congestion associated with the construction of many buildings and other encroachments. Sand mining limits the spreading of water and causes flow to concentrate in more concentrated channel. Because drainage is congested and the area of impervious surfaces great, storm water stands stagnant in urban areas. The fact that the value of land along the Bagmati has increased substantially tempts landowner to build stone protection walls along the bank in the name of an investment in real estate, and riverbanks have been built-up with houses and roads. This kind of haphazard development has caused recurrent floods in low-lying lands. Poor households report that the river has moved closer to their houses and that they now experience floods they never used to in the past.

Perceptions of people who reside along the banks of the Bagmati

Our interactions with people who live along the banks of the Bagmati revealed that they do have an understanding of the key issues facing the Bagmati, including pollution, low water flow, sand mining, and loss of cultural sites. No one mentioned flooding, however. Those living along the bank showed different perception to the environment along the river. The following narrative is based on the opinions of people who live along the Bagmati River from Sundarijal to Chovar.

The people of Sundarijal, the headwater of the Bagmati, are more worried now about the pollution of the river than they were before 1990. The settlers in village development committees (VDCs) north of Sundarijal were not concerned about pollution in the past because there were few new settlers. Now, with an ever-growing number of houses and industries discharging untreated sewage into the river, they see pollution as a major problem. They suggested that the problem is caused by the failure of the government to plan, regulate water usage and enforce laws. People expect the government to come forward to solve the problem and to work together with NGOs and civil society.

Downstream of Sundarijal, at Gokarna, the river flow reduces because water is diverted in the upper reaches. As more and more houses dump sewage and solid waste into the river, the level of pollution has increased. The opinion of the people at Gokarna is similar to that at Sundarijal—the government should come forward to act. People living further down the river, at Shankhamul, the Bagmati is joined by two tributaries, the Manahara River and the Dhobi Khola also express similar views

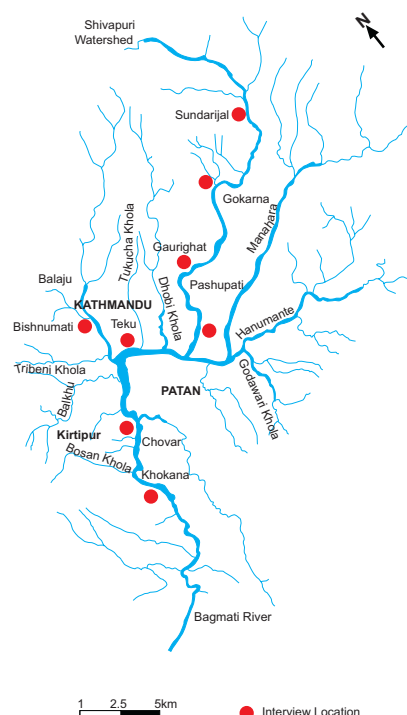
At Gauri Ghat, the Bagmati is much less polluted than it was before the Guheswari treatment plant was constructed. Treating sewage at the plant is an effective solution to pollution, say residents. They are happy because the river no longer stinks. Even though the plant breaks down often, the diversion of sewage keeps the river stretch relatively clean up to Tilganga, where the treated water is discharged. Downstream of Tilganga the river again becomes polluted. People at Bhimsengola recall the good old days when they used to drink the river water. Today drinking water comes from the municipal supply and they do not have to rely on river for any water-related activities. Even so, those who live close to the river think the river should be protected. People who live about half a kilometer away, however, are indifferent to its plight. The people of Gauri Ghat believe that unless the government, non-governmental organisations and civil society work together, improvement is not possible.

People complain that river bed has deepened because of sand mining and its low flow consists largely of sewage. They also lament that no room is left for the river itself as, in many places, land that belongs to the river is registered as private property. Some respondents suggest that river's boundary should be clearly delineated and that the management of the river should rest with the combined efforts of the government, NGOs and civil society. They understand that the discharge of untreated sewage and the dumping of solid waste is the major cause of the problem. They expect the government to implement restoration projects and to establish treatment plants all along the river. Similar views were expressed by people in Thapathali and Teku. In the Thapathali area, households along the river have formed the *Bagmati Sewa Samittee* to protect the *ghat*.

South of Kathmandu, at Khokana and Chovar, the quality of the river worsens considerably. People here claim that untreated chemical effluent flows in the river. They would like to see sewers laid on both sides of the river and sewage not allowed in the river at all.

Our general impression based on our field visits and interactions is that people have lost all hope of seeing the river restored. They believe that studies carried out in the past have not been used properly and that the unplanned development of the valley has exacerbated the degradation of the river. In their view, because well-intended efforts to save the river lacked key elements such as providing for adequate flow, they did not truly further restoration efforts. They believe that the only way for action to be effective is to bring the government, NGOs, and civil society members together. Most people express willingness to participate in restoration efforts as long as they are well-coordinated and results-oriented and they result in some personal benefits.

FIGURE 1: Map of sites where people's perceptions were solicited



Stakeholders Meeting

On November 16, 2008 we organised a meeting of stakeholders, including representatives of the valley's five municipalities, NGOs and civil society, as well as graduate students, journalists, water resource experts, environmentalists, and community members. As summarised below, each group had a distinct viewpoint on the river and pollution.

Representatives of Municipalities

Municipalities are responsible for managing waste disposal. They favor structural solutions. In the preliminary study for three large land development projects to be implemented in Bhaktapur, for example, no environmental aspects other than a waste water treatment plant were included. Municipal officials clearly understand that about 90% of all pollution is of organic origin, and that more than 80% of that can be treated by rehabilitating existing treatment plants. Even though municipal officials are capable of and free to design and implement their own programme under the Local Government Act, the views they expressed indicate that instead of piloting innovative ideas, they often seek direction from the central government. For example, they believe that solid waste treatment must get priority and that dams be built to store monsoon water. They also advocate building community-level treatment plants and avoiding the duplication of efforts. They see the role of monitoring environmental quality as belonging to the Ministry of Environment.

Members of Civil society

Besides being concerned about environmental problems, civil society members are worried about the loss of cultural heritage, including the holy shrines along the bank where religious rites are performed. They believe that protection of cultural heritage must be a part of

rehabilitation. They argue that while science and technology are usually key aspects of development plans, such plans should also concern themselves with cultural aspects. They also believe that rehabilitation should include teaching both implementers and beneficiaries about social engineering using simple and practicable tools using local materials, and that such materials must also be prepared in local languages.

Graduate students

Most discussions about the Bagmati focus on restoring the river environment by improving water quality and saving cultural heritages along the river. Many social, political, and economic changes have taken place in the country since the initial attempt to prepare a restoration plan in the early 1990s. These changes have modified the needs, the aspirations, and the perspectives of the new generation. This new generation defines the problems of the Bagmati in their own terms. Conventional norms and values associated with culture and religion have become less important for them and sometimes they have no significance at all⁴. We must not forget that in the past the protection of rivers was guided more by religious norms and values than by environmental standards, which have now changed as economic issues are awarded more priority than religious ones. Students raised question about why we want to conserve and protect in Bagmati, whether we are concerned only with water pollution or also with protecting the along the river from toxic and biological contamination, or if our sole concern is the river's holiness as a cultural heritage. They suggest that the growing domination of economics over culture and environment may lead to a desire to cover sections of the river and use it as a road. They see the need to pursue a strong programme of rehabilitating existing treatment plants and constructing new ones. They suggest that a public/private partnership can achieve these objectives and build a network of stakeholders. Coordination among agencies is crucial but difficult to achieve. Legislation alone is not sufficient to stop the degradation of the river or sand mining. They believe that the recycling of biodegradable waste to use as manure needs to be revived.

Media Persons

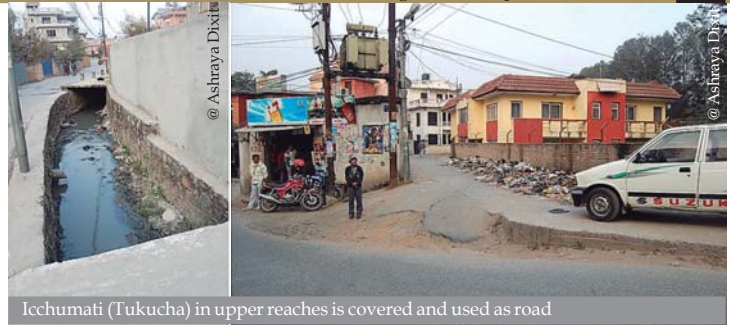
The perspectives of journalists are mixed and sometimes conflicting. Though they have a broad understanding of the problems, the solutions they propose ignore the basic principles of river flow. One viewpoint, for example, was that construction of link roads along the river would preserve the river as well as reduce the traffic in Kathmandu. This view also suggested that tax can be collected from each new house constructed to generate funds for river protection. They believe that the weak linkage between the government and the private sector is a major problem.

Water resource experts

The problems of the Bagmati will not be solved with one single grand "master plan," but with a plethora of multiple and partial solutions where different participants with different perspectives make a variety of small contributions. There is a need to protect *ghats*, in particular by fostering the participation of the religious community, their main users. When Nepal was still a Hindu kingdom, there was royal patronage for religious aspects of life such as cremation and river offerings; now that the state is secular, alternatives must be found. Some possibilities include rainwater harvesting, the efficient use of water (e.g., the use of low-volume flush toilets and bathing with small quantities of water); and vermi-compost preparation using kitchen waste. To begin with, local water management customs, like *Sitthi Nakha* and *Chhath Parba*, must be revived. This group also thinks taxation could be a solution to meeting the requirement for funds, but stress the importance of transparency in their use.

Environmentalists

Although Nepal has changed in many ways in the 21st century and a large number of people understand better than anything else that the country has undergone a major change in the past decade, the nature of the problem associated with the Bagmati has not changed; it has only intensified and its ramifications multiplied. How users and stakeholders view the problem is now important and the conventional approach to managing the environment must be reviewed as past approaches and ways of thinking may no longer be applicable. The problem of the Bagmati is not only one of the costs and benefits of a rehabilitation programme but of emotions that cannot be measured in terms of money. The dumping of both solid and liquid wastes are deliberate behaviours, behaviours which can be modified or even changed. It will be difficult to revive the Bagmati, but it is a goal worth pursuing.



Ichchumati (Tukucha) in upper reaches is covered and used as road



Linkroad upstream of Bagmati at Guheswari

Community leaders and NGOs

Community leaders are angry about the weak performance of past governments and doubt that any new plans will work because the institutional context is, as it has always been, one of corruption and unaccountability. Activities carried out to restore the Bagmati in the past were *ad hoc*, done solely to seek media attention. They produced no substantial benefits. This group asked what benefits from restoration work an individual could expect to see for him or herself.

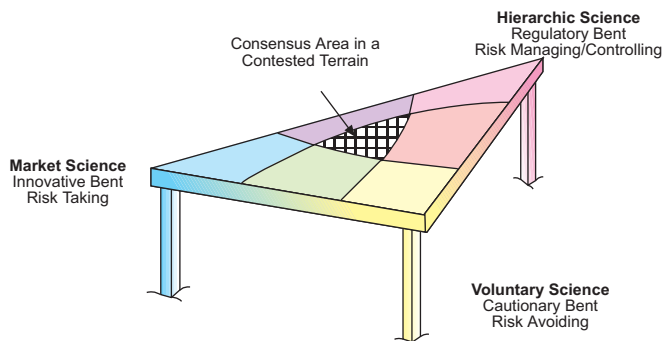
As is typical, the NGO representatives had a readymade list of proposals that they would like the government to implement. That list included a series of activities such as improving existing treatment plants, increasing water flow, promoting composts, raising awareness about old traditions like *Sithi Nakha*, raising funds through taxation and so on. This group questioned how all these diverse proposals, each a solution in its own way, could be “integrated” into a common purpose.

The perceptions of all participants in the meeting and those involved in Bagmati River issues can be explained by what social scientist Michael Thompson has called the “myths of nature.” One perception, veers towards exuberance is that of the market: it sees nature as a source of rich opportunities. Opposite this view is the view of egalitarians. They see nature as fragile and suggest that those who see nature as an opportunity must reconsider their view. In the case of the Bagmati, the group which sees nature as fragile is mired in expressing critical views and has not come up with any way forward. They maintain that the degradation of Bagmati will undermine the very civilisation of the valley. Managerial, hierarchical and governmental sectors adopt an attitude in between the two extremes. They

FIGURE 2: Plural Perceptions



FIGURE 3: Plurality in Science



Source: Gyawali (2001)

argue that nature is vulnerable, but to a limit, and that good planning can address problems effectively (Figure 2).

Summarising these styles of response, Douglas (1999) suggests that “they refer to different perceptions, definition of physical reality, they shift evidence through different sorting process arguing for different premises, employing different styles of discourse”. Gyawali (2001) uses this framework to suggest that the practice of science can be conceived as hierarchic science, market science and voluntary science. All three strategies (or sciences) are necessary to produce benefit society, in this case with a restored Bagmati. While these strategists scheme, the apathetic residents of the capital wait for the Bagmati River to be restored—or to die. They espouse the fourth strategy in Thompson’s schema—fatalism.

The examples of the Rhine and the Lai rivers

The Rhine River

The example of Rhine River in Europe may be relevant in the restoration of the Bagmati. Once heavily polluted with chemical waste, it was cleaned by implementing a series of small programmes at the local level with the cooperation of governments, nongovernmental organisations,

businesses, and environmentalists. In contrast, earlier attempts implemented by governments alone had failed miserably.

The environmental degradation of the Rhine River in Europe peaked in the late 1960s and early 1970s. Since the river provided drinking water for more than twenty million people, maintaining its quality was essential. The problem was complicated by the fact that the Rhine flows through several countries, each of which contributed to its degradation.

The Rhine River begins in the Alps and flows through Switzerland, France, Germany and Netherlands before emptying into the North Sea. This snow-fed river has a high and steady flow of water, which, for many centuries, stimulated trade and shipping and supported industrialisation and urbanisation along its banks. As a result, about 20 percent of the world’s chemical industries and many paper and pulp industries were established along its banks. In

addition, the river received the wastewater of about fifty million people as well as the untreated waste of chemical and other industries, potassium and coal mines, and agricultural sources. The discharge of polluted wastewater continued to degrade the river ecosystems until the notorious Sandoz spill of 1986. This disaster triggered a series of responses that eventually led to the clean-up of the Rhine. Market and political individualism, environmental egalitarianism and bureaucratic hierarchism all came together in a constructive engagement to identify not one big “master solution” but multiple solutions to be implemented in myriad local communities in all four countries. The river once crowned as the “sewer of Europe” was rediscovered as a result of this collaborative effort.

Switzerland, France Germany and The Netherlands put forth a massive coordinated effort and, by the end of the 1960s, cities had invested heavily in sewage treatment plants and clearing up municipal waste. They got help in their efforts from domestic policies developed at the local and national levels. Companies along the Rhine also invested in protecting the river’s water: they built treatment plants, changed their production processes, and began incorporating extensive environmental measures.

The impressive reduction in the levels of the pollution in the Rhine was the result of voluntary measures in water protection which addressed point-source pollution. The governments did not believe that firms would invest in water protection only when forced to do so by legal means. They assumed that they would cooperate in order to realize common benefits. There was no coercion on the part of a bureaucratic hierarchy.

The Lai River

Work in the Lai basin in Islamabad is designed to clean up the highly polluted river as well as to reduce its flood risk both in Islamabad itself as well as in downstream Rawalpindi. A stakeholder process involving the government, local people and NGOs demonstrated that each group perceived the problem differently. River rehabilitation was seen as central by all, but participants suggested different modalities of implementation. A number of cost-effective interventions were identified, including an early warning system, river improvement, community ponds, and relocation of exposed households. The government, however, failed to make a major investment in the endeavour.

In Kathmandu, reviving the Bagmati implies reviving both its cultural values and its hydrological sanctity. Some treatment plants were built in Kathmandu, but none functioned as designed. The most recently built, the plant at Guheswari, suffers from operational sustainability and management challenges. A start needs to be made by rehabilitating existing treatment plants and making the treatment of sewage mandatory. There is a great deal of similarity between the Lai River in Pakistan and the Bagmati in Kathmandu. If steps are not taken to rehabilitate Bagmati, it will soon end up like the Lai.

Conclusions

In the past the Bagmati and its tributaries were clean and the banks were used for religious and cultural purposes. As Kathmandu expanded, the river began to be mined for sand. In fact, river restoration advocate Huta Ram Baidya claims that the Nepal Army actually used bulldozers in its efforts to collect sand. Local efforts to stop sand mining in certain stretches by forming committees failed after a while. The problem was exacerbated when roads linking the

Box 5: The River Front as a Public Space

Traditionally the land use adjoining the river front consisted of stone stepped Ghat for cremation, ritual bathing, temple complexes and agricultural land. The new-land use pattern characterizes a mix of variety of (sometimes conflicting) use and intentions, from squatters colonies to prime real estate, from institutional activities to informal businesses, from religio-cultural enclaves of significant heritage value to secular recreational spaces for a city starved of public space. The river front is a place for ritual cleansing and giant city sewers simultaneously. While pollution of the river front water has increased dramatically new plantations on flood plains has also increased significantly.

A new comprehensive and realistic vision of the river front needs to be presented. In this vision all that has been achieved should be presented together, not isolated efforts, to instill confidence in the vision. The new vision can project the Sankhamul-Teku-Thapathali riverfront as system in the new Metropolis Together with the Tundikhel urban space system, which runs perpendicular to it. This great urban space can provide the emerging metropolis with strong renewed image and a much enhanced quality of life.

Adapted from Shah (2009)

core city area with its outskirts were opened fostered settlement expansion. This expansion has put pressure on cultural heritages, whose needs have not been addressed by any of past rehabilitation programmes. Action plans are made on the basis of science and technology but also need to consider how they are going to be implemented, and who will be involved as stakeholders. Even people who want to help rehabilitate the river lack the tools to do so. There is a need for practical action plans to be implemented with the support and involvement of local people.

The flow in the river during non-monsoon months is too low to flush the solid and liquid waste dumped in the river and its tributaries. As the population of the valley continues to rise because of pull and push factors, the current infrastructural capacity to manage wastes in the valley is becoming increasingly inadequate. The rehabilitation process must include the government, the business community, environmentalists, and local people. To that end, a network of stakeholders must be established and a multi-stakeholder process begun. In addition, cultural values need to be assimilated with scientific and technological approaches to make revival effective; without them, revival may be only partial. Building on the practices of Chat Parba and Sithi Nahka is a good beginning. Though difficult, the treatment and proper disposal of septic tank wastes in gardening or biogas systems also has merit and past

mistakes like septic tanks to sewer lines needs to be avoided. We also need to focus on regulating land use along the river's banks to prevent the remaining agricultural land from being converted into settlements.

Climate models predict that some changes in rainfall patterns and intensities in the Kathmandu valley and elsewhere are inevitable. Floods in the Bagmati need to be analysed afresh keeping in mind these changes. Though the aim of river restoration is not to deal with micro climate change, the implication of these changes in flood magnitudes and their impact on lives and properties needs to be addressed. There might very well be high floods in the Bagmati in the future, even in places people have invested billions of rupees in developing infrastructures and housing. As the example of the Lai River in Pakistan suggests, flood management needs to be made a part of restoration efforts. Flooding in the Lai exacerbates problems for women as the solid wastes dumped on river banks cause disease and discomfort.

The following points need to be taken into account when making a concerted effort to revive the Bagmati:

- 1 Who are the different actors using and misusing the Bagmati and what modality of persuasion, coercion or appeal to higher values will make them part of the solution instead of part of the problem?

- 2 What are the plethora of solutions which, while in isolation may not make much of a dent in the overall seriousness of the problem, will nonetheless contribute to the overall solution? They range from reviving out-of-operation sewage treatment plants at the high-cost, expertise-dependent end to earthworm composting of household organic waste for flower gardens and the low-cost, doable-by-all end.
- 3 Which institutions and organisations can best provide the services needed to implement these solutions? A pairing of institutions and technologies is needed.
- 4 Reviving the use and significance of the *ghats* is associated with the rich Hindu and Buddhist traditions of Bagmati civilisation. In the secular republic of Nepal, how can the motivations and sentiments associated with these traditions be harnessed for the enormous task of cleaning up the Bagmati?

The emerging context may be best explained by what Terry Magee began defining as the *desakota* phenomenon, an Indonesia term meaning “village-town” (McGee, 1991). Increased migration and mobility in general as well as market-centric livelihoods now dominate many parts of Kathmandu, a city that was once dominated by rural agriculture or natural resource-based socio-economic systems. It is in the mixed-economy region between the “rural” and the “urban” where local forest, water and land ecosystems face stresses that traditional methods cannot address. The formal institutional hand of the state has no presence in this region either. The “Bagmati Problem” in this sense is a “wicked problem,” a problem that cannot be easily defined, and, once any attempt at a definition is made, suddenly reveals layers upon layers of nested and intermeshed series of problems that cross administrative, disciplinary and even conceptual boundaries. Such intractable problems demand “uncomfortable knowledge,” or non-conventional, out-of-the-box thinking, which will then hopefully provide “clumsy solutions,” or solutions not linear, neat and rigid, but accommodating of a wide range of physical and social uncertainties and thus flexible and conducive to strategy switching if the need arises.⁵

The process of arriving at solutions for restoring the Bagmati must be informed by varied disciplinary concerns. It must hear from, and speak to, not only officials in government departments, but also cautionary and critical voices and the exuberant business.⁶ Unless rivers and their ecosystems are preserved, the environmental downslide of Kathmandu cannot be stalled, let alone reversed. Perhaps we can draw lessons from the processes that restored the Rhine and other similarly polluted rivers. If a river as polluted as the Rhine can be cleaned up, any river can be cleaned up. And should be.

Box 6: Earlier Reports and Master Plan

1. Kathmandu Valley Physical Development 1963.
2. Physical Development Plan for the Kathmandu Valley 1969.
3. Master Plan for the Water Supply and Sewerage of Greater Kathmandu and Bhaktapur, Binnie and Partners 1973.
3. Kathmandu Valley Town Development Plan 1976.
4. Nepal Urban Development Assessment 1984.
5. Greater Kathmandu Drainage Master Plan studies Snowy Mountains 1990.
6. Kathmandu Valley Urban Development Project 1991.
7. Bagmati Basin Water Management Study 1993.
8. Teku Thapathali Group Report John Sanday Consultant 1994.
9. Detailed Feasibility Study of Sewerage System from Sankhamul to Teku Dovan, WELINK Consultants, 1997.
10. UN Park Project Report, Design Consortium 1997.

BOX NOTES

- ¹ Pahari (1992)
- ² Parajuli (2008)
- ³ This section is adapted from Beck et al.

END NOTES

- ¹ The Bagmati Basin Water Management Strategy and Investment Programme was developed in 1993 with an objective of identifying activities to restore the river and its tributaries to an environmentally safe condition for all users, including riverine life, and to enhance the historic and cultural endowments along the water courses of the basin.
- ² Some of the details of the initial stages of the movement are found in Baidya. See Dixit A. (1992) for a discussion on the degrading state of the Bagmati Scorned *Himal* Kathmandu.
- ³ This section is adapted from Beck *et al.*
- ⁴ While this was the view representative of most of the youth we interacted with, we must also acknowledge the unprecedented participation of youth, many who generally exhibit no special religious inclinations, in the Deepankha Yatra of 2062, which was reintroduced after a lapse of 38 years and is tied to the cultural tradition of what is called Bagmati Civilisation.
- ⁵ See Thompson and Verweij (2006).
- ⁶ For discussions on desakota see Desakota team (2008)

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Nepal Water Conservation Foundation (NWCF) is a non-governmental, non-profit and non-political organisation that conducts interdisciplinary research on interrelated issues that affect the use and management of water and energy. NWCF aims to promote the sustainable development, management and conservation of natural resources through generating and disseminating scientific knowledge to be used in informed decision making. It promulgates research findings through education and advocacy. Its specific focus is on capacity building, both of the upcoming generation as well as of disadvantaged groups, so that resources can be used without compromising the rights of either the future generation or non-human life. By building the capability of younger generations of professionals to analyse issues related to sustainable development, NWCF maintains a pool of interdisciplinary analytical expertise. NWCF publishes the interdisciplinary journal *Water Nepal*.



Nepal Water Conservation Foundation

The National Trust for Nature Conservation (NTNC)

The National Trust for Nature Conservation (NTNC), previously known as the King Mahendra Trust for Nature Conservation was established in 1982 by a Legislative Act as an autonomous, not-for-profit and non-government organisation, mandated to work in the field of nature conservation in Nepal. The Trust has successfully undertaken over 200 small and large projects on nature conservation, biodiversity as well as cultural heritage protection, ecotourism, and sustainable development. The Trust's experience over the years has shown that conservation efforts in low income economies, such as Nepal, cannot be successful, much less sustainable, unless the needs and welfare of the local people are addressed. Holistic and integrated conservation and development programme with active people's participation aimed at promoting local guardianship, have been the focus of all the Trust activities. As a new initiative, the Trust has established an Energy and Climate Change unit to address the emerging issues of climate change and renewable energy technologies.





The Bagmati

ISSUES, CHALLENGES AND PROSPECTS

The Bagmati

ISSUES, CHALLENGES AND PROSPECTS



Nepal Water Conservation Foundation



Cover Photo: Bagmati River stretch downstream of Arya Ghat © Ashraya Dixit

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Contents

The context	1
Existing knowledge	6
Collective concerns	7
The synthesis	11
Floods	13
Perceptions of people who reside along the banks of the Bagmati	14
Stakeholders meeting	15
The examples of the Rhine and the Lai rivers	18
Conclusions	19
Box notes	22
End notes	22
References	23

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