

A Study of Effect of Chure Degradation on Water

A Case of Kamala Basin in Nepal

“Unchecked plunder of the Chure region, which recharges ground water for the lower plains, could have irreversible effect on the water cycle and water table not only within the region but also across border.”

Covering 13 per cent of Nepal’s land area, Chure region boasts a special place in Nepal for its ecological, social, economic and political significance. However, unchecked deforestation, unplanned urbanisation and haphazard extraction of sand and stones have left the region fragile.

Chure’s loose lithology and sloped incline make its conglomerates and sandstones easily erodible. The rivers emerging from the range is estimated to take away debris at the rate of about 780-20,000 tonnes/sq km annually (FRA/DFRS, 2014) and are contributing to gradual desertification of Chure, Bhawar¹ and Terai regions. The debris containing sand and coarse stones have become the largest source of construction material, such as sand, gravels and stones (SGS), across Nepal and in neighbouring states in India. The legal and illegal extraction have not only changed the ecology and topography of the region but has impacted the lives of the people living there.

Chure and Water

Since the Chure region also serves to recharge the ground water for the lower plains, such unchecked plunder could have an irreversible effect on the water cycle and water table not only within the region but also in areas far into Indian territory. Many studies have found degradation in Chure hills responsible for reducing its water-holding capacity and, thereby, causing the off-season flow in the streams (Padhya 2014). Changes have been also observed in precipitation, the nature and frequency of floods. According to the President Chure Terai Madhesh Conservation and Development Committee (PCTMCDC) water retention in the Terai and Bhawar regions has fallen making them drier. The rivers originating from the range pass through valleys and plains in Nepal and India to merge with the Ganges River; in this context, the degradation could affect the water cycle of not

Box 1 Chure Range

The Chure Range, spread across entire length on Nepal over 33 districts, is a home to nearly 14 million people. Also known as Siwaliks, Chure is a young mountain range situated between the Mahabharat Range in the north and the Terai plains in the south. It covers 13 per cent of total area with 60 per cent of the population residing in the region (including Bhawar and Terai).

only the Siwaliks and the Terai in Nepal but the entire Ganges basin.

Despite, repeated attempts by the government to rein in such assaults on nature, such as declaring the region protected area and promotion of community forestry, the forest encroachment and haphazard extraction has yet to be checked.

Kamala River Basin

Against this context, a perception survey was conducted in the Kamala River basin to examine the effects of the Chure degradation on river water flow and groundwater availability. The Kamala River Basin, which has become one of the major sources of construction material in Nepal, have long been subjected to haphazard deforestation and unchecked extraction of sand and stone. Kamala River, which originates near Maithan in Sindhuli district, flows through Udaypur, Dhanusha and Siraha districts before entering India near Madhubani district in Bihar. The study conducted in the upper (Sindhuli District) and lower (Dhanusha district) parts of Kamala River Basin found that the locals perceive that the debilitating activities which are undermining the Chure have affected their livelihood especially with regard to access to water.

Felling trees

Deforestation in the Kamala Basin area has been prominent as all the sampled districts have a forest cover percentage that is less than the national percentage.² Compared with 1995, forest cover in those districts has declined in 2010 as illustrated in table 1. This has been attributed to a long political transition and the absence of elected representatives at local bodies. At the same time, hardly any oversight over illegal activities is in place, especially pertaining to public property and exploitation of natural resources.

Table 1 Percentage of forest covers in the select districts in 1995 and 2010

Districts	%forest cover in 1995	%forest cover in 2010	Change in the area*	Annual change rate	
Sindhuli		41	39	-4234	-0.29
Siraha	15	14	-1185	-0.48	
Dhanusha	24	22	-1333	-0.32	
Udayapur	35	34	-2017	-0.15	

Source: DFRS (2015). *measured in hectares

Moreover, this is not a recent phenomenon as history of Chure's systematic deforestation can be traced back to 1960s when government distributed a significant size of forest land to accommodate the people of Nepali origin returning from Myanmar in 1960s and to solve the problem of landlessness.³ Deforestation accelerated when the Land Tax Act 1977 was enacted. As the Act defined forested land as government property, people cut down trees in their private land to protect their ownership (FRA/DFRS: 2014). Moreover, eradication of malaria and resultant population growth in addition to the construction of the East-West Highway are also attributed for causing deforestation in the region.

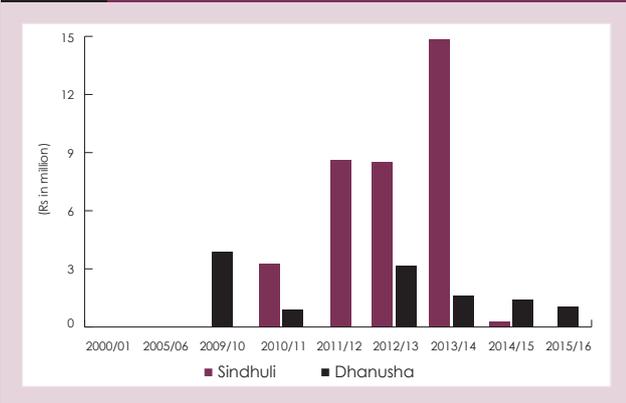
Mining in Chure

Kamala River is one of the major sources of sand, stone and gravels in the central Terai, which is then trucked off to various cities in Nepal and in the adjoining states in India. According to President Chure Terai Madhesh Conservation and Development Committee (PCTMCDC), the area annually supplies about 6.5 million cubic metres of sand, gravels and stone (SGS) legally and the amount extracted without permits could

Box 2 Kamala river

Kamala River originates near Maithan, Sindhuli District, in the lower parts of the Mahabharat range, at an elevation of 1,200 metres. Kamalamai Municipality and VDCs such as Ranibas, Harshai, Nipane fall along the way as the river passes through the Chure area of the district. The main tributaries of the river in Nepal are Tawa, Thakuar, Kali, Chadaha, Gwang and others. The combined flow debouches in the Terai, at Chisapani, where the river borders Siraha and Dhanusha Districts. The river has a higher gradient when it flows through the Mahabharat range in the north and becomes flatter as it runs south.

Figure 2 Annual revenue mobilisation



Source: Department of Environment of DDC Sindhuli and Department of Account of DDC Dhanusha and Siraha.

Figure 3 Impact of extraction

Impacts on	Description
Biodiversity	Impacts on related ecosystems (for example; fisheries)
Land losses	Both inland and coastal through erosion
Hydrological functions	Change in water flows, flood regulation and marine currents
Water supply	Through lowering of the water table and pollution
Infrastructures	Damage to bridges, river embankments and coastal infrastructures
Climate	Directly through transport emissions
Landscape	Coastal erosion, changes in deltaic structures, quarries, pollution of rivers
Extreme events	Decline of protection against extreme events (flood, drought, storm surge)

Source: <http://www.moef.nic.in/sites/default/files/Sand%20Mining%20Guideline%2028.08.2015.pdf>

be double that amount.⁴ For District Development Committees (DDC) of Sindhuli, Dhanusha and Siraha, such material extraction is an important source of revenue. As Local Self Governance Act 1999 has bestowed the rights to sell such material on the DDC, checking excessive extraction from the rivers is not in the interest of the DDC.

However, official revenue data does not explain the extent of actual extraction that is going on. One estimate suggests that the actual value of extraction is twice the amount that official extraction revenue figures suggest.⁵ Indeed, huge amounts of illegal extraction are not even reported. In addition, a significant amount of quarrying is done by the local people to construct their own houses, a booming activity even in the rural areas.

Unfortunately, the local bodies that grant the permission for extraction do not conduct necessary environmental impact studies, so limited information

is available to scientifically assess the dangers posed by these activities. Likewise, subsequent government decisions such as bestowing discretionary authority to Ministry of Federal Affairs and Local Development regarding the use of excavators for extraction has further provided impetus to haphazard extraction.

Degradation

These assaults on environment in the forms of deforestation and extraction has led to large scale degradation whose impact could be traced to water availability – from rainwater to groundwater and river flow.

The effects of these activities are observed in the precipitation rates and ground water availability in the adjoining areas, not to mention the water flow in Kamala. The Precipitation data of two stations — Sindhuligadhi and Chishapani - shows only slight increase over a period in the average rainfall. But, the

Figure 4 Effects of deforestation and extraction

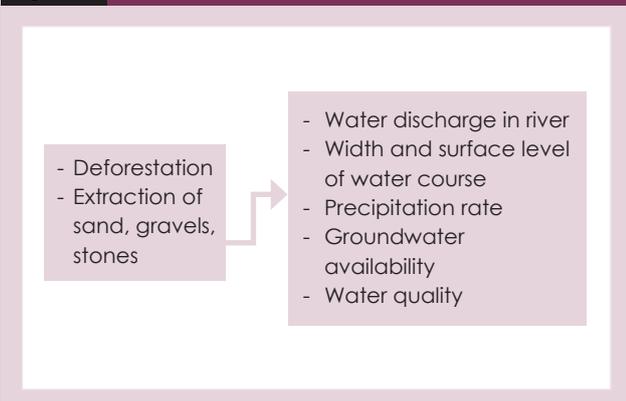
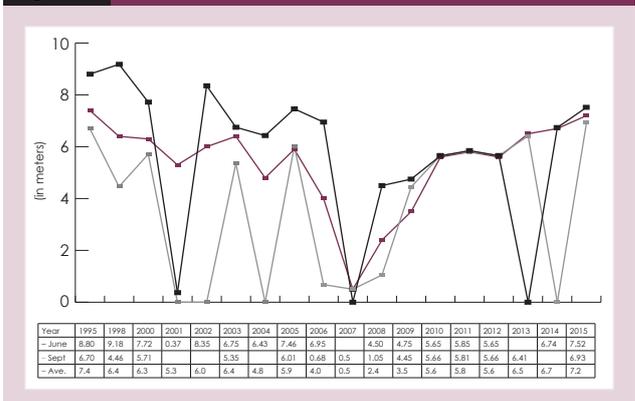


Figure 5 Static water level data at Godar, Dhanusha



Source: Department of Hydrology and Metrology.

available data shows significant changes in the ground water level. The depth at which ground water was accessible has increased after 2007 when the region experienced devastating flood (illustrated in figure 5). The water that was accessible some 2.4 metres from the surface in 2008 had gone down to the depth of 7.2 metres by 2015. Climate change along with the ongoing quarrying and deforestation are perceived as responsible for changes in ground water depth.

There is a lack of adequate and valid time series data related to the Kamala River to carry out quantitative study. Thus, only perception study was conducted to observe the relationship between the basin's degradation and its impact on Kamala's water.

Conservation efforts at upper basin

The perceptions of the households from upper and lower basins vary regarding the effect of degradation and depletion of the resources. The community in the upper reaches appear to have become aware of the dangers of degradation and have increased participation in resource conservation. They have declared vulnerable areas as a No Grazing Zone and have begun conserving the forest by forming community forest groups. Their initiatives have even led to restoration and recovery of the river flow, water discharge capacity, forest cover and farmlands that had been wasted away. Thanks to these efforts, water availability within Nepal is not much affected but such initiatives are lacking in the lower parts of the basin.

However, lack of forest management and the extraction of sand and stones in the absence of effective monitoring have left the areas in the lower basin

vulnerable. Most of the respondents in the lower basin said that the region as a whole was at risk because of the degradation of forest, land and sand.

Depleted water sources

A perception survey conducted in the Kamala River catchment area in Sindhuli and Dhanusha district found that the locals attribute the ever increasing deforestation and extraction of construction materials from Kamala for affecting the water cycle of the basin. They said that haphazard quarrying of sand and stones from the lower belt has changed the water course such that both the width and depth of the water channel have fallen, indicating reduced regular flow. Likewise, they also perceived that the water sources, such as underground boring and natural wells, are not providing sufficient water to meet household needs at present in comparison to the situation 10 or 20 years ago.

Likewise, about 45 per cent of the respondents from Dhanusha and over 37 per cent from Sindhuli perceive that the river's water course has been shifting from time to time. As the physiography is already fragile, even minor floods bring huge amounts of debris and deposit it along the lower parts of the river. Such deposits usually alter the regular path of the river. The excavation of the river bed for construction material without any technical study has created many nick points along the river ultimately causing the change in the river course.

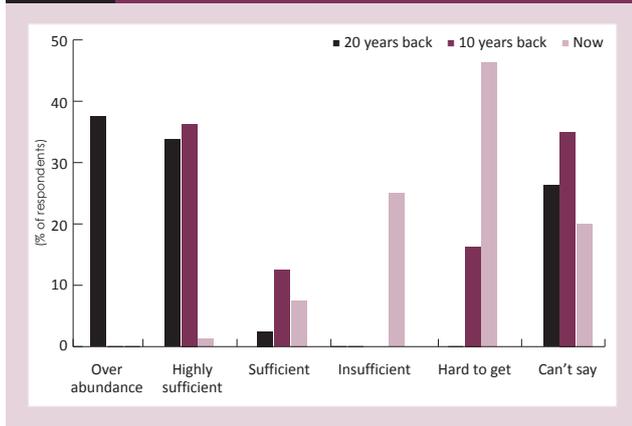
Erratic Kamala

Against this context, the findings from key informant interviews (KII) indicate that the surface of the river has

Causes of extraction of sand, gravel and stone	Percentage
Domestic use at local level	36.3
DDCs' income	20.0
Expanded market	17.5
Lack of awareness	8.8
Deforestation	6.3
Nexus	5.0
Fragmented activities of the government line agencies	2.5
Ineffective security	2.5
Not much extraction	1.3
Total	100.0

Causes of deforestation	Percentage
Fulfillment of domestic use	33.8
Income generation (by tapping Indian and Nepalese markets)	28.8
Nexus helping deforestation	15.0
Terai people desirous to access forest but without responsibility	7.5
Resource mobilization by community forestry user groups	6.2
Lazy forestation activity of government	3.8
Forest encroachment for farmland	2.5
Insurgency induced encroachment	1.2
Exploitation of resources	1.2
Total	100.0

Figure 6 Water availability from natural wells



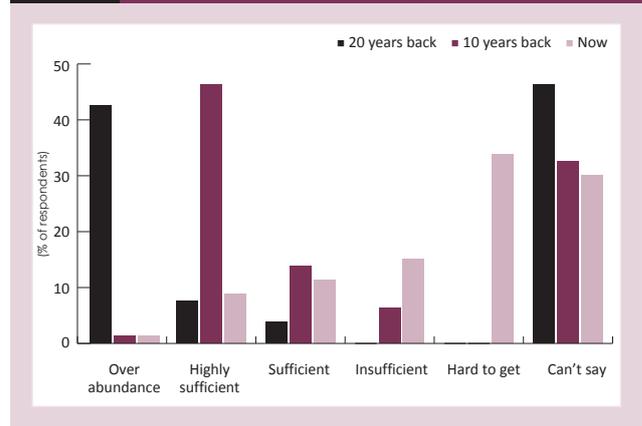
moved up compared to previous decades. Floods bring heavy amounts of aggregates because of extraction of sand and deforestation has already weakened the physiography of the study area. Additionally, for a few years, a couple of villages of Sindhuli banned digging in the river. Therefore, in the upper parts of Sindhuli, the deposits are untouched and the surface level of the river has risen. Therefore, a majority of the people in Dhanusha and some from the lower parts of Sindhuli perceive that the riverbed in the lower reaches has gone down despite the increased deposition of debris compared to previous decades.

According to the locals, the flow of debris, including sand and pebbles, from north to south, along the Kamala has been increasing. At the same time, the lower parts of the river are witnessing a decrease in the riverbed level due to excessive excavation. Moreover, frequently occurring floods caused by deforestation and quarrying have reduced the land's water storage capacity. As a result, the banks are eroding and the flow channels change course frequently. The locals say that the river's regular water flow has declined and the entire water cycle in the catchment area is affected by the degradation.

Drinking water troubles

The degradation has also affected livelihood in the region. People are increasingly finding the river water unsuitable for drinking. Likewise, increased population and frequent changes in the course of the river have made the available water insufficient for irrigation. The figure 6 shows that over 37.5 per cent of respondents believe that water was overabundant in natural wells 20 years ago while now 46.3 per cent think it is hard to get.

Figure 7 Ground water availability



Likewise, in terms of ground water availability, about 42.5 per cent believed that it was overabundant and 46.3 per cent believed it was highly sufficient 10 years ago, but, in the present, 33.8 per cent felt that it was hard to get.

These figures indicate that it has become difficult today than it was in the past to extract ground water from Kamala's the catchment areas.⁶

The quality of river has also been affected in the recent times as clay and silt content has increased in the water and these get deposited on the farmland through irrigation. During the household survey, about 59 per cent of the respondents were found arguing that Kamala's water was fine for irrigation at the moment.

In terms of adequacy of the Kamala River water for drinking purposes, over 46.3 per cent said that it is not fine for drinking at the moment. The KIIs unearthed two basic reasons for the quality deterioration: increased content of silt and mud and urbanisation-induced pollutants. About 53.8 per cent of the respondents thought that Kamala water was more than adequate for drinking purpose 20 years ago. Only about 32.5 per cent think that current Kamala river water is adequate for drinking.⁷

Recommendations

- The entire river and its tributaries need to be managed sustainably, adequate forest and shrub covers have to be ensured in the basin and the sand and gravel extraction allowed only as per the recommendation of scientific studies.
- To replicate successful conservation activities held in the upper basin, similar awareness campaign should

be launched in the lower basin to encourage locals towards taking steps towards conservation on their own accord.

- An integrated approach should include the management of the entire rivers and rivulets, afforestation, conservation of traditional knowledge and promotion of community initiatives regarding the use and management of the river system.
- Regular environmental assessment of fluvial erosion and deposition of debris materials, scientific infrastructural development, among other aspects, also need to be considered.
- Equally important, if not more, are effective enforcement of laws, elected local bodies leading the efforts, enhancement of technical capacity of the sectoral agencies, extensive awareness campaigns and wider participation of the local people.
- A complementary study on the Indian side is equally vital to assess the impact of Chure degradation and lack of conservation efforts on the lower basin on the water table in the plains.

The Kamala River basin is in an urgent need of a proper river management and flood control mechanism encompassing the entire catchment area. To curtail haphazard extraction of sand and stones from the river and the hills, a tighter regulation is required to mitigate the repercussions on the ecology and the environment. Illegal export of the materials to India is one of the major reasons for unchecked extraction, thus authorities, both in India and Nepal, need to be effective. Moreover, the Chure degradation is not only a concern of Nepal but resultant changes in the river flow would have a severe impact in the Indian side where the river becomes flatter. Thus, preservation of Kamala River basin will even require a collaborative effort between the two countries. ■

End Notes

- ¹ Bhawar region is a buffer area which separates the Terai from Chure/Siwalik region. Though it is very thin regarding its width, the Bhawar region sediments the sand and boulders as well as the mud that gushes from the northern parts during rainy/flood season.
- ² National forest cover is about 40.36 percent of the total area of the country.
- ³ Conflict between state and landless people is an unfinished agenda since the settlement started in Chure region. Land mapping and survey programme conducted in different periods and construction of east-west highway invited more people in the region. As a consequence, the number of landless people increased in this region.
- ⁴ <http://rccp.gov.np/>
- ⁵ *ibid*
- ⁶ It is important to mention that about 30 percent of the respondents can't say anything about current situation of ground water availability. Those respondents are from upper part of the river (Sindhuli) where people use ground water less and natural wells more.
- ⁷ As the people living lower part of the river basin don't use Kamala river water for drinking purpose, there are higher percentage of respondents saying 'can't say' about adequacy and usability.

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This briefing paper is prepared by Ms. Dikshya Singh, Research Officer, based on research report on "A Study of Effect of Chure Degradation on Water : A case of Kamala Basin in Nepal" carried out by Mr. Prakash Ghimire, Senior Program Officer and team of SAWTEE. The study was conducted by SAWTEE under the project Sustainable Development Investment Portfolio (SDIP) in partnership with CUTS International, Jaipur, India. Views expressed are of the author and do not necessarily reflect the position of SAWTEE and its member institutions.