Sand Mining as a Flood Hazard Mitigation Measure in Nepal

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1. Introduction

Due to active tectonics in the Himalayan region of Nepal, the mountain building process is still going on. The consequence of this dynamic process is that the mountains are young, the rocks in the mountains are moving and cracking, landslides are ubiquitous, and the erosion rate of the rocks is high. The steep topography of Nepal and the intense monsoon rainfall results in reducing the slope stability and transport of stone-gravel-sand (SGS) materials from the mountains to the lower elevation areas. The anthropogenic activities, mostly the land-abuse, are exacerbating the process of erosion and transport of SGS by playing a catalytic role in existing fragile nature of the mountains in Nepal. Every year millions of tons of SGS materials are eroded in the upstream areas, transported in the mid-stream areas and deposited in the downstream areas. The specific sediment yield of Karnali River in Nepal, for example, was found to be 4362 tons/km²/year, which is several times higher than other rivers with high sediment yield (WECS, 2003). As a result, the bed profile of Nepalese rivers is constantly changing. In the upstream areas the river bed is degrading, while in the downstream areas the river bed is in the process of aggradation; in some particular cases the annual rate of river bed dynamics, both the degradation and aggradation, is more than a meter.

For the people residing along the river banks, the dynamics of river bed poses a major flood hazard. In the downstream stretch of the river, the river bed aggradation is causing problems like the change in river course, flooding in riparian settlement, inundation of agricultural fields, choking of river under the bridges, reservoir sedimentation, damage to infrastructure and death of people. The potential solution to the problem is to reduce the rate of erosion in the upstream part of the watershed; however, given the realities of active tectonics in Nepal, it is easier said than done. The concerned agencies in Nepal are, therefore, working in a two pronged approach – one is to better manage the watershed and another is to mine the sand from the river bed. The Department of Soil Conservation and Watershed Management, under the Ministry of Forest and Soil Conservation is primarily focused on improving the watershed management. Almost all of the 75 districts of Nepal are mining sand from the river beds, to a greater or lesser extent. The Local Self Governance Act 1999 of Nepal has empowered the District Development Committee (DDC) of each district to mine and sell the SGS materials or permit private parties to mine the sand from the rivers and terraces within the jurisdiction of the DDC. Through sand mining, the DDCs have been able to channelize the river flow, reduce flood hazard of the riparian communities, control haphazard shifting of river course during flash floods, and reduce river bank erosion by utilizing the income from licensing of the sand mining activities. Thus sand mining is used as a flood mitigation measure in Nepal.

2. Management Aspects of Sand Mining

As long as properly managed, the sand mining can be a sustainable and self supporting flood hazard mitigation method. The DDCs are able to generate income from a potential problem of river bed aggradation, the riparian settlement are protected from flood, the construction industries obtain a steady supply of basic construction materials, and the private sand miners are able to provide jobs to untrained laborers and generate profit (Sayami and Tamrakar 2007, MoLD 2011).

The unmanaged sand mining, however, can result in problem rather than solving them. The parameters associated with unmanaged sand mining are: (a) unsustainable sand mining (extracting more than deposit), (b) mining from unauthorized locations along the river course, (c) extracting more than authorized volume of sand, and (d) ignoring the environmental mitigation provisions listed in the Initial Environmental Examination report which is the basis for sand mining activities in Nepal.

Owing to the lack of and quality of fluvial
sedimentation data, it is very difficult to reliably estimate the rate and location of sand deposits in the river beds of Nepal. The WECS (2003) study established a basis for the study of sedimentation in the Himalayan rivers of Nepal. Many other project site specific river sedimentation data are available, but many of them are for short durations. The lack of data is hindering estimate of sand deposit, which is posing a challenge to determine the extractable volume of sand on a sustainable basis.

The DDC is responsible to monitor the sand mining activities which it has licensed to operate and ensure that all environmental safeguards are followed. However, recent site visits to the sand mining sites in three districts (Banke, Chaitwan and Kathmandu) indicated that the monitoring aspect of the sand mining is extremely weak. The monitoring is not a priority, and there are some fundamental structural flaws in the existing sand mining system in Nepal. The official reports published annually by each DDC openly admit of failure in monitoring (DDC Kathmandu, 2013). As a result, the sand mining activities in Nepal which are supposed to be an effective mitigation measure against flood hazard and a reliable source of revenue for the DDCs’ development activities have started to result in undesirable consequences. The sands is being extracted from unauthorized locations causing river bank degradation, localized deep holes, diversion of river flow due to unbalanced and over-extraction of sand from one or the other bank, and over-extraction, by several folds, than permitted by the DDC contract and the related regulations. Several infrastructures and agricultural fields have been damaged, river bank protection structures have failed, landslides have occurred and environment have been hurt due to unmanaged sand mining. These scenarios have given a bad name to this sector. Many reports have come out pointing towards the negative environmental consequences of sand mining and the popular newspapers frequently carry articles on conflicts related to this sector (Republica 2013, Nagarik 2013).

Some of the basic reasons for the mis-management of sand mining are: (a) upfront payment of the sand mining license fee by the license holder to the DDC which removes incentive for the DDC to monitor since the entire fee has already been collected, (b) illogical bidding process for sand mining license in which the quantity and rate of sand extraction are already fixed by the rule and hence no room for fair competition, (c) infiltration of crooks and criminals in the sand mining business due to relatively low investment, low skill requirement and very high profit margin, and the nexus between the sand mine operators, line agency personnel and law enforcement officers.

Due to the poor record of the DDC in proper monitoring of sand mining activities, the Ministry of Federal Affairs and Local Development (MoFALD) which oversees the DDC activities related to sand mining has recently implemented a novel idea of teaming up with the academic institutions (namely Tribhuvan University and Kathmandu University, for now) and use the students as seasonal monitors of sand mining operations. The students are expected to observe the implementation of environment protection measures adopted by the sand mine operators and compare results with the parameters listed in the IEE report of the respective sand mining site.

To better manage sand mining and to protect negative consequences of this sector on environment, MoFALD (2013) has prepared a series of documents like Environment Friendly Local Governance Guidelines, Environment Friendly Infrastructure Development Resource Book and Local Unit Resource Mobilization and Management Procedure. The format and the standard of the IEE reports have become more consistent; however, positive impacts of all these attempts are yet to be seen in the field applications.

3 Concluding remarks

The sand mining is adopted as an effective mitigation measure against flood hazard in Nepal by the local government agencies. If managed properly, the sand mining can be a sustainable and self-funded approach to flood hazard mitigation. Due to lack of adequate resources at the DDCs and flawed institutional mechanism, the sand mining sector in currently badly managed. As a consequence, many negative environmental aspects of sand mining are surfacing and giving sand mining a bad name. Rather than controlling flooding in riparian settlement, unmanaged sand mining is causing flooding by shifting river course. Some attempts have been made recently to improve the management aspect of this sector. We can certainly hope that with the concerted effect of all the stakeholders, the sand mining can be an effecting flood hazard mitigation measure in Nepal.

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