

Impact of River Mining: A Case Study of Itram River, Surkhet

Kiran Raj Regmi*

DOI: <https://doi.org/10.3126/academia.v4i2.82968>

*Assistant Professor, Tribhuvan University, Mahendra Multiple Campus, Nepalgunj, Department of Rural Geography

Email: regmikiranraj@gmail.com

Article History: Received: Feb. 12, 2025 Revised: June 21, 2025 Received: July 7, 2025

Abstract

The demand for sand and gravel is increasing in many parts of the world due to rapid urbanization and economic development for infrastructural building activities. It has resulted in rapid extraction of stone, sand and gravel from river areas, leading to serious effects on river basin environments as well as nearby communities. Nevertheless, socio-economically, some local miners are also benefited by material extraction from the river. The lack of adequate information on the impacts of sand and gravel extraction is a major challenge in the environmental sectors of the developing countries. This study highlights the impacts of mining activities in the Itram River of Birendranagar, -12, Surkhet. Field observations and an interview guide were administered among 30 dwellers of riparian community of Itram to collect qualitative data, which focused on the identification of positive and negative impacts emerging from river mining activities. Few local people who are involved in mining activities are benefited. Except them, most of the local people conveyed the highest magnitude of negative impacts regard mining activities. Therefore, it is suggested to control mining activities and river encroachment to preserve the drainage system and riverine environment for the riparian community.

Keywords: Riparian community, River material, Employment opportunity, Negative impact, Symbiotic relation

Introduction

Extraction of the sand and gravel is one of the most important processes that is extracted for the development of the infrastructure in the country. There are different sources for sand and gravel mining. Among them, river valley is one of the most important sources for it. Stone, sand and gravel have been used for constructing various infrastructure such as roads, dams, buildings, etc. Stone, sand and gravel are riverine nonmetallic nature products formed from eroding mountain rocks carried by streams and rivers. Sand and gravel are obtained directly from the river channel, floodplain and adjacent river terrace by quarrying.

Quarrying is defined as an activity where stone, sands, gravel are excavated for infrastructure building work. Stone, sand, gravel mining refers to a process of removal of stone, sand or gravel from one place to another. "Quarrying activities is a huge strategy for local economic development by creating jobs and creating new habitats for the people" (Langer, 2003). According to Draggan as cited in at present, as subsidence materials for constructing work, sand and gravel are very important

properties for the economic development of the nation. However, increasing demand for stone, sand and gravel leads to excessive extraction within a few years. Most of the river of Nepal, which traverse through urban areas, legally or illegally, have been encroached upon in some way. “The rivers lying near to the main city areas has degrading condition due to the lack of policies and standards regarding river, sand quarrying and encroachment process” (NRCT, 2017).

Therefore, the Government of Nepal has implemented Land Use Policy-2015, where the country is classified into various land use zones. Among them a zone has been pointed out as “building materials (stone, sand, concrete) excavation zone to maintain a balance between physical infrastructure development and environment” (MoLRM, 2015). But “the major environmental problems of Nepal are improper land use as well, and effective environmental governance facing challenges” (Sharma & Ghimire, 2015). Due to unmanaged urbanization, “rivers have been facing multiple problems, conflicts and competitive demands from various angles of the society. Legal, policy and institutional mechanisms have failed to address the problem. Encroachment of river areas and banks has also been a major threat to rivers mostly in cities” (Bhattarai, 2015).

Within the two-decade rapid developmental period of physical condition in Birendranagar valley, constructional material such as stone, gravel and sand highly and rapidly quarried along the Itram River by adopting traditional methods. Consequently, nowadays the Itram River is wide and deep due to the results of the river edge falling down and it has adversely affected the surrounding environment of this river. Whereas, the Constitution of Nepal 2016 has provided the right to live in a clean and healthy environment for every citizen. Hence, the main theme of this paper is to identify the impact due to continuous quarrying activities along the Itram River. Negative consequences of overexploiting sand are felt in the study area, whereas socio-economic benefit provides livelihood opportunities to local people who are engaged in quarrying activities in the study area.

River Mining Scenario

River mining is the extraction of sand, gravel, boulder and stone, which is often used in manufacturing. After modernization and urbanization, the demand for these materials increased in the world. In 1940 AD mining operations began on the Kurnell Peninsula of Australia to supply the expanding Sydney building market (Wikipedia). According to Draggan, as cited in (Huaian, Hamid, Bilal, Yassen, & Anjum, (2017), at present, sand and gravel extraction is a worldwide activity in both developed and developing countries.

Industrial sand and gravel are produced, processed, and used in constructional work all over the world. “In nearly all densely populated areas of the world, sand, gravel, or even clay are dug for use as building material” (Goltremman, 1975). The leading nations in mining and processing sand and gravel are the United States of America, Australia, Austria, Belgium, Brazil, India, Spain, Nigeria, Kenya, and South Africa (Tariro, 2013). According to a conference paper, “globally, about 53 billion tons of material are mined every year, where sand and gravel account for the largest volume of raw material used on earth after water. Their usage greatly exceeds natural renewal rates, which has resulted in the erosive processes now being extracted at a rate far greater than their renewal” (Chilamkurthy, Marckson, Chopperal, & Santhanam, (2016). Similarly, in developing countries, floods are also associated with ever-increasing demographic pressures and economic development. Inappropriate exploitation of resources near rivers for developmental work often result in devastating damage during

floods, which was “estimated at 60 percent of global economic losses due to floods in Asia during the 20th century” (Ali, 2013).

Nepal is a developing country where, urbanization process has been rapidly increasing. The river materials have been supplied from the nearest river for the development of urban infrastructure. In this context a study has identified that “rapid urbanization within a short span in the Kathmandu Valley for the last two decades has increased the demand of sand, and construction of infrastructures has grown day by day, adding to the demand of sand” (Sayami & Tamrakar, (2007). Similarly, “illegal extraction of sand and aggregates has increased recently from various riverbeds and streams in various locations as, Byas and Suklagandaki municipalities and Myagde and Aabukhaire ni the central part of Nepal” (Baral, 2017). Likewise, it has also expressed that “riverbed materials such as sand, pebbles and stones are being extracted illegally without permission from local authorities in many parts of the country, which activities not only hit government revenue but also pose environmental hazards” (Government of Nepal, 2074 BS).

The Chure hill and Tarai belt of Nepal has seriously been facing raw material extraction to construct buildings and other infrastructure. President Chure-Tarai Madhesh Conservation and Management Master Plan has noticed that the river-bed materials, especially stones, boulders and sand have become the important source of income in the Chure hills, Dun, Bhavar and Tarai Madhesh Landscape, and the local governments use to take these as the durable source of revenue. Now a day, the excavation of the river-based materials in Chure region is, generally, practiced through the private sector on contractual basis. While the physical and environmental damages during the excavation period are not taken into consideration.

Realizing this kind of vicious environmental problem articulated that currently, the most popular method employed by the Local Government of Banke to control riverbank erosion is the construction of gabion walls along both banks of the affected river sections. However, due to various political interferences, the government has not been able to prevent illegal export of river materials. As a consequence of the unmanaged and over extraction of sand, gravel and stone, the riverbanks are eroded, threatening the life and livelihood as well losing the property of the local people alongside the river settlement of Banke district.

Similarly, the riparian environment and climate change are exacerbating the existing problem of riverbed aggradation in downstream areas of Nepalese rivers. The riverbed aggradation is causing river to divert from their natural path, resulting in flood in riparian settlements and destruction of life and property in most of riverbed overexertion areas of Nepal. A similar situation also exists in the riparian settlement of the Itram River.

Theoretical approach

Sand, gravel and stone are all resources. According to the functional theory of mineral resources, a natural phenomenon that can satisfy human wants, is functional, and so a resource that relates to man is functional for his benefit and for satisfying his wants at a given time and given place however, the functional aspect must be beneficial to man or society. On the other hand, it may be harmful for humans and the environment. Moreover, functionally some resources are automatic resources that function in their original state and form. But mineral do not possess their functional capacity in their original state (Guha & Chattoraj, 1991).

As long as sand, gravel and stone were unknown to local people of the nearby Itram River, they did not possess their functional capacity in their original state. When infrastructural development began in the Birendranagar valley, river materials acquired their functional capacity after the exploitation of these materials by local efforts into various uses. So, nowadays, sand and gravel are important resources for local people, which fulfills the requirements of the local community. As the human beings become social, economic, and technological men, they start to create their own environment through their own design and skill for comfortable life. For comfortable life, the relation between the local people and the environment behaves towards a teleological approach which, preaches “man is superior to all creatures, and everything is created for his use and enjoyment” (Singh, 1991).

For a long time, the river material utilization behavior in the study area has been appearing as teleological ethics. Similarly, the utilization behavior of river resources also seems to be toward an economic deterministic approach, which approach advocates the higher priority of economic development by rapacious exploitation of resources and the lower priority of environmental conservation, as well as believes in man’s ability to solve environmental problems after the achievement of economic growth.

The river material utilization behavior of local people aside the Itram River should be thought of as an ecological approach that led to a symbiotic relation with the environment.

Statement of the Problem

Most of the rivers of Nepal, on the one hand, face a number of serious environmental and ecological challenges. “Unmanaged development and over-extraction of sand and boulders has caused over-siltation of the river system, affecting the biotic system of water resources in almost every part of the country” (NRTC, 2017). Constructional resource needs are key factors for rising causes of river encroachment for sand, gravel and stone in urban areas, which results in flood damage and risk to public safety. Nowadays, the Itram River is also dying due to such encroachment of urban influence. On the other hand, such encroachment in the catchment area of water bodies is a serious issue and challenges the balance between physical infrastructure development and the environment, which is one of the current strategies of the Land Use Policy 2015 implemented by the Government of Nepal. Over the years, the Itram River has been exploited by mining activities aimed to meet construction needs of developers in and around the Birendranagar valley. Annually, rock material extraction has been seen from the Itram River without consideration to the consequences on the entire environment as well as negative impacts such as distortion of the livelihood chain of communities, flood occurrence, and the incremental deepening and widening of the Itram River. Although, socio-economically, some local miners and communities are also benefited by rock material extraction from this river. Most of the rivers of Nepal that are flowing relatively near the town center are encroached upon and extracted by local people. Illegal riverbed extraction is common in Nepal, such as in the Siwalik region, the Kaligandaki River or any other hill or river (Kathmandu Post, Jun 25, 2024), and illegal quarrying and crusher industrial activities cannot be controlled in the Roshi River in Panauti (Kathmandu Post, Oct 03, 2024). While the Department of Mines and Geology (Government of Nepal) used to release notices every year and also noticed in BS 2082/03/29 for well-managed mining activities. But mines versus man issues have been existing all over the country. Which have been inviting a lot of negative impact in the socio-environment. A similar situation exists in the drainage system of Birendranagar valley.

The study area is one of the samples, and this study may be a representative research work for such problems of Nepalese rivers.

Objectives

The study was concerned with examining residents' perception of the effect of sand, gravel and stone mining on the communities along the Itram River course. The main objectives of this study are:

- To identify the positive impact of mining activities, and
- To identify the negative impacts of mining activities.

Methodology

The study is mainly based on a qualitative research design collecting primary data, involving direct field observation and interviews. Mining activities are enormously perceived near about 1.5 Km. length along the eastern side of the river valley. There are around 197 households (HH) in the study area. Among them, 30 HH, which calculates to about 15 percent of the universe, were randomly selected to collect information, which is descriptively analyzed about the impacts of river material extraction along the Itram River. To acquire information about the river channel, its settlements, and mining activities areas, as well as draw thematic maps, Google Maps were snapshotted from Opera Snapshot_2025-07-23_120850_www.google.com.png.

Study Area

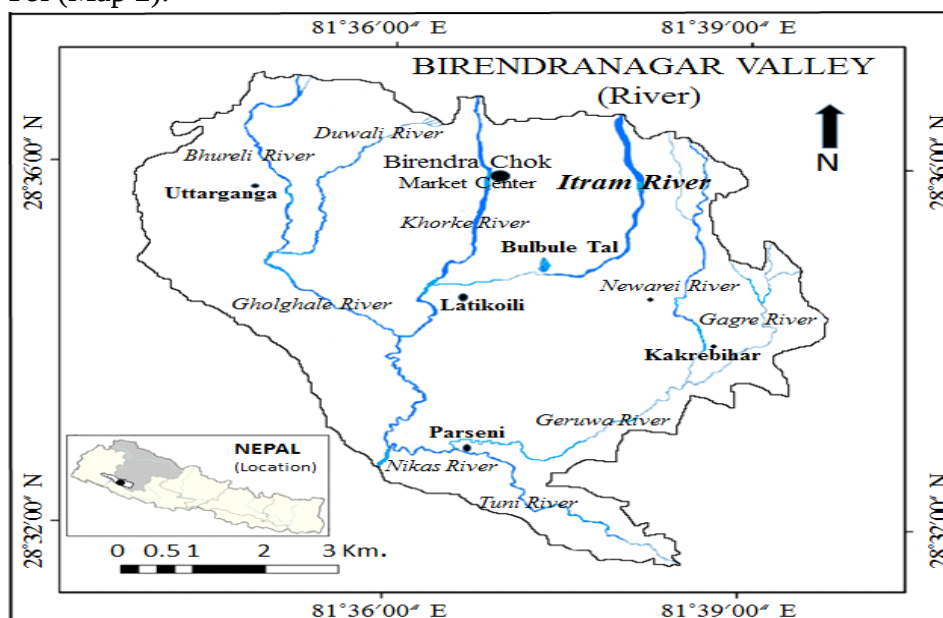
The study area covers the Itram River, located at an average distance of average 1.5 km northeast from Birendranagar town center. Birendranagar municipality is the oldest municipality as well as a major commercial center of Karnali province (Regmi, 2018), which is the district headquarter as well as the provincial capital of the Karnali province of Nepal. The municipality was established in 2033 B.S. According to the 2021 census, the population of Birendranagar Municipality was 153863. Birendranagar Municipality lies between 28°22' to 28°58' north latitude and 80°59' to 82°2' east longitude, extends 245.06 square kilometers and is 665 meter high from sea level. Climatically, the maximum and minimum temperatures range between 33°C to 10°C, and the average rainfall is 1500 mm per year.

The Birendranagar valley is drained by five main river (stream) systems: The Neware River, Itram River, Khorke River, Dhodekhali River and the Gholghole River, which are flowing inside the valley (Map 1). Hence, at present, these river systems flow only during rainy seasons. However, flow during the whole year only reaches a few ranges from its place of origin, then it dries up along the way. The valley floor comprises the “fluvio-lacustrine sediments made up of sand, silt, clay, pebbles, cobbles and boulder-sized particle brought up by the rivers from the northern part of the hills” (UNDP/ERRRP, 2010). Among the five rivers that are mentioned above, the Itram River has a large catchment area under the Birendranagar valley as well as extensive sediment deposits on the valley floor. The Itram River deposit scatters mainly in the northern part of the valley above the Jumla Highway and consists of gravel -to boulder -sized sediments. Hence, soil is good for agriculture and foundation purposes.

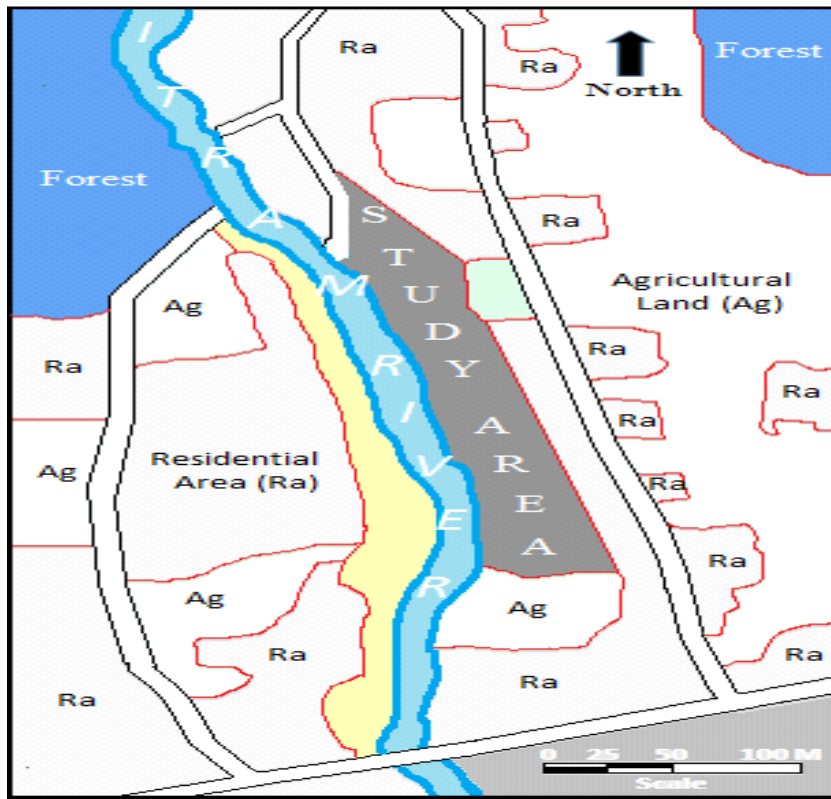
The Thakreni River is originating from the southern slope of the Mahabharat range near the Sidhhapaila and Lade watersheds. According to observation of Google Maps, this river seems to be the

main origin place of the Itram River which is flows vertically from north to south from origin to confluence into the Bheri River has a length of 23.3 Km and falls from 1932 m elevation from sea level. Spatially, the Itram River system is a local river that has about 6.5 Km. in length, which, at present, flows only during rainy seasons. However, flow during the whole year only reaches a few ranges from its place of origin, then it dries up along the way like other river systems of the Birendranagar valley.

The settlement of the study area is spread in Saraswati Tol of Birendranagar municipality -12, where mining activities are highly accelerated along about 1.5 Km of the eastern side of the river valley. There are around 197 HH in fertile land for agriculture in this basin community of Saraswati Tol (Map 2).



Map 1: Major River and Place of Birendranagar Valley.



Map 2: Itram Riparian Land Use Pattern and Study Area of Saraswati Tol.

Perception of the Impacts of Mining Activities

All the local people were not involved in mining activities. As observed in their house structure and home economy, economically the community is seen as mixed-up society of rich and poor. Most of the poor people were involved in mining activities.

Mining activities in the natural river channel always result in harm for the riverine community and their environment. The majority perception of the respondents has been expressed as harmful to these mining activities in the study area. Contrary to that, minority perception indicates it is very beneficial to the communities (Table 1).

Table 1

Respondents rating of the sand mining in the study area

S/N	Rating	No of respondents	Percentage
1	Very beneficial	4	13.33
2	Beneficial	7	23.33
3	Not Certain	2	06.67
4	Harmful	8	26.67
5	Very harmful	9	30.00
	Total	30	100.00

The result is notable in that the perception of the mining activities in the study area was expressed as beneficial by nearly less than one-fourth of the respondents, and 13 percent of the respondents expressed their view as very beneficial due to their surrounding mining activities. Altogether, more than one-third local people benefit from stone, sand and gravel extraction as a local economy. Accordingly, Zimmerman's theory is that the local people are beneficial by satisfying their wants, even though it is harmful for the environment.

Positive View on the Mining Activities

Enhancement of the economic value of construction raw materials in the Birendranagar valley has been observed due to the high demand for this material, like sand, gravel and stone. Local people of the study area have benefited a lot from the high demand for stone material in their community. The locals have been traditionally involved in the sand excavation, which provides them employment opportunities resulting in a source of income to manage their livelihood. But most of the locals being involved in such mining activities, due to a lack of other income-generating opportunities or personal skills, results in long-term negative impact on the environment. Despite such probable consequences, for the time being, the local people are not hesitant to take the benefits from their local environment to support their living and have expressed a positive view regarding the mining activities in their community. (Table 2).

Table 2

Respondents positive view on the mining activities

S.N.	Attributes of positive aspects	No. of respondents*	Percentage
1	Employment opportunities for local people	30	100.00
2	Employment opportunities for women and children	28	93.33
3	Increases level of income	27	90.00
4	Cheap construction materials available for community	25	83.33
5	Respect for labor rights	22	73.33
6	Accessible to housing materials	18	60.00
7	Development of neighborhood infrastructure.	16	53.33
8	Respect of traditional occupation	11	19.56
9	Artificial ponds for livestock watering	4	13.33

* Multiple Response

The mining activities in the society of the study area, landowners, contractors, labors and drivers are getting employment opportunities. As well as women, they are also employed for extra time after their household work. Eventually, local children supported their parents after schooling. Similarly, increasing income level, cheap and accessible housing materials, labor rights, and development of infrastructure are major positive factors for local people. Therefore, the majority of respondents expressed a positive view in 7 attributes among 9 within multiple responses. Only a few respondents accepted the respect for traditional occupation and artificial ponds as positive aspects. Being superior in the animal kingdom, most people are rapaciously exploiting river resources as if they own them therefore, local people stand for affirmative towards mining activities.

Negative View on the Mining Activities

The Itram River has been serving as a key resource for quarrying for a long time. Along with supplying the demand of the people using the extracted materials, it has also contributed to the benefits of the local community. But that's only one side of mining activities. The socio-physical impacts that it leaves on the local environment after a large-scale extraction of sand and gravel near the river cannot be ignored. Residents of the river area have always been explicit regarding the negative impacts, as they are the ones who have to bear the consequences directly. (Table 3).

Table 3

Respondents negative view on the mining activities

S.N.	Attributes of negative aspects	No. of respondents*	Percentage
1	Roads destroyed by tractor for stone, gravel and sand transportation	30	100.00
2	Mining deepens and widens river banks	30	100.00
3	Destroys the aquatic environment	28	93.33
4	Stone, gravel, boulder and sand store beside the public road	26	86.66
5	Dissolve the riverine scenario	24	80.00
6	Depressions on mining sites which unsafe for livestock and children	22	73.33
7	Leads to air pollution	19	63.33
8	Sound pollution by vehicle	16	53.33
9	Ground water pollution by reducing the thickness of the filter material	15	50.50
10	Soil subsidence around river banks near mining site	14	46.66
11	Vegetation and grazing land degrade through soil erosion	7	23.33

* Multiple Response

The quarrying activities in the community of the study area have been a conflicting issue at the community level. Among the respondents in multiple responses more than 80 to 100 percent have voiced negative views as major problems i.e., roads destroyed by tractors, deepened and widened riverbanks, destruction of the aquatic environment, river material storage beside the public road, and dissolved riverine scenarios due to the mining activities. Similarly, more than 53 to 73 percent of respondents have recognized the harmful effects of depressions on mining sites and air pollution and sound pollution by means of transportation in the study area. As well as, 23 to 50 percent of respondents have denoted groundwater pollution and soil subsidence around riverbanks, and grazing land is destroyed through soil erosion as negative impacts of the mining activities in the study area of this community. Some local people are conscious of local environmental problems, which have been created due to rapaciously exploiting the river and they are anxious about their symbiotic relation with their local environment; therefore, local people stand against mining activities.

Conclusion

The Itram River was a perennial river, but at present it seems to be brooks in locality. Traditionally, the local people nearby this river used to utilize water resources. Accordingly, teleological ethics, at present they are feeling the extraction of river materials as their rights. Therefore, the Itram River system is affected by local people due to excessive quarrying of stone, gravel and sand. These mining activities are harmful for most of the local people in spite of a small benefit. Employment opportunities, wages, easily available housing materials, labor rights, and infrastructural development in the community are major positive factors. As well as, road damage, river deepening and widening, eradication of aquatic environments, river material storage beside the public road, dissolution of riverine scenarios, and depressions on mining sites as air, sound, groundwater pollution, soil subsidence and erosion are major to minor problems that are negative impacts of mining activities in the study area of this community.

Although, over the last few decades, the riparian people all over the country may have benefited from their local river mining activities, even though, those activities must be controlled to preserve the drainage system and riverine environment of the community.

References

- Ali, A. (2013). *Indus Basin Floods Mechanisms, Impacts and Management*. Philippines: Asian Development Bank.
- Baral, P. (2017). Illegal extraction of sand on the rise. The Kathmandu Post. Published on: 30-07-2017.
- Bhattarai, C. (2015). Nepali Laws and Rivers. *Proceeding on 2nd National River Summit 2017* (pp. 31-32). Kathmandu: Nepal River Conservation Trust (NRCT).
- Chilamkurthy, K., Marckson, A., Chopperla, S. T., & Santhanam, M. (2016). A statistical overview of sand demand in Asia and Europe. India: Department of Civil Engineering, Indian Institute of Technology, Madras. Retrieved from https://www.researchgate.net/publication/309409121_A_statistical_overview_of_sand_demand_in_Asia_and_Europe
- Goltremann, H. (1975). *Physiological Limnology: An Approach to the Physiology of Lake Ecosystems*. New York: Elsevier Scientific Publishing Company Amsterdam.
- Government of Nepal. (2074 BS). *President Chure-Tarai Madhesh Conservation and Management Master Plan*. Nepal: President Chure-Tarai Madhesh Conservation Development Board.
- Guha, J. L., & Chattoraj, P. R. (1991). *A new approach to economic geography: A study of resources*. Calcutta: The World Press Private Limited.
- Husain, V., Hamid, G., Bilal, M., Yassen, R., & Anjum, S. (2017). Environmental Impact of Sand Mining in Malir River Bed Karachi, Pakistan. *International Journal of Economic and Environmental Geology*, Vol. 8(1), 41-45.
- Langer, W. H. (2003). *A General Overview of the Technology of In-Stream Mining of Sand and Gravel Resources, Associated Potential Environmental Impacts, and Methods to Control Potential Impacts*. United State: U.S. Geological Survey.
- MoLRM. (2015). *Land Use Policy*. Kathmandu: Gov. of Nepal, Ministry of Land Reform and Management (MoLRM).
- NRCT. (2017). *Proceeding on 2nd National River Summit 16-19, March 2017*. Kathmandu: Nepal River Conservation Trust (NRCT).

- Pokhara Bureau. (2018). *Illegal extraction of riverbed materials goes unchecked*. The Kathmandu Post, Published on: 18-01-2018.
- Regmi, K. R. (2018). Development of Urbanization in Karnali Province. *Prayas*, Vol.1, No. 1, 306-324.
- Sayami, M., & Tamrakar, N. K. (2007). Status of Sand Mining and Quality in Northern Kathmandu, Central Nepal. *Bulletin of the Department of Geology*, 89–98.
- Sharma, S. K., & Ghimire, M. (2015). Development of Environment Statistics in Nepal. *Compendium of Environment Statistics Nepal* (pp. 1-12). Kathmandu: Government of Nepal National Planning Commission Secretariat, Central Bureau of Statistics.
- Singh, S. (1991). *Environmental Geography*. Allahabad: Prayag Pustak Bhawan.
- Tariro, M. (2013). *Case Studies of Environmental Impacts of Sand Mining and Gravel Extraction for Urban Development in Gaborone*. University of South Africa. Retrieved from <https://core.ac.uk/download/pdf/43174281.pdf>
- UNDP/ERRRP. (2010). *Vulnerability Profile and Preparedness Plan of Birendranagar Municipality*. Vulnerability Profile and PreEarthquake Risk Reduction and Recovery Preparedness Program for Nepal, UNDP/ERRRP – Project Nep/07/010.
- Wikipedia. (n.d.). Retrieved from http://en.wikipedia.org/wiki/sand_mining#mw-head