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Study of Human Intervention on River and its Impact on Local Economy: A Case Study of Chamta Channel of Darjiling District

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Abstract : *The geometry of channel bed and bank boundary as well as long profile is nothing but the combined effect of the channel hydro-geomorphological drivers in any riverine environment. But the human intervention is considered as one of the important independent variables of river hydraulics. The present paper deals with the study of human interference along the Chamta channel in the piedmont of Darjiling district of West Bengal. The present research incorporates the linkage between the change in hydro-morphology and its impact on local economy. The local economy can be considered as a construct which can be reflected through many indicators like the change in land use land cover, change in water fish availability in channel, change in occupation structure, change in population size of the buffer villages along the Chamta channel the change in riverine environment puts its direct and indirect impact on local economy on the basis of available natural resources along the Chamta channel.*

Key words: *Anthropogenic interference, land use land cover change, endogenic and exogenous economy*

Introduction

Fluvial geomorphology and surface hydrology of a river basin control the dynamics of river channel (Bandyopadhyay and De, 2017). Changes in hydrological and sedimentological character of a channel can be referred the modification of channel hydraulics (Gurnell and Petts, 1995). Anthropogenic interventions are responsible for the gradual change of the state of the riverine landscape in the name of development. The riverine character and the adjacent economic activity are closely associated to each other throughout the world. The modification of riverine as well as socio-economic landscape has been focussed by several researchers. Thoms (2003) did research on the implication of human interference on riverine flood-plain. Mazumdar (2018) worked on the status of soil pollution and surface water created by the brick kilns at Palasbari revenue circle, Saha et.al. (2021) emphasized on the loss of agricultural productivity by the brick kilns. Saha and

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Mostafa (2021) worked on impact of brick kilns on surface water around the kiln area. Sarkar et. al. (2021) emphasized on the declining discharge and its relation with river water pollution which controls the fish health in the Mathabhanga-Churni River. Panda et. al. (2018) tried to understand the change in magnitude of water quality parameters with the change of river regime in India. Islam et. al. (2024) worked on river water quality and its relation with ecological risk. Rasid and Romshoo (2012) noted that water quality in the Lidder river in the Kashmir valley and Mondal et. al. (2021) worked with fourteen indicators for the measurement of water quality of the Karala River in Jalpaiguri. Regarding river and ground water pollution as environmental issues, Dutta and Misra analysed the concentration of heavy metals in ground water in small tea gardens of Sonitpur District, Assam. Singh et. al. (2015) found the presence of pesticides in water of the in the foothills of West Bengal as effluents from nearby tea gardens. Bandyopadhyay and De (2017) tried to find the role of human interference on Haora River in Tripura. Chi et. al. (2018) worked on the spatiotemporal characteristics and ecological effects of the human interference in Yellow river delta. Dai et. al. (2015) worked on human interference in the river discharge of the Yangtze River in China. Lowe et. al. (1995) explained the transformation of endogenous economy to exogenous model through the discussion of rural development. Epicoco (2021) emphasized on the economic development and its relation with the transformation of economy. Malek and Tahir (2018) came with the concept of Neo-endogenous and Neo-exogenous model of rural economy. Kotlewski (2012) said on the endogenous and exogenous component of economy and its relation with the holistic growth. These literatures have cited to structure the present research regarding the human intervention on natural channel and its modifications which put great impact on the local economy of buffer villages and surroundings along a particular channel.

Study Area

The Chamta channel rises to an elevation of 331 m in the Kurseong Himalayan foothills, flows over the Darjiling Himalayan piedmont (known locally as Terai), and ends at an elevation of 212 m at the Panchanoi channel near the Sishudangi area of Siliguri. It takes Chamta 18.3 km to travel to its confluence. First five km. of the Chamta channel falls under the jurisdiction of Mahananda Wild Life Sanctuary which is not approachable by the general people. The field survey starts from Kanyan (five km in downstream direction) and continues up to Tomba along the Chamta main channel. The Chamta channel finally discharges at Panchanoi river near Sishudangi area. The present research has been framed along the 13.3 km Chamta channel from Kanyan to Tomba. There are 14 villages are considered as buffer villages along the Chamta river as they share their village boundary at the bank of the channel (Figure 1).

Objective

The present research paper deals with the issue of human intervention over the Chamta channel and its impact on local economy. The anthropogenic interference acts as an independent

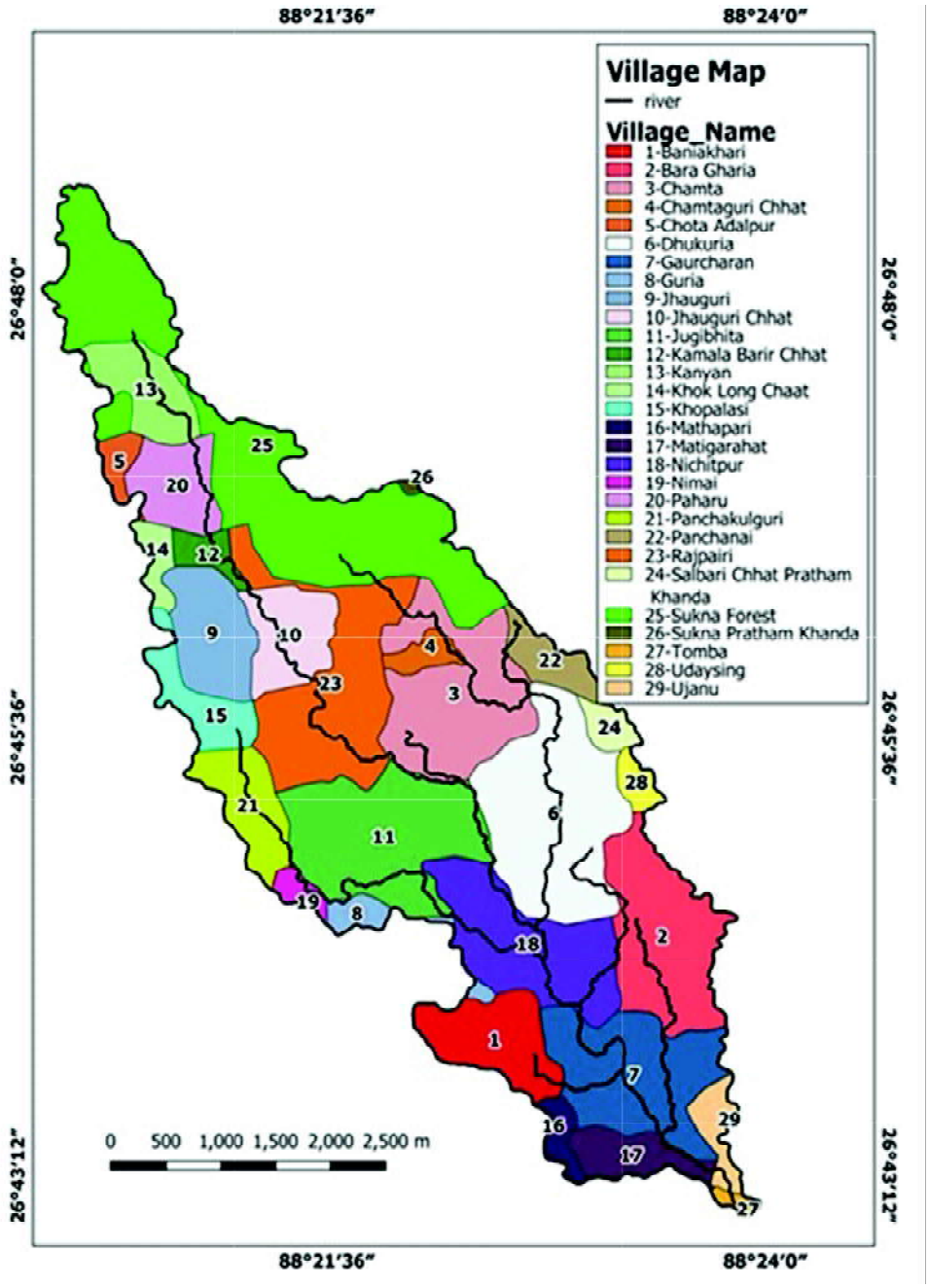

Fig. 1: Location of villages in Chamta basin extracted from SEDAC and Bhukosh, GSI

variable which can able to modify the local economy of adjacent buffer villages along the Chamta channel. The main objective of this paper can be divided into the following sub-objectives:

1. Change in availability of sediment flux in Chamta channel due to human intervention and its impact on local economy
2. Changes in land use land cover of buffer villages along the Chamta due to anthropogenic activities and its impact on local economy
3. Change in water quality and availability of fish in Chamta channel by human interference and its impact on local economy

Methodology

As the present paper deals with the human intervention on Chamta channel and its impact, it is essential to observe the perception of local inhabitants of the Chamta basin regarding this issue. Intensive interview has been executed at river-side villages in the basin to collect information regarding the history of changing economy and their strategy to cope with that. It passively gives the information regarding the intervention over the Chamta channel, executed by them time to time. LANDSAT satellite images are extracted from USGS Earth explorer for assessing the change in land use land cover in very recent past [LT05_L1TP_139041_20041229_20200902_02_T1.TIF (for the year of 2004) and LC08_L1TP_139041_20220214_20220222_02_T1.TIF (for the year of 2022)]. The supervised classification of those extracted images and their interpretation also helps to verify the information regarding recent past which are collected from the villagers through interview method. Information regarding the transformation of land use land cover has also been verified by using the recent Google satellite images extracted from Google Earth Engine (Year 2011 to 2022). Evaluation of water quality has been made by testing the water samples from the Chamta channel on spot by using the field kit. Field photographs are also taken as ground truth verification to substantiate the facts extracted through image classification. Statistical analysis has been executed on the basis of socio-economic data of the villages under the Chamta river basin which has been extracted from the latest Socio-Economic and Caste Census of 2011.

Results and Discussion

River Chamta is the main river for nearly twenty-nine (29) villages located within its basin. The Chamta influences the life of the people of these villages in various ways. Conversely the people living in the vicinity of Chamta make use of the river in their own ways having mostly negative effects on the condition of the river. There are 14 villages located almost along the course of the Chamta from Kanyan to its point of fall at Tomba. In other words, the Chamta shares its channel among the people of these 14 villages, while the remaining other fifteen (15) villages are not located too far way off from the Chamta channel. The natural riverine environment of the Chamta channel has been modified in several ways by the intervention of the inhabitants of the villages under Chamta basin.

Photo. 1: Chamta channel at Kanyan

Photo 2: Chamta channel at Kamalabarir Chaat

Photo 3: Chamta channel at Nichitpur

Photo 4: Chamta channel at Gourcharan

Photo 5: Chamta channel at Matigarahat

Photo 6: Chamta channel at Tomba

Photo 7: Interviewing people at Tomba

Photo 8: Interviewing people at Gaurcharan

Photo 9: Interviewing people at Nichitpur

Photo 10: Interviewing people at Kamalabarir Chaat

Change in Availability of Sediment Flux in Chamta Channel:

The near-bank fertile traditional agricultural croplands along the Chamta have been converted to a great extent into brick-fields since the late 80s of the last centuries, especially at Jhauguri chaat, Rajpairi, Jugivita under Pathargata gram panchayat to supply the growing market of civil construction centring around Siliguri. With the development of civil society at Siliguri, a gradual change in economic pattern has been taken place at the peripheral zone of Siliguri area. The producers or the agricultural labourers got an easy option to engage themselves with the newly built brick kilns at their villages along the Chamta channel. These brick fields used the river-borne and

deposited silt of the Chamta. The local agricultural labours were engaged in brick-fields, which denotes a transition of local in-situ economy into modified in-situ economy. The trend continued for the next twenty to thirty years up to the end of the last century. The early years of the 21st century saw a gradual decay of brick field in these areas because of very high return from the

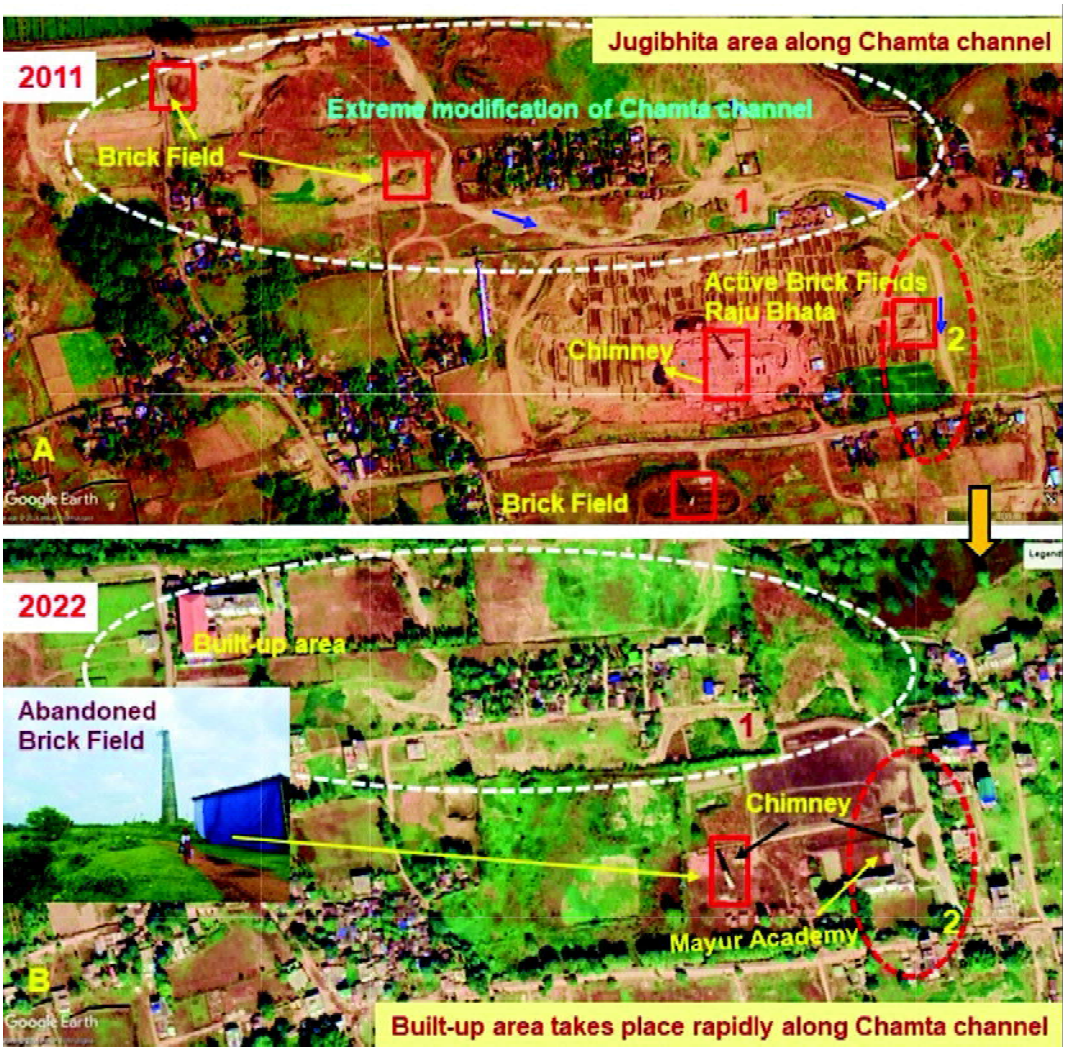

Fig 2: Change in LULC along the Chamta channel at Jugibhita area under Patharghata GP. A) Location of active brick fields along the Chamta channel in 2011 and B) Displacement of brick fields in the year of 2022 while only the abundant chimney (s) caries the signature of previous economic landscape. New constructions taken place along the Chamta channel. Path of the previous channel is almost disappeared due to change of LULC.

land parcel when sold out as real estate for tertiary services including education institutions and health care centres. A few deserted brick-field chimneys of Raju *bhata* (now used for Real estate, Shree Shree Academy, Mayur RSG Academy), Asoke *bhata* (now Ramanujan Public school), Moti brick field (now Bhabi-Ma flour mill), B.P. Brick factory (partly the land now used for milk factory and private settlements) are still standing out as witness of the bygone activities. Moreover, diversion of the Chamta channel at several points at the upstream greatly reduced the supply of river-borne fresh silt sediments as raw materials for the brick fields. To overcome lack of supply of fresh silt from the Chamta several brick fields of the locality dug up wide parts of the surface soil up to nearly a depth of 1 to 1.5 m. There was no excavation below 1.5 m depth because the finer silts good for brick manufacture was only available from the surface layer of soil till about 1.5 m depth. Below these the texture of soil changes to predominantly coarser sediments of the Baikunthapur formation, unfit for brick making. So, the decay of brick fields was not due to any fall of demand of bricks at nearby markets but due to lack of continued supply of fresh silt along the Chamta and spiking land price due to the spread of Siliguri Urban Agglomeration. A representative study has been done on the basis of the evidence of Google image available for the year of 2011 and 2022, where the location of brick fields can be seen in 2011 but has been replaced by the new constructions (school buildings with other built-up area)

Changes in Land Use Land Cover (LULC) of Buffer Villages along the Chamta:

Land use and land cover of the Chamta basin are characterised in general by tea plantations, agricultural lands with seasonal diversities of crops and irrigation, settlement and built-up areas, fallow lands (abandoned brickfields) forests (such as Mahananda Wild Life Sanctuary-MWLS (Chamta Beat area), river (the Chamta channel with depositional bars of various types).

Two (2) LULC maps have been prepared over 200 m buffer area on both sides of the Chamta channel from Kanyan to Tomba for the years of 2004 and 2022. These are meant to observe changes in LULC for the studied span of time. A LULC change map 2004-2022 has also been prepared to find out the type of changes in land use and land cover both along the Chamta channel as well as in its surrounding areas within a buffer of 200 m. Information regarding the change in land use has been gathered from LANDSAT images with field verification for status of 2022 land use by questionnaire and interviews with local people.

The following sectors of change in LULC have been noticed within a period of nearly two (2) decades, namely, 1. Agricultural land to forest (due to social forestry), 2. Forest to agricultural land 3. Tea garden to forest 4. Forest to tea garden 5. Tea garden to agricultural land 6. Agricultural land to tea garden 7. Forest to fallow land 8. Fallow to agricultural land 9. Agricultural land to fallow land 10. Settlement to agricultural land 11. Fallow land to tea garden 12. Tea garden to fallow land 13. Agricultural land to settlement 14. Settlement to tea garden 15. Tea garden to settlement 16. Settlement to fallow land 17. Fallow land to settlement.

It appears from the above data that maximum change in land use has occurred in the sector of agricultural land to tea garden, while minimum change has been noticed in case of change

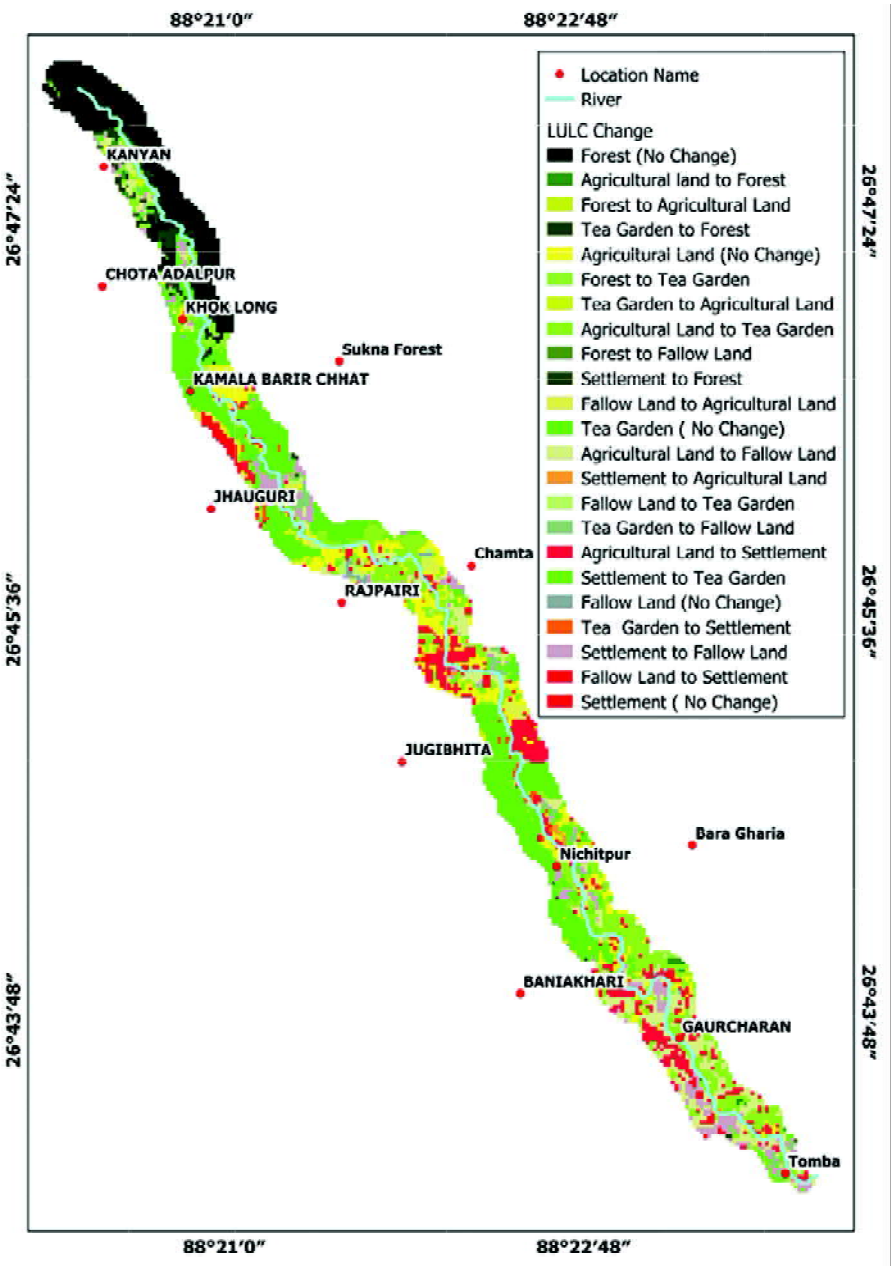

Fig 3: LULC change map along the Chamta channel is prepared on the basis of LANDSAT images [LT05_L1TP_139041_20041229_20200902_02_T1.TIF (for the year of 2004) and LC08_L1TP_139041_20220214_20220222_02_T1.TIF (for the year of 2022)]

Photo 11: Boroli fish collected from Chamta at Tomba in downstream reach

Photo 12: Very tiny Nodiali fish collected from Chamta river at Kamalabarir Chhat in upstream area

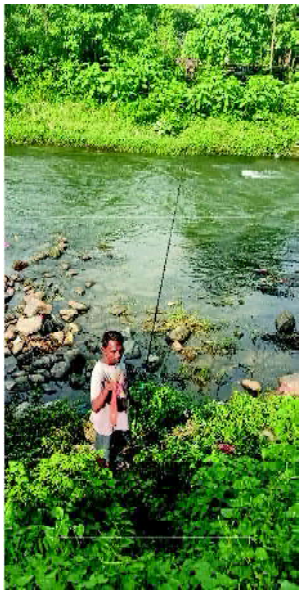

Photo 14: Collecting riverine Boroli fishes at Matigarahat area in downstream region near confluence

from forest to agricultural land. The second and third maximum change in land use have occurred in agricultural land to fallow land and agricultural land to settlement sectors.

There is also a noticeable parcel of land where no change either has been recorded as peer LANDSAT images or impression of change has been viewed by the local interviewees. This includes forest area under MWLS, older settlements in villages along the Chamta channel (like Kanyan, Matigarahat, Tomba), older tea gardens (Chumta TG) as well as in areas of old agricultural lands where farming activities have been undertaken since the last few decades (like areas near Matigarahat).

Changes of Availability of Fish in Chamta Channel:

Fish has become rare now-a-days in the Chamta. After crossing the Gaurcharan area along Chamta channel, even near the Chamta-Panchanoi confluence near the Chandmoni TG, the reach has become devoid of fish such as Boroli, Sol, Magur, Bami, Kuchia, Gittu, Koi etc. Falling water quality of the Chamta, as per the views of the local people, has a telling effect on the size of the available fish. The Chamta channel passes through the greater Siliguri area after crossing Gaurcharan in its downstream stretch. Both the banks of the Chamta channel are intensively occupied by displaced and economically poor slum dwellers

Photo 15: Washing utensils by using Chamta water at Gourcharan area

Photo 16: Domestic drain outlets are discharging at Chamta

Photo 17: Bio-medical wastes from newly built hospitals along Chamta discharging into channel near Gourcharan-Matigarahat stretch

of the Siliguri township area. They illegally occupy portions of river bed and river bank for their livelihood. They are actively or passively responsible for the declining stream water quality as well as change in Chamta channel planform.

The released domestic waste water, solid waste, untreated residue of human and animal's excreta directly make the water quality of Chamta poor. This toxic water has been found to increase incidence of skin diseases among the local people. This is further to mention that the domestic septic tanks are open to the channel of the Chamta. As a result, the river water is neither used as drinking water nor for washing, bathing and cleaning linens. Water samples are tested at field by using field kits and water quality index has been prepared to observe the change in water quality of Chamta channel at some selected stations throughout the year. Poorest water quality has been observed in pre-monsoon months. Though it improves a little in the monsoon months. Best water quality has been recorded in late-monsoon season. It again deteriorates gradually from December to May. The water sample also been tested to observe the presence of Ecoli. Presence of Ecoli has been confirmed from Kamalabarir Chhat to Tomba along the Chamta channel.

Water quality is better in the upstream near Kanyan even during the pre-monsoon lean season, while Water Quality Index (WQI) falls gradually up to Chamta-Panchanoi confluence.

Photo 18: Water of Chamta becomes polluted by the effluent of TG and cropland

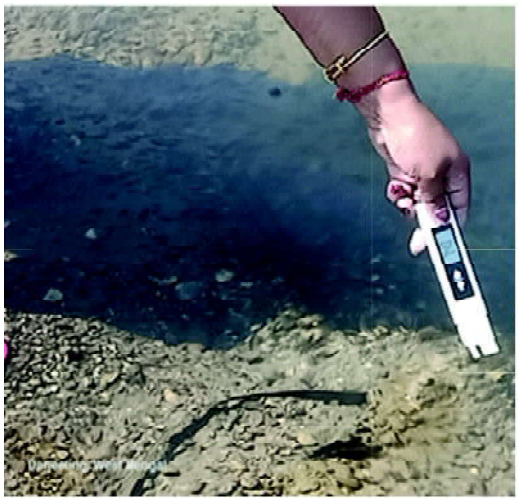

Photo 19: Using field kit to measure the chemical parameters of the water sample collected from Chamta channel

Water quality for July and October maintain the same spatial trend. Gaurcharan acts as a WQI divide between the upper reach water quality collection stations and those at the lower reach below Gaurcharan. Further upstream of Gaurcharan, the reach is dominantly under tea-gardens. Below Gaurcharan, Greater Siliguri township prevails. There are markets and malls, offices real-estates, roads, hospitals etc. These directly affect water quality of the Chamta due to discharge of untreated effluents, domestic solid wastes, bio-medical wastes, open defecation, market waste as so on. Deterioration of water quality of Chamta has its effect on fish species. A number of river-borne fish species either have become extinct or at the verge of extinction from the Chamta. Falling water quality of the Chamta influence availability of fish. Large size fishes are available more in the better quality upstream water while in the downstream the size of Nodiali fishes gradually decreases. body-mass and fish-density reduces. Release of surplus chemical fertilizers from tea-gardens in the upstream areas increases the problem of toxicity which is responsible again for decay of fishes. As such the

Photo 20: Water sample collection from Chamta channel at Gourcharan area for water quality measurement

reach between Gaurcharan and Chamta confluence has almost become fish-less through it was rich in fish variety even a decade ago.

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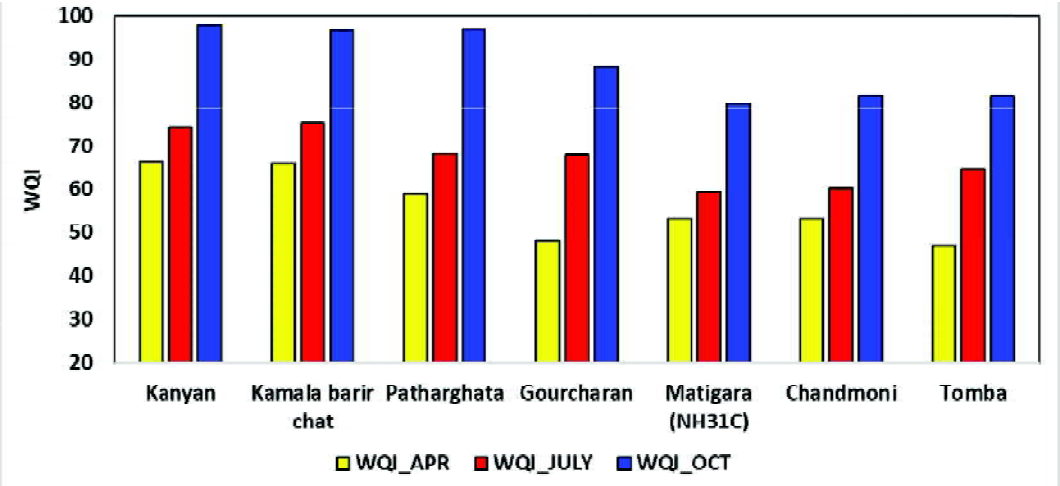

Fig. 4: Variation of water quality index (WQI) at representative buffer villages along Chamta channel from Kanyan to Tomba

Changing Economy in Chamta Basin:

The hydrology and geomorphology of the Chamta channel has been regularly compromised by the human interventions in last few decades. The deterioration in channel discharge changes the sediment flux in channel, which not only changes geomorphological configuration but also the land use land cover along Chamta channel. The decrease in channel discharge favours the deterioration of water quality of Chamta. The water quality of Chamta is partially regulated by the discharge regime. The upper catchment of Chamta is covered by the Mahananda Wild Life Sanctuary. The fringing area of the forest near the Kanyan, Kamalabarir Chaat has been partially deforested to establish the tea gardens at riverside terraces as the deposited oxidized soil layers are very much favourable for tea plantation. The Chumta tea estate was established in 1866 and the garden and factory are still in operative mode. This garden was the oldest tea garden in Terai foothills. Lower terraces were used for intensive paddy and vegetables production. Sudden and huge discharge of Chamta channel in form of flash flood generated economic loss by overtopping the banks along the Chamta channel. Economic approach of local resource utilization encouraged

local inhabitants to bi-furcate the main Chamta channel to reduce the flow volume of the channel in high discharge months. It allowed to reduce successfully the stage of water in Chamta channel which keeps the monsoonal discharge in channel bed. It gradually reduced the velocity of the main channel and sub-channels of Chamta. As the local inhabitants of Chamta channel tried to cope with the changing economy of the Siliguri. Wave of colonization brought a change in occupation structure in the Chamta basin. Local cultivators were engaged themselves with the newly built tea garden factory, which continues for centuries. As the tea-garden and intensive farming-based economy were built up on the basis of local available resources and climatic conditions on Darjiling Himalayan foothill terrain. The tea industry has been progressed throughout the years even after the British period. It might be a successful attempt with the changing economy which favours the sustainable development of the basin without hampering the natural environment. But significant changes in economy were taken place since the transformation of rural Siliguri into a *rurban* area. Need of brick was obvious for the newly developed Siliguri township in the span of late eighties. Bricks are imported either from South Bengal or mostly from the peripheral districts of Bihar. The non-Bengali investors (Bihari) found the Chamta as a silt-bearing river which is not common in that sub-Himalayan foothill area. Most of the neighbouring rivers were infamous as bajri or sand-bearing rivers, like- Balasan, Mahananda, Rakti, Rohini. But the human-interfered braided modified low-discharging Chamta and its tributary network were unable to carry sand and boulders by its lower discharge. The upper catchment lithology set up of Chamta channel might be also responsible to generate and re-transport the silt-clay sediment flux in downstream area. Two to three m depth of silt layer has been found in buffer villages of Chamta basin along the main channel and tributary network. The Chamta basin is basically lying on the Baikunthapur formation which is characterised by the deposition of thick silt-clay layer at upper horizon of soil profile. The local inhabitants found new option of occupation in their locality which provided a little bit better income at those days. The brick kilns became the main source of economy of the villagers. The agriculture based intensive rural economy has been converted into brick-kiln based economy. The brick kilns dug the entire silt layers and used the silt to make brick. Even they modify the shallow depth channels of Chamta to get the fresh silts in high discharge months. The trend continues up to 2010. Thus, the Chamta channel almost lost its original path and its entity only visible in monsoon months specially in downstream area. Now, the Chamta lost its silt bearing capacity and the brick-fields has no option get its raw-materials for manufacturing activity. Now, the local people become jobless as they have lost their jobs at local brick-kilns as well as lost their fertile land. Now, most of the brick-kiln plots are sold out to the external business houses who have already started either real-estate business or built educational institutions for business purpose. But the local inhabitants have no job at these sectors. Finally, they are discarded from the local economy and become jobless. The poor local inhabitants are now engaged themselves as the temporary casual labourers at local construction sectors or outside area as unskilled workers. The changing economy and transformation of land use land

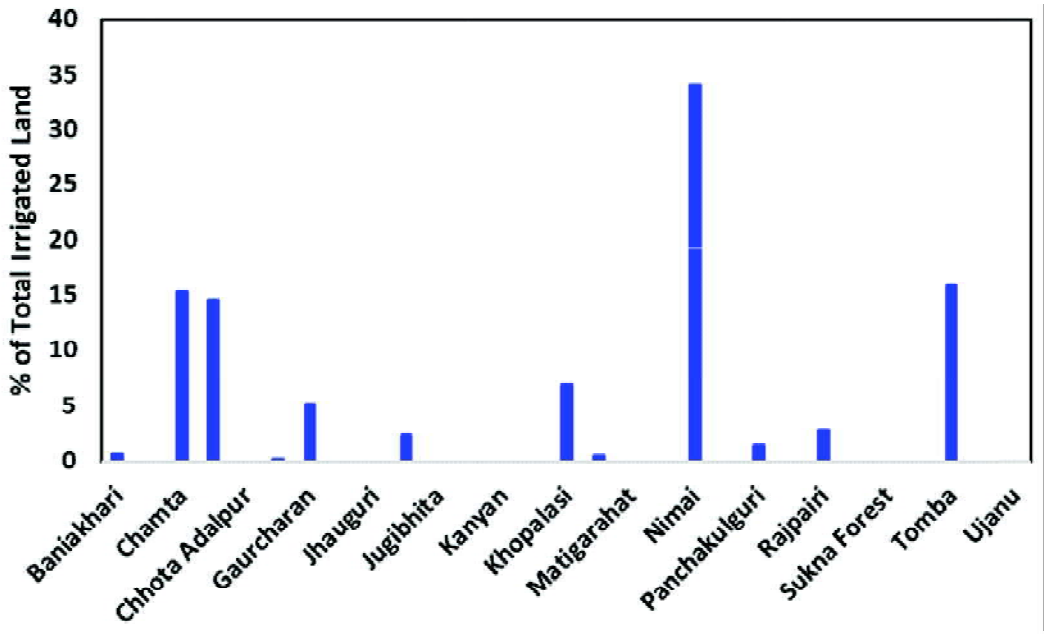

Fig. 5: Spatial variation of total irrigated land (%) under the villages of the Chamta basin extracted from the latest Socio-Economic and Caste Census of 2011

cover in very rapid manner may not favour the sustainability of development of local inhabitants, which can be observed through the socio-economic parameters of the villages under the Chamta basin. Nimai, Tomba, Chamta, Chota Adalpur is characterised by better irrigation facility in Chamta basin (Fig. 5). Villages called Tomba, Jhauguri, Chamta is recorded as cultivator's villages in recent past (Fig. 6). But their tradition of agriculture has been modified as the inhabitants were engaged with the brick making activity for instant economic benefit. Latest Socio-Economic and Caste Census (2011) refers that the villages called Matigarahat, Tomba, Nimai, Chamta, Gaurcharan, Baniakhari are now suffered by a significant percentage of deprived population who have struggling for their economic existence (Fig. 7). As the inhabitants have no scope to engage themselves in the agricultural activity, they are bound to work as casual labour in their villages or outside area (Fig. 8). A significant percentage of population of Mathapari, Matigarahat, Nimai, Tomba, Chamta are now converted themselves into manual casual labour (Fig. 10). Villages like Baniakhari, Chamta are suffering due to poor economic condition as the inhabitants become jobless. Economy of Tomba village becomes vulnerable as half of the village population are depended only on begging or alms collection activity as recorded in latest Socio-Economic and Caste Census 2011 (Fig. 11). But, the presence of higher percentage of households in Tomba reflects the steady economic background at Tomba in recent past (Fig. 12). Though the villages like Khopalsi, Mathapari, Sukna Pratham Khanda, Tomba are characterised by higher percentage of households where more than

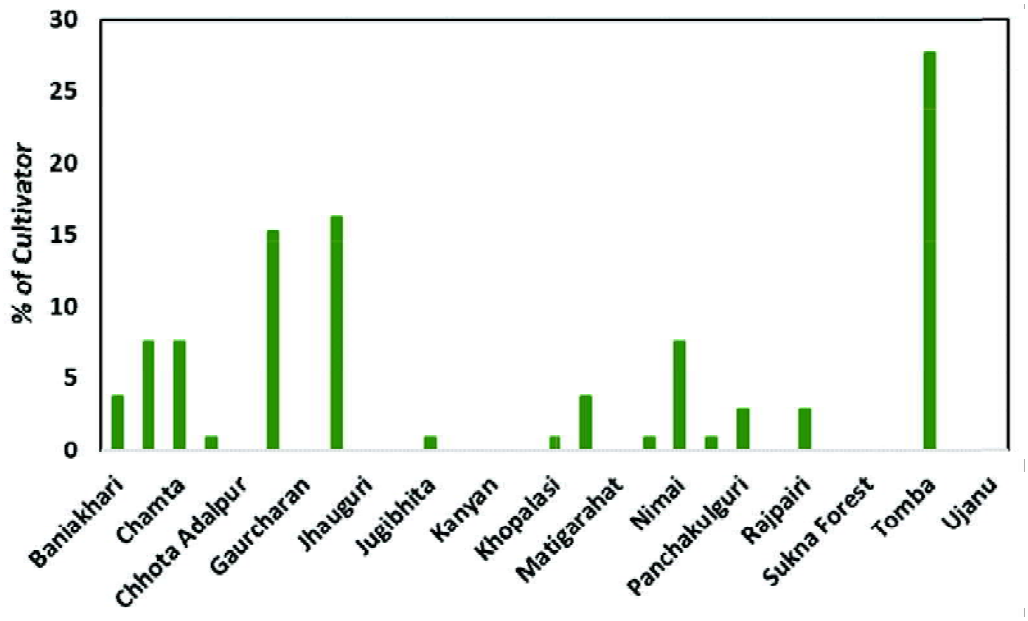

Fig. 6: Spatial variation of cultivator (%) under the villages of the Chamta basin extracted from the latest Socio-Economic and Caste Census of 2011

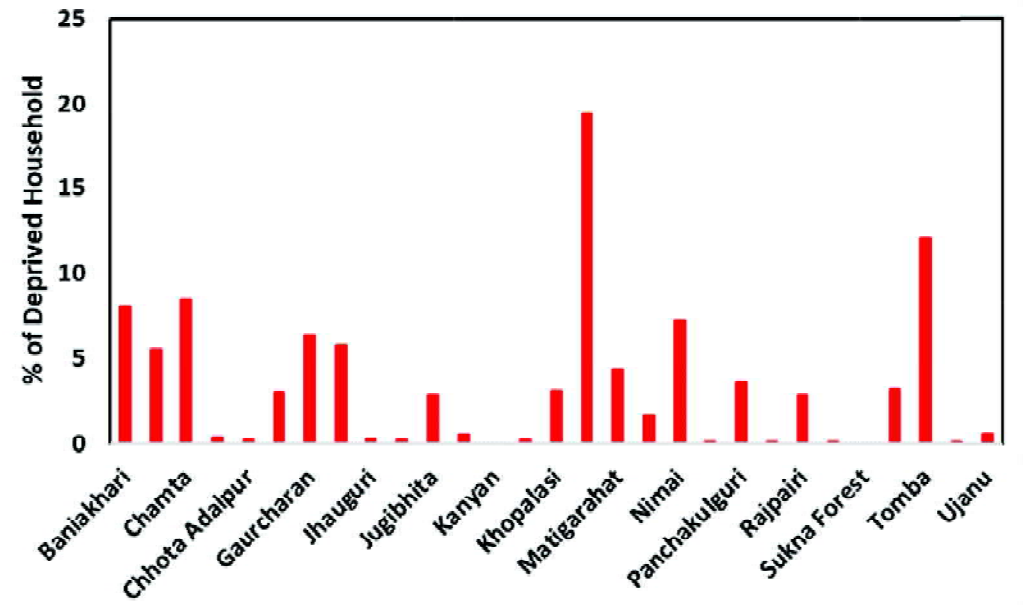

Fig. 7: Spatial variation of deprived household (%) under the villages of the Chamta basin extracted from the latest Socio-Economic and Caste Census of 2011

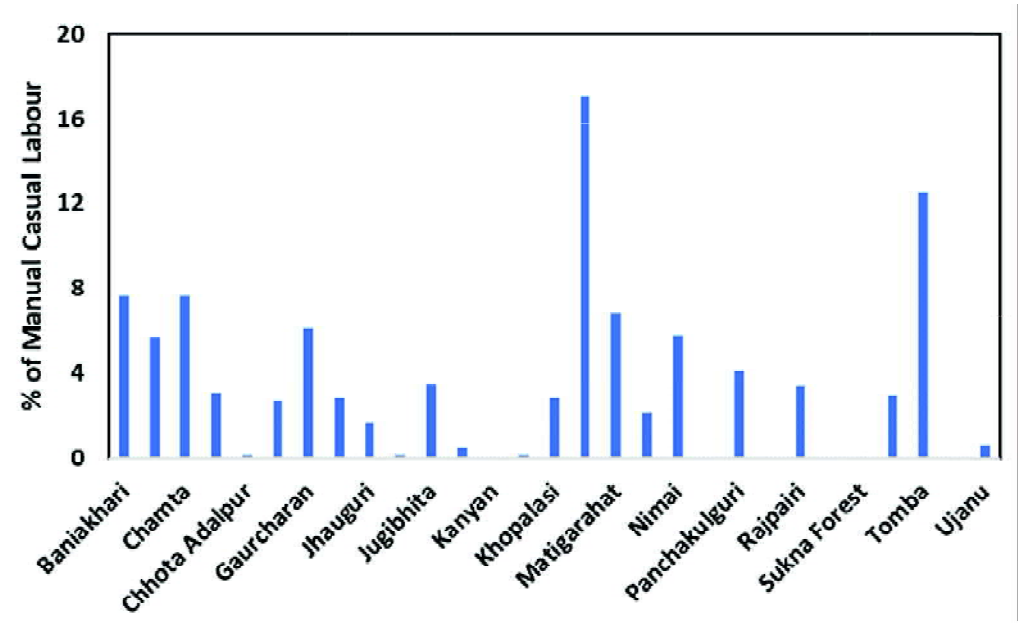

Fig. 8: Spatial variation of manual casual labour (%) under the villages of the Chamta basin extracted from the latest Socio-Economic and Caste Census of 2011

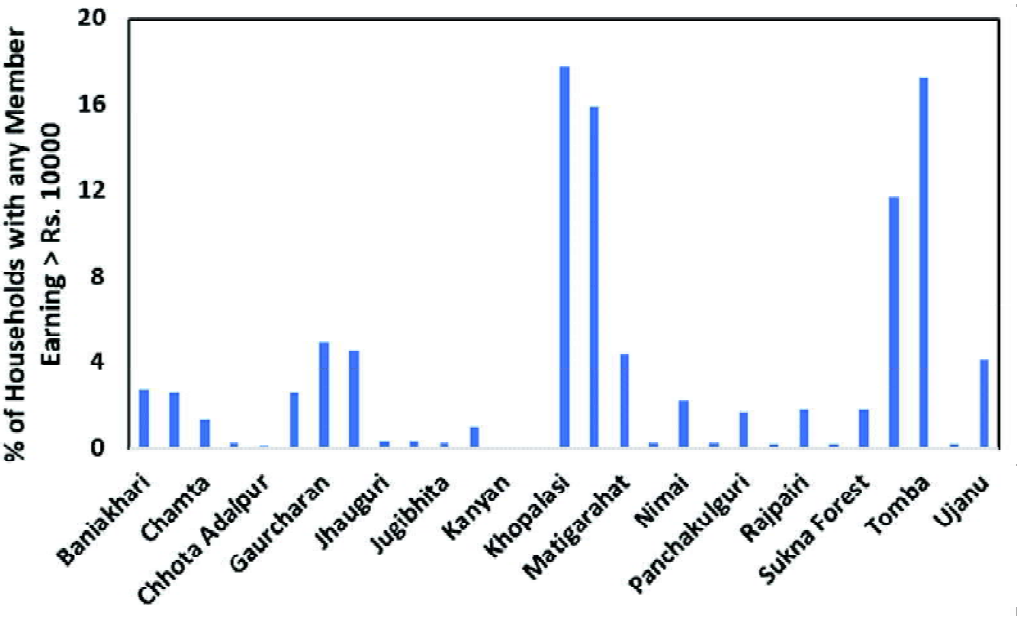

Fig. 9: Spatial variation of households with any member earning > Rs. 10000 (%) under the villages of the Chamta basin extracted from the latest Socio-Economic and Caste Census of 2011

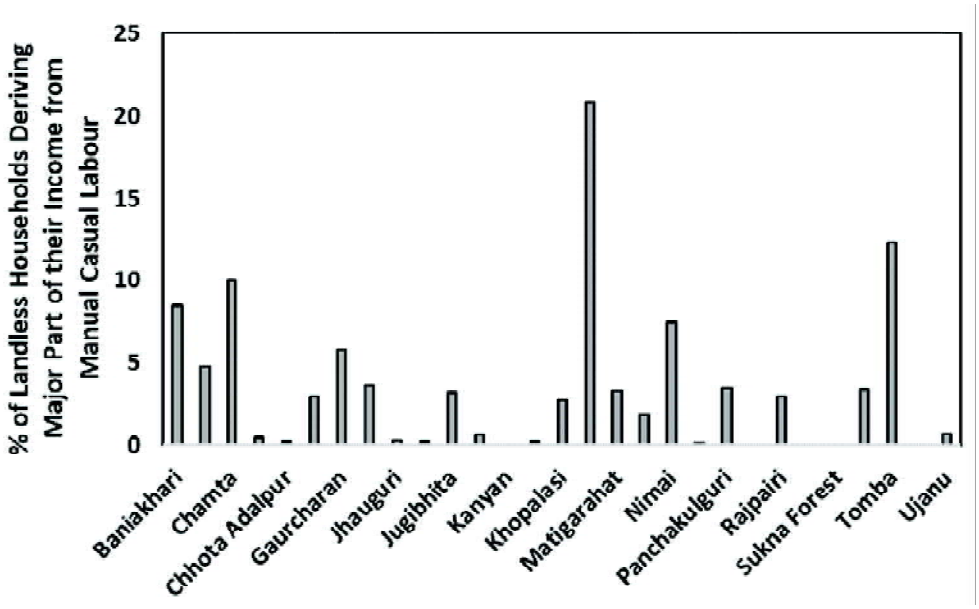

Fig. 10: Spatial variation of landless households deriving major part of their income from manual casual labour (%) under the villages of the Chamta basin extracted from the latest Socio-Economic and Caste Census of 2011

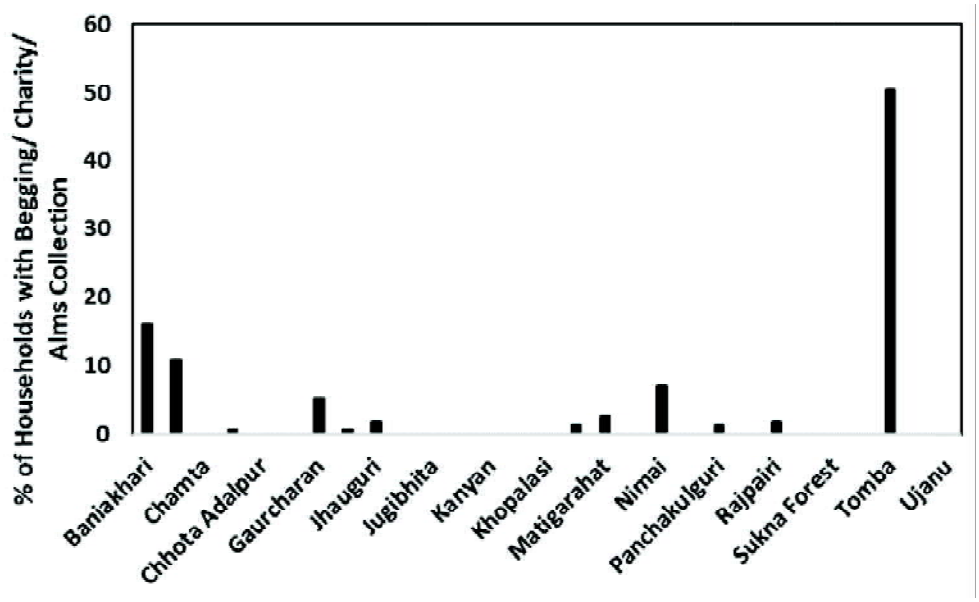

Fig. 11: Spatial variation of households with begging or charity or alms collection (%) under the villages of the Chamta basin extracted from the latest Socio-Economic and Caste Census of 2011

one member is able to earn more than thousand rupees per month (Fig. 9). But mostly they are the people who come here in these villages from outside and settled themselves in newly built-up area. It does not represent the sustainable development of local resource-based economy.

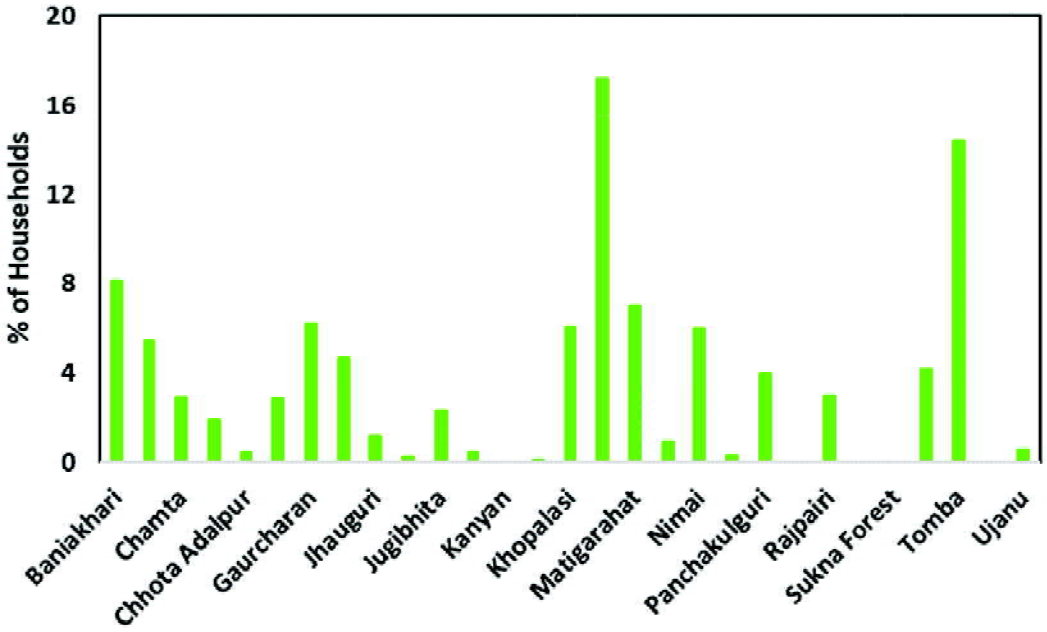

Fig. 12: Spatial variation of households (%) under the villages in the Chamta basin extracted from the latest Socio-Economic and Caste Census of 2011

Economic prosperity of the villages under the Chamta basin now is not at all associated with the traditional agricultural prosperity. Villages with higher percentage of recorded cultivators or area under irrigation are now suffering due to economic instability. Regular uncontrolled human interventions trigger the change in the hydrological and geomorphological characteristics of the Chamta river. The flow bearing silt was the back-bone of local economy which provided assured job in form of cultivator or even in form of brick-field worker in modified economic transformation. But the decay of the Chamta channel discharge and deposited silt layer through the unscientific utilization caused a permanent damage of locally available natural resource collapse the back-bone of endogenous economy of Chamta basin.

Conclusion

There has been a perceptible change of the status of local economy of the people living within the confines of the Chamta basin. This is positively related and directly proportional to the rate of change of land use and land cover. The village based primary activities were the main stay of the local economy almost till the 70s of the last centuries. There was gradual shift in land

	A	B	C	D	E	F	G	H
A	1							
B	0.38	1						
C	0.35	0.49	1					
D	0.33	0.53	0.99	1				
E	0.17	0.41	0.63	0.65	1			
F	0.34	0.50	0.97	0.97	0.64	1		
G	0.36	0.73	0.47	0.48	0.47	0.54	1	
H	0.29	0.54	0.91	0.94	0.78	0.95	0.61	1

A Total irrigated land (%)

B Cultivator (%)

C Landless households deriving major part of their income from manual casual labour (%)

D Deprived household (%)

E Households with any member earning more than Rs. 10,000 per month (%)

F Manual casual labour (%)

G Begging/Charity/ Alms collection (%)

H House Ownership (%)

Fig. 13: Correlation among the socio-economic parameters of buffer villages along Chamta channel

use from intensive firming centric uses to plantation-based uses of land for tea garden. This is a shift from a rudimentary purely endogenic local economy to a modified endogenic commercial economy due to advent of tea plantations in the piedmont areas of the Darjiling hills. The flood-plains of the Balasan, Mechi, Mahananda (Chamta basin being a part of the Mahananda system under Darjiling Terai) testify this modification in land use. Gradually service sectors coupled with brick kilns emerged having their respective influence on the pattern of local employment of people. The local unskilled labours are gradually becoming jobless as they find hardly any work in these economic sectors. They are compelled to go outside of their villages to earn a livelihood. A handful of these people have found employment in a few factories and cold-storages (Moti brick field (now Bhabi-Ma flour mill), B.P. Brick factory (partly the land now used for milk factory) that have come up at the sites of those abandoned brick-fields. Thus, the changing pattern of local economy, changing nature of land use and change in channel discharge-sediment flux in Chamta channel are closely associated.

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