A Study on Riverbank Conservation Works: Evidences from Sindhuli District Nepal





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Executive Summary

The study on riverbank conservation works was undertaken to know about status of riverbank's bio-diversity in Kamala and Chandaha river, to identify major challenges encountered during riverbank conservation works and study about remarkable changes occurred before and after riverbank conservation in 8 VDCs of Sindhuli distrcit namely Ranibas, Belghari, Bhimsthan, Nipane, Harshahi, Sirthauli, Dudhauli and Tandi and 1 municipality (Kamalamai municipality). The study was conducted by interaction with key informants and focus group of respective VDC which included 10 focus groups comprising 153 participants.

Study identified that 5043 households were affected, 3005 directly and 2038 indirectly. About 2940 hectare of total land was eroded by riverbank erosion during floods in Kamala and Chandaha river. The riverbank conservation initiated by Parivartan has succeeded to conserve about 2002 ha of land in which about 524 ha of land was used for cultivation of cereals like - rice, maize and wheat benefiting 3659 households directly and 2360 households indirectly.

The riverbank species was identified from quadrant where minimum of 22 species of grass and a maximum of 39 were found. Native grasses like kans (Saccharum spontaneum), Banso (Digitaria spp) and Siru (Imperata cylindricalare) were dominant on riverbank which were said to be restablished after conservation.

Study identified various challenges faced by the communities during conservation. The release of cattle on riverbank, burning of grazing land, quarrel between middle class and landless people and cutting grass illegally were the main.

The major remarkable changes occurred after conservation were decrease of river width preventing heavy land loss during flood, increase of land value from 40000 to 150000 per kattha, increase in availability of fodder, easy access of fodder from riverbank, improved stamina of cattle, conversion of barren land into greenery, control of the blow of sand and dirt and generation of income from grasses i.e. in 5 years, Sirthauli VDC earned Rs. 32000 from grasses, in Dudhauli, Rs. 150 per household per year and Rs. 155000 from sissoo.

1. Background

Parivartan Nepal is a non-governmental organization which has been working with farmers to enhance their livelihoods by focusing on agro-biodiversity conservation and its utilization. The organization had first started the riverbank conservation activity along the Kamala river of Sindhuli district as rehabilitation of devastating flood of 1993 at Hatpate. But it was implemented at large scale from the year 2000. The working area of Parivartan is in six VDCs of Kamala belt of Sindhuli, 7VDCs of Makawanpur and 6 VDCs of Sarlahi district.

The agro-ecosystem of Nepal is vulnerable to land degradation because of steep slopes, heavy rainfall and changing land use practice which has threatened livelihoods, agriculture and agrobiodiversity. The steep slopes especially in Siwalik range of East Central Nepal is often susceptible to landslides and floods. The high intensity of rainfall during monsoon season wash away the farmland near riverbank, ruin the crop and increase the width of river.

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Year	Human	Human	Families	Livestock	Houses	Loss of	Loss of	
(A.D)	death	injured	affected	killed	destroyed	Ag.land	properties	
					-	(ha)	(Million	
							rupees)	
1999	113	91	8844	NA	3507	17732	3.60	
2000	173	100	15617	822	5417	888.90	932.10	

Table 1.1. Loss and damage from floods, landslides and avalanches in Nepal (1999-2000)

Source: Nepal Government, Ministry of Home (2000)

About 173 people died with millions of financial loss from flood and landslide in 2000 in Nepal. The devastating flood in Terai region of Nepal in July 1993 took life of 1336 people and left 487534 people homeless (Pokhrel, L. 2002). About 540 mm of rainfall in 24 hours has been recorded in Siwalik region in 1993 during monsoon period which caused devastating flood resulting in damage of infrastructure and loss of human life. This incidence brought the concentration of Parivartan to work towards land rehabilitation in East Central Nepal.

The traditional agriculture of Nepal was eco-friendly which included the use of various landraces of crops and vegetables. But the introduction of hybrid varieties of crops like maize, wheat and rice in East Central Nepal has led to excessive use of chemical fertilizers and pesticides which has ultimately resulted in land degradation. Animal husbandry is a part of Nepalese farming system. The grazing of animals along the riverbank has been common practice which has resulted

in damage of vegetative cover and native plant. Moreover, the increase in width of river channel leading to heavy loss of human and soil during monsoon is the impact from free grazing along the riverbank. Sindhuli district is one of the hazard prone areas in Central Nepal. A timeline of disaster in district is given below (Table 1.2)

S.No.	Year (A.D)	Disasters
1	1902	Flood, Landslide
2	1933	Earthquake
3	1954	Flood,Locust
4	1961	Locust
5	1966	Flood, Landslide
6	1970	Drought, Famine
7	1972	Flood, Landslide
8	1981	Flood, Landslide
9	1984	Flood, Landslide
10	1988	Earthquake
11	1993	Flood, Landslide
12	2004	Flood, Landslide
Source: Dictric	t Dovelanment Committee Sindh	

Table1.2.Timeline of various disasters in Sindhuli district

Source: District Development Committee, Sindhuli (2004)

The biggest flood in Sindhuli was occurred in 1984 which took life of more than 155 people. Altogether 48VDCs including municipality were affected by floods and landslides in 2001 and 2002 in Sindhuli district. With a view to improve the livelihood and environment, Parivartan had initiated the riverbank conservation work in Sindhuli district. Riverbank stabilization, community forestry and organic agriculture are the activities launched by Parivartan to minimize the impact of land degradation.

1.1. Objectives

The overall objective of the study is to gather information about riverbank conservation works. The specific objectives were as follows:

- 1. To study about status of riverbank's bio-diversity.
- 2. To identify major challenges encountered during riverbank conservation works.
- 3. To study about remarkable changes occurred before and after riverbank conservation.

1.2. Scope and limitation of the study

The study helps to access the impact of riverbank conversation work and provide guidelines for the project for future plans and programs in the area. The study was limited to the area of Sindhuli district. Hence, the generalizations made out of the study should be interpreted with care and caution.

2. Methodology

Altogether 8 VDCs namely Ranibas, Belghari, Bhimsthan, Nipane, Harshahi, Sirthauli, Dudhauli and Tandi and 1 municipality (Kamalamai municipality) were taken for the study. The study was conducted by detail interaction with key informants and focus group of respective VDC. Altogether 10 focus groups were taken. A semi-structured questionnaire was used. The information regarding number of household and area of land affected by riverbank erosion, area under conservation and rehabilitated, directly and indirectly benefited household, major crops cultivated, date of conservation, major challenges faced during riverbank conservation works and changes occurred before and after riverbank conservation were gathered. In order to study the status of riverbank's bio-diversity, transect walk was performed. The key informants, few staffs of Parivartan and few members of conservation committee were involved in transect walk. The walk was performed inside the conserved area and name of plant species was noted. The riverbank was divided into three parts (2 edges and central) and the name and type of plant species and their common uses was recorded. The density of biomass of riverbank was calculated from 1 m² quadrant. The biomass was measured from various points at regular interval and average was taken.



Fig.2.1Map of Nepal showing Sindhuli district



Fig.2.2 Map of Sindhuli showing working areas of Parivartan Nepal

3. Result and discussion

3.1. Socio-economic characteristics of focus group participants

The caste of the participants is categorized into Brahmin/Chhetri, Dalit and Janajati (Appendix1). Altogether, there were 153 participants in the study. Among them, 76% were male followed by female (24%). Brahmin/Chhetri were dominant which comprised about 66% followed by Janajati (29%) and Dalit (5%). Majority (46%) of participants were more than 45 years of age i.e. old aged. It can be said that the old aged participants can describe the event of flood long years back.

The educational level was categorized as primary, secondary, college and university (Appendix 2). About 50% of participants in the study site had received education up to grade 5 followed by secondary level (26%), college level (11%) and university level (10%). Agriculture, service and business were major occupation of participants (Appendix 2). Majority (76%) of participants were engaged in agriculture followed by service (14%).

3.2. Conservation Committee

Kamala and Chandaha were two main rivers in Sindhuli district. The riverbank conservation activity was conducted through conservation committee in different VDCs as presented below in Table 3.1.

Name of VDC/	Ward covered	Name of	Name of the Committee	Number of member		Total Member
Municipality		nvei		Men	Women	MEITIDEI
Ranibas	1,2,3	Kamala	Charicharan Samrakchan Samiti	6	5	11
Ranibas	4,5	Kamala	Gadatantrik Yuba Club	31	-	31
Kamalamai (Dobhan)	18	Kamala & Chandaha	Triveni Jaibik Bibhidhita Tatha Ban Samrakchan Samiti	9	4	13
Belghari	1,2,3,9	Chandaha	Chandaha Khola Nadi			
Bhimsthan	1,2,3,4, 5	Chandaha	Niyantran Charicharan Samrakchan Samiti	10	3	13
Nipane	6,5	Kamala	Panchadhara Samudayik Ban Upabhokta Samiti	6	7	13
Harshahi	1,2,3,4,5,6,7,8,9	Kamala	Charicharan Samrakchan	8	3	11

Table3.1. Details of Conservation Committee by VDC

Name of VDC/	Ward covered	Name of	Name of the Committee	Number of member		Total Member
Municipality		IIVEI		Men	Women	MEILIDEI
			Chhetra			
Sirthauli	9	Kamala	Mahila Bachat Samuha+Kuluwa Khola Jal Upabhokta Samiti	-	36	36
Dudhauli	2	Kamala	Biruwa Samrakchan Samiti	11	-	11
Dudhauli	6,7,8	Kamala	Kamala Nadi Niyantran Ko lagi Charicharan Samrakchan Samiti	2	19	21
Tandi	1,7	Kamala	Pachani Pancha Kanya Samrakchan Samiti	5	4	9
	88(52.07)	81(47.93)	169(100)			

Figures in parentheses indicate percentage

The conservation committee had been formed which conducted regular meeting to discuss about problems and successes. Committee members set up mechanisms for implementation. Altogether there were 10 conservation committees operating in 8 VDCs and one municipality. Altogether there were 169 members. The highest percentage share was of male (52%) members followed by female (48%) members in the conservation committee. Two VDCs namely Belghari and Bhimsthan worked jointly through single committee i.e. Chandaha Khola Nadi Niyantran Charicharan Samrakchan Samiti. The conservation activity was done from Samudayik Ban Upabhokta Samiti in case of Nipane and in Sirthauli through joint collaboration of Mahila Bachat Samuha and Kuluwa Khola Jal Upabhokta Samiti.

3.3. Land affected by riverbank erosion

The riverbank erosion in the rivers affected household and land. The households were categorized into directly affected in terms of loss of land, crops, house etc. and indirectly affected households. Indirectly affected households were those who were affected by blowing sand in their house, loss of agro-biodiversity etc. The details have been shown clearly in Table3.2.

		ЦЦс	ШЦс	Total cultivable la		
Name of VDC/Municipality	Name of river	affected directly	affected indirectly	Private land with certificate	Private land without certificate	Total public land eroded (ha)
Ranibas-1,2,3	Kamala	150	234	46.67	6.67	100
Ranibas-4,5	Kamala	250	30	66.66	100	33.33
Kamalamai-18 (Dobhan)	Kamala & Chandaha	35	165	13.33	20	20
Belghari-1,2,3,9	Chandaha	290	405	53.32	63.32	23.33
Bhimsthan- 1,2,3,4,5	Chandaha	800	50	133.33	133.33	-
Nipane-6,5	Kamala	35	104	36.66	20	6
Harshahi- 1, 2, 3, 4,5,6,7,8,9	Kamala	700	300	666.66	466.66	400
Sirthauli-9	Kamala	300	50	133.33	-	13.33
Dudhauli- 2,6,7,8	Kamala	230	700	43.33	43.33	266.66
Tandi-1,7	Kamala	215	-	20	10	-
Total		3005 (59.59)	2038 (40.41)	1213.29 (58.43)	863.31 (41.57)	862.65

Table3.2. Distribution of household and land affected by riverbank erosion

Figures in parentheses indicate percentage

In total, 5043 households were affected, 3005 directly and 2038 indirectly. About 2940 hectare of total land was eroded by riverbank erosion in Kamala and Chandaha river during various floods. Among them 71% of land were cultivable land which was privately owned by the affected households. Only 29% of total land were public land eroded which included forest, grazing land etc.

3.4. Land after riverbank conservation

In order to minimize flood and its impacts, Parivartan initiated riverbank conservation programme in collaboration with farming communities. The programme was first started in 3

V.D.Cs namely Harshahi, Dudhauli and Tandi. A series of woven bamboo and reed baskets set were distributed which was filled with local stone. These structures were supposed to act as catchments for soil and leaf fall at the time of flood. The organization encouraged to plant saplings of fodder, forage and fruit trees along riverbank and as a result 400000 saplings had been planted in Sindhuli district since 2001. The main logic behind the programme was if open grazing is stopped on riverbank, the plants like kas, khayer, sissoo grow naturally which helps in binding the soil along riverbank and minimize losses during flood. They are more effective than metal-net.

Name of VDC/Municipality	Name of river	Total area under conservati on (ha)	Total area rehabilitated (ha)	HHs HHs Major directly indirectly crops benefited benefited cultivated		Date of conservation start (A.D)	
Ranibas-1,2,3	Kamala	200	53.33	150	234	Rice, Wheat, Maize	2004/05
Ranibas-4,5	Kamala	200	23.33	35	300	Rice, Wheat, Maize	2004/05
Kamalamai-18 (Dobhan)	Kamala & Chandaha	73.33	-	165	500	-	2008/09
Belghari-1,2,3,9	Chandaha	200.66	-	320	410	-	2008/09
Bhimsthan- 1,2,3,4,5	Chandaha	333.33	133.33	100	1000	Rice, Maize, Banana	2008/09
Nipane-6,5	Kamala	366.66	6.66	90	200	Rice	2004/05
Harshahi- 1,2,3,4,5,6,7,8,9	Kamala	333.33	266.66	400	300	Rice, Wheat, Maize	2001/02
Sirthauli-9	Kamala	21.33	14.33	300	50	Rice, Wheat, Maize	2002/03
Dudhauli-2,6,7,8	Kamala	240	-	700	450	-	2001/02
Tandi-1,7	Kamala	33.33	26.66	100	215	Rice, Wheat, Maize	2001/02
Total		2001.97	524.30	2360	3659		

Table 3.3. Distribution of land after riverbank conservation

Under this program about 2002 ha of land was under conservation. Within that area, about 524 ha of land was under cultivation for food production. Rice, Maize and Wheat were major crops cultivated by the households. There were 3659 households under directly benefited followed by indirectly benefited households (2360).

3.5. Status of riverbank's bio-diversity

The riverbank was covered by various types of plant species (Appendix 3). There were 72 plant species found in riverbank.

Table 3.4. Distribution of bio-diversity on riverbank

Name of VDC/Municipality	Name of river	Density of bio-mass	
		(ton/ha)	
Ranibas-1,2,3	Kamala	31.03	
Kamalamai municipality-18 (Dobhan)	Kamala and Chandaha	32.25	
Nipane-6,5	Kamala	15.71	
Dhudauli-2,6,7,8	Kamala	17.5	

Source:Field measurement

In each quadrant made to assess biodiversity, a minimum of 22 species of grass and a maximum of 39 have been found. Native grasses like kans (Saccharum spontaneum), Banso (Digitaria spp) and Siru (Imperata cylindricalare) were dominant on riverbank which were restablished after conservation work. They were used for fodder and medicinal purpose. The roots of Siru is said to be medicine for worms. The density of biomass included only biomass of grasses. The biomass of tree was not measured because of inconvenience from destructive method.

3.6. Major challenges encountered during riverbank conservation works

Communities faced several challenges during implementation of conservation works which were tackled simultaneously. The details have been shown in Table 3.5.

Name of VDC/ Municipality	Name of river	Major challenges	Activities addressed
Ranibas-1,2,3	Kamala	Complained to police station	Negotiation between two opponents

Table 3.5. Major Challenges encountered during riverbank conservation works

Name of VDC/ Municipality	Name of river	Major challenges	Activities addressed
		Cattle were left free on riverbank for grazing	Charged fine for cattle
		Burned the conserved grazing land	Charged fine
		Burned the conserved grazing land	Controlled fire by offering money
Ranibas-4,5	Kamala	Cattle were left free on riverbank for grazing	Stopped by convincing
Kamalamai municipality-	Kamala and	Quarrel between middle class and landless people	Started fodder plantation program, each household was given 100*9 m ^{^2} land for plantation
18 (Dobhan)	Chandana	Cattle were left free on riverbank for grazing	Charged fine (Rs.200 per cattle)
Belghari- 1,2,3,9		Cattle were left free on riverbank for grazing	Cattle were caught and kept in a house
	Chandaha		Cattle were chased from grazing land with the help of police
		Cut grass illegally	Charged fine (Rs.50 per bhari)
		Ploughed on conserved land	Demarcation made between land for ploughing and land not for ploughing
Bhimsthan- 1,2,3,4,5	Chandaha	Cattle were left free on riverbank for grazing	Charged fine (Rs.100 per cattle)
		Cut grass illegally	Charged fine (Rs.50 per bhari)
Nipane-6,5	Kamala	Cattle were left free on riverbank for grazing	Cattle were caught and kept in a house
llarahahi 1	Kamala	Cottle were left free on riverbank for	Charged fine (RS.50 per Callie)
2,3,4,5,6,7,8,9	Nailiaia	grazing	Rs.25 per cow, Rs.15 per goat)
		Cut grass illegally	Charged fine (Rs.20 per bhari)
Sirthauli-9	Kamala	Cattle were left free on riverbank for grazing	Charged fine (Rs.50 per buffalo, Rs.25 per cow, Rs.10 per goat)
Dudhauli- 2,6,7,8	Kamala	Cattle were left free on riverbank for grazing	Charged fine (Rs.1051 per cattle)
Tandi-1,7	Kamala	Argued that grazing land should be open	Charged fine per decision of committee

The release of cattle on riverbank, burning of grazing land, quarrel between middle class and landless people and cutting grass illegally were main challenges. These problems were solved by charging fines for cattle and grass, controlled fire by offering money and separated land for each household for fodder plantation. There was also the involvement of police to settle the problem.

3.7. Remarkable changes occurred before and after riverbank conservation

Communities with riverbanks in the process of rehabilitation have experienced several changes which are shown in Table3.6.

Name of VDC/ Municipality	Areas of change	Before riverbank conservation	After riverbank conservation
	River	Large river	Decrease width of river
Ranibas-1,2,3	Cultivable land	No cultivable land	Formation of cultivable land (started cultivation of crops)
	Fodder	Scarce fodder	High availability of fodder
	Land value	Rs.40,000 per Kattha	Rs.1,50,000 per kattha
Ranibas-4,5	Sand	Large amount of sand in house	Less amount of sand in house
Kamalamai 18 (Dobhan)	Cattle	Poor stamina of cattle	Strong stamina of cattle
	Death of villagers	High incidence of death of villagers from slopes while cutting grass	Decrease incidence of death of villagers as grasses are available on riverbank
	Health of villagers	Affected from sand on riverbank	Healthy villagers as sand and dirt were less
	Time	Time consuming to get grass as villagers had to travel long distance	Time saved as grasses are found near to their house (able to eat food in time)
Belghari-	River	Large river	Decrease width of river (less land damage)
1,2,3,9	Grass	Less grass for cattle	Increase availability of grass
	Vegetation	Less vegetation	Increase vegetation

Table3.6. Remarkable changes occurred before and after riverbank conservation

Name of VDC/ Municipality	Areas of change	Before riverbank conservation	After riverbank conservation		
	Sand	Large amount of sand in house	Less amount of sand in house		
	Greenery	No greenery	Establishment of greenery		
	Land	Loss of land	Addition of land		
Bhimsthan-	River	Large river	Decrease width of river (less land damage)		
1,2,3,4,5	Grass	Less grass for cattle	Increase availability of grass		
Nipane-6,5	Grass	Less grass for cattle	Increase availability of grass		
Harshahi-1, 2,	Grass	Less grass for cattle	Increase availability of grass		
3,4,5,6,7,8,9	Greenery	No greenery	Establishment of greenery		
Sirthauli-9	Grass	No sell of grass	Income from grass (Rs.32000 in 5 years)		
Dudhauli-	Grass	No sell of grass	Income from grass (Rs.150 per HH per year)		
2,6,7,8	Sissoo	No sell of sissoo	Income from grass (Rs.155000)		
Tandi-1,7	River	Large river	Decrease width of river (less land damage)		

The width of river has been decreased which has prevented heavy land loss during flood. The accumulation of organic matter on riverbank has resulted in formation of fertile land which were suitable for cultivation of crops like-Rice, Maize and Wheat. Because of this, land value has increased from 40000 to 150000 per kattha. There has been increase in availability of fooder. The members of the community used to collect grass from sloppy land which was quite risky. Some of them lost their life also. As there is easy access of fodder from riverbank, they need not to go to such slopy land and ultimately, incidence of death has been decreased. Moreover, the stamina of cattle was also improved since they were monitored closely via stall feeding. The barren land has been converted to greenery, full of vegetation. Because of this, the blow of sand and dirt was controlled around the periphery of riverbank. Communities generated income by selling grasses. In 5 years, Sirthauli VDC earned Rs. 32000 from grasses, in Dudhauli, Rs. 150 per household per year and Rs. 155000 from sissoo.

Conclusion

- Conservation committee acted as a bridge between Parivartan and community for implementation of riverbank conservation activity.
- The programme launched by Parivartan succeeded to conserve about 2002 ha of land in Sindhuli district, benefiting 3659 households directly and 2360 households indirectly.
- There has been remarkable contribution in conservation of biodiversity. About 72 plant species has been recorded. Native grasses like kans, Banso and Siru were reestablished on riverbank after conservation.
- The main challenges encountered during riverbank conservation work were- the release of cattle on riverbank, burning of grazing land, quarrel between middle class and landless people and cutting grass. But community succeeded to solve by charging fines for cattle and grass, controlled fire by offering money and separated land for each household for fodder plantation.
- The major achievements of riverbank conservation work were decrease of width of river, formation of fertile land, increase of land value, increase in availability of fodder, decrease of incidence of death of community from sloppy land, improved stamina of cattle via stall feeding, conversion of barren land to greenery, control of blow of sand and dirt, generation of income from grasses.

Case study

Riverbank conservation, initiation for sustainability

The flow of Kamala & Chandaha river was wild during floods on years-1981, 1984, 1993 and 1994. Immediately after the disaster, different non-governmental organizations and the district line agencies distributed metal nets for flood control. Since, it was too late, it became meaningless.

Then Parivartan Nepal initiated riverbank conservation work in the site. It increased awareness to stop open grazing and distributed seedlings of fodder and forage. Community thought that they had to follow the program if they would achieve success. The land around the periphery of river used to be sold long year back. With the increment of width of river and its damage during flood, buying and selling of land had been stopped. There was sharp decline in value of land as compared to its previous value. As a outcome of conservation work, native grass like *kans* was seen along the riverbank. Land became more fertile which ultimately increased the value of land. The river seemed to be controlled. There is possibility to bring the river back before 1981 in the long run of the implementation of program. The riverbank conservation had to be launched in both sides of river. Previously, river was so narrow that it could be crossed even by few steps. The width of river is not less than 500 m. Because of large width of river, construction of bridge and other developmental works have become difficult in the site.

"Chimeki ward lai pani sabailai jankari garayera yesto karyakram garna sakera safal banauna sakyau bhane hamro bhavisya ujwal huncha jasto lagcha (By informing our neighbour ward if we become success by launching the programme then our future will be bright "-Pawan Bhattarai, a member of Triveni Jaibik Bibhidhita Tatha Ban Samrakchan Samiti, Kamalamai municipality-18)

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Appendices:

	Gei	nder		Caste	;			Age	
Name of VDC/Municipality	М	F	BC	Dalit	Janajati	less than 25	25-35	35-45	more than 45
Ranibas-1,2,3	10	5	14	-	1	-	1	2	12
Ranibas-4,5	5	4	7	-	2	2	2	2	3
Kamalamai -18	23	3	25	-	1	2	5	13	6
Belghari-1,2,3,9	22	1	18	1	4	-	-	11	12
Bhimsthan-1,2,3,4,5	7	3	5	-	5	-	1	6	3
Nipane-6,5	16	3	16	-	3	4	3	1	11
Harshahi- 1,2,3,4,5,6,7,8,9	15	4	7	-	12	-	3	7	9
Sirthauli-9	4	4	2	2	4	-	-	5	3
Dudhauli-2,6,7,8	6	5	6	-	5	-	2	3	6
Tandi-1,7	8	5	1	5	7	-	3	4	6
Total	116	37	101	8	44	8	20	54	71

Appendix 1.Gender, caste and age of focus group participants by VDC

Note:M=Male, F=Female

BC=Brahmin/Chhetri

Source: Focus group discussion

Appendix 2. Educational le	el and occupation of focus	group participants by VDC
reportant El Eddoddorlario		group participarite by the c

Name of		Educational level Occupa					ion		
VDC/Municipality	Illiterate	primary	secondary	college	university	Agriculture	Service	Business	Other
Ranibas-1,2,3	-	6	9	-	-	11	4	-	-
Ranibas-4,5	-	5	2	2	-	7	1		1
Kamalamai -18	-	11	2	6	7	21	4	1	
Belghari-1,2,3,9	-	9	10	3	1	19	4	-	-
Bhimsthan-1,2,3,4,5	-	2	5	2	1	6	4	-	-
Nipane-6,5	-	10	4	-	5	16	-	-	3
Harshahi-1, 2, 3, 4, 5,									
6, 7, 8, 9	-	12	3	2	2	12	3	-	4
Sirthauli-9	-	6	2	-	-	7	-	1	-
Dudhauli-2,6,7,8	-	8	1	2	-	9	2	-	-
Tandi-1,7	3	8	2	-	-	8	-	-	5
Total	3	77	40	17	16	116	22	2	13

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Name of VDC/Municipality	Name of plant species
Ranibas-1,2,3	Siru,Kas,Dubo, Godtapre, Banso, Andi, Ilame, Bhringaraj, Chesme jar, Mamarkhe, Leu, Khayer, Lajawanti,Tite jar Balujar,Masi jar,Sayapatri, Karaute jar, Charcharejar, Aiselu, Kamle,Rudilo
Kamalamai -18	Siru,Kas, Lajawanti,Dubo,Banso,Balu jar,Kuro,Mothe,Banmara,Khaniyo,Khasreto,Guava, Bhringaraj, Godtapre, Leu,Chesme jar, Gandhe, Khayer,Aak, Titepati,Pater,Sissoo, Chariamilo,Karam, Dude jar,Mango,Ipil,Khari,Simal,Bakaino, Musekharki, Sittho,Gahate,Taki,Nibaro
Nipane-6,5	Siru,Kas, Lajawanti,Dubo,Godtapre,Banso,Chariamilo,Dhaicha,Karaute jar,Mothe, Sittho,Salai jar, Furkekharki, Balu jar, Karkalo, Bhringaraj, Gandhe, Surke, Sunakhari,Dade jar,Guj, Sissoo, Lwange, Khayer, Tulsi, Ilame,Guava, Rudilo
Dudhauli-2,6,7,8	Siru,Kas, Balu jar, Khayer, Banso, Dude jar,Kuro,Babari,Lahare ghas,Titepati, Sissoo, Mothe, Banmara,Bhati, Lajawanti, Indreni lahara, Chariamilo,Simal,Dudilo,Charchare,Gittho, Aakhle,Rudilo,Siudi,Kauso,Bhogate,Jamun, Batulpate,Ipil,Napier,Dubo,Silame, Gideri ghas, Chesme jar, Totelo,Kamle, Gandhe, Mulapte, Foke,

Source: Field observation

Appendix 4. Classification of plant specie	Appendix	4. Classification	of plant species
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Type of plant species	Name of Plant species
Tree	Khayer, Khaniyo, Khasreto,Guava, Karam, Taki,Nibaro Mango,Ipil,Khari,Simal,Bakaino, Sissoo, Bhogate,Jamun,Napier, Gideri ghas,Totelo
Herb	Dubo, Godtapre, Andi, Ilame, Bhringaraj, Leu, Lajawanti, Balu jar,Masi jar, Sayapatri, Karaute jar, Charchare jar, Aiselu,Kuro,Banmara, Gandhe, Aak, Chariamilo,Dude jar,
	Dhaicha,Salai jar,Karkalo,Surke,Sunakhari,Dade jar,Lwange,Tulsi,Bhati,Dudilo,Aakhle,Siudi,Silame,Mulapate,Foke
Shrub	Siru,Kas, Banso,Mothe,Titepati, Rudilo,Kamle, Pater, Musekharki, Sittho, Furkekharki, Guj

Climber

Chesme jar,Mamarkhe,Gahate,Indreni lahara,Gittho,Kauso,Batulpate,Lahare ghas,

Source: Field observation

		Gender					
						Educational	
S.No.	Name of participant	Men	Women	Caste	Age	level	Occupation
1	Sitaram Bakhrel	\checkmark		Brahmin	63	S.L.C	Agriculture
2	Narayan Prasad Kattel	\checkmark		Brahmin	54	S.L.C	Teaching
3	Bhojraj Baral	\checkmark		Brahmin	60	S.L.C	Teaching
4	Badri Prasad Baral	\checkmark		Brahmin	48	S.L.C	Agriculture
5	Krishna Hari Pokhrel	\checkmark		Brahmin	72	S.L.C	Agriculture
6	Bishwa Raj Baral	\checkmark		Brahmin	63	S.L.C	Agriculture
7	Lila Maya Sapkota		\checkmark	Brahmin	49	Literate	Agriculture
8	Bhagwan Kumar Pokhrel	\checkmark		Brahmin	46	S.L.C	Teaching
9	Krishna Prasad Bakhrel	\checkmark		Brahmin	59	Literate	Agriculture
10	Gorkhali Majhi	\checkmark		Janajati	47	Literate	Agriculture
11	Devka Bakhrel		\checkmark	Brahmin	55	Literate	Agriculture
12	Sabitra Baral		\checkmark	Brahmin	30	Literate	Agriculture
13	Jhalak Devi Baral		\checkmark	Brahmin	40	Literate	Agriculture
14	Laxman Baral			Brahmin	42	S.L.C	Teaching
15	Binda Baral			Brahmin	48	S.L.C	Agriculture

Appendix 5. Focus group participants of Ranibas-1,2,3

Appendix 6. Focus group participants of Ranibas-4,5

		Gender				Educational	
S.No.	Name of participant	Men	Women	Caste	Age	level	Occupation
1	Jhalak Bahadur Raut			Chhetri	78	Literate	Agriculture
2	Kanta Dhami			Janajati	70	Literate	Agriculture
3	Tek Bahadur Raut			Chhetri	70	Literate	Agriculture
4	Ram Babu Dhami			Janajati	40	Literate	Agriculture
5	Reuti Karki		\checkmark	Chhetri	40	Literate	Agriculture
6	Sanjela Karki		\checkmark	Chhetri	18	11	Agriculture
7	Rajan Neupane			Brahmin	25	I.A	Service
8	Binita Neupane		\checkmark	Brahmin	26	8	Agriculture
9	Pavitra Neupane			Brahmin	15	8	Student

		Gender				Educational	
S.No.	Name of participant	Men	Women	Caste	Age	level	Occupation
1	Saraswati Khadka		\checkmark	Chhetri	38	S.L.C	Agriculture
2	Talak Bahadur Khadka	\checkmark		Chhetri	55	Literate	Agriculture
3	Khem Bahadur Karki	\checkmark		Chhetri	40	S.L.C	Service
4	Jibnath Baral	\checkmark		Brahmin	40	I.A	Agriculture
5	Ganesh Bahadur Karki	\checkmark		Chhetri	49	Literate	Agriculture
6	Surya Paudel	\checkmark		Brahmin	31	Literate	Agriculture
7	Partha Bikram Chauhan	\checkmark		Brahmin	33	Literate	Agriculture
8	Purna Bahadur Karki	\checkmark		Chhetri	41	Literate	Agriculture
9	Ramji Baral	\checkmark		Chhetri	49	Literate	Agriculture
10	Saradsi Khanal	\checkmark		Chhetri	25	Literate	Agriculture
11	Sher Bahadur Thapa	\checkmark		Chhetri	40	Literate	Agriculture
12	Uddab Neupane	\checkmark		Brahmin	37	10+2	Agriculture
13	Baikuntha Neupane	\checkmark		Brahmin	36	I.A	Agriculture
14	Santosh Paudel	\checkmark		Brahmin	29	I.A	Agriculture
15	Iswor Majhi	\checkmark		Janajati	39	Literate	Agriculture
16	Binod Koirala	\checkmark		Brahmin	30	B.A	Student
17	Chabi Raman Pahadi	\checkmark		Brahmin	43	Literate	Agriculture
18	Sabitra Pahadi		\checkmark	Chhetri	45	Literate	Agriculture
19	Hari Bahadur Bhandari	\checkmark		Chhetri	50	Literate	Agriculture
20	Gayatra Chauhan		\checkmark	Chhetri	35	Literate	Agriculture
21	Dipendra Kumar Thapa	\checkmark		Chhetri	32	B.A	Teaching
22	Pawan Prasad Bhattarai	\checkmark		Brahmin	39	I.A	Business
23	Hasta Bahadur Bohora	\checkmark		Chhetri	45	I.A	Teaching
24	Devi Bahadur Pathak			Chhetri	35	Literate	Agriculture
25	Indu Prakash Khadka	\checkmark		Chhetri	36	Literate	Agriculture
26	Upendra Chalise			Brahmin	23	B.Ed	Agriculture

Appendix 7. Focus group participants of Kamalamai -18

S.		Ger	nder	Casto	٨٩٥	Educational	Occupation
No.	Name of participant	Men	Women	Casie	Aye	level	Occupation
1	Prakash Paudel	\checkmark		Brahmin	25	B.A	Student
2	Dan Prasad Paudel	\checkmark		Brahmin	51	8	Agriculture
3	Lalu Dhami	\checkmark		Janajati	46	5	Agriculture
4	Krishna Bahadur Thapa	\checkmark		Chhetri	24	4	Agriculture
5	Arjun Giri	\checkmark		Chhetri	31	-	Agriculture
6	Jit Lal Adhikari	\checkmark		Janajati	41	B.A	Agriculture
7	Lal Bahadur Bogati	\checkmark		Chhetri	53	Literate	Agriculture
8	Shankar Barma	\checkmark		Chhetri	46	B.A,B.Ed	Agriculture
9	Ramesh Baral	\checkmark		Brahmin	21	B.Ed	Student
10	Dambar Bahadur Thapa	\checkmark		Chhetri	55	-	Agriculture
11	Buddhi Prasad Adhikari	\checkmark		Chhetri	48	-	Agriculture
12	Prem Bahadur Khadka	\checkmark		Chhetri	58	-	Agriculture
13	Gayatri Bogati		\checkmark	Chhetri	45	5	Agriculture
14	Rabia Adhikari Danuwar	\checkmark		Janajati	82	-	Student
15	Tikanath Bhurtel	\checkmark		Brahmin	22	B.A	Student
16	Maiya Khatri		\checkmark	Chhetri	20	-	Agriculture
17	Gita Ghimire			Brahmin	32	8	Agriculture
18	Padam Prasad Baral			Brahmin	47	8	Agriculture
19	Netra Prasad Kafle			Brahmin	55	S.L.C	Agriculture

Appendix 8. Focus group participants of Nipane-6,5

Appendix 9. Focus group participants of Dudhauli-2,6,7,8

S.	Name of participant	Gen	der	Caste	Age	Educational	Occupation
No.		Men	Women		J.	level	
1	Modnath Pahari	\checkmark		Brahmin	45	Literate	Agriculture
2	Bharat Kafle			Brahmin	50	Literate	Agriculture
3	Leknath Neupane	\checkmark		Brahmin	50	Literate	Agriculture
4	Pashupati Karki	\checkmark		Chhetri	40	Literate	Agriculture
5	Jyotika Gurung		\checkmark	Janajati	34	I.Ed	Agriculture
6	Shyam Prasad Adhikari			Janajati	40	10+2	Medical Clinic
7	Divya Dev Paudel	\checkmark		Brahmin	69	Literate	Agriculture
8	Gita Adhikari		\checkmark	Brahmin	31	Literate	Agriculture
9	Goma Gurung		\checkmark	Janajati	49	S.L.C	Service
10	Hari Maya Magar		\checkmark	Janajati	41	Literate	Agriculture
11	Nanda Kumari Gurung			Janajati	52	Literate	Agriculture

S.	Name of participant	Ge	ender	Casto	٨do	Educational	Occupation	
No.	Name of participant	Men	Women	Casie	Аус	level		
1	Khil Bahadur Sunuwar			Janajati	36	S.L.C	Agriculture	
2	Sudarsan Paudel	\checkmark		Chhetri	36	Below S.L.C	Agriculture	
3	Gore Bahadur Sunuwar	\checkmark		Janajati	56	Literate	Agriculture	
4	Khadi Maya Gurung		\checkmark	Janajati	39	Literate	Agriculture	
5	Khilka Sunuwar		\checkmark	Janajati	38	Literate	Agriculture	
6	Beli Maya Sunuwar		\checkmark	Janajati	35	Literate	Agriculture	
7	Ujir Bahadur Magar	\checkmark		Janajati	61	Literate	Business	
8	Padam Kumar Paudel			Chhetri	58	Literate	Agriculture	

Appendix 10. Focus group participants of Sirthauli-9

Appendix 11. Focus group participants of Harshahi-1,2,3,4,5,6,7,8,9

		Gender					
S.						Educational	
No.	Name of participant	Men	Women	Caste	Age	level	Occupation
1	Ram Autar Adhikari	\checkmark		Janajati	62	Literate	Politics
2	Sarup Lal Adhikari	\checkmark		Janajati	46	S.L.C	Agriculture
3	Samsher Bahadur Thapa	\checkmark		Janajati	60	Literate	Agriculture
4	Ram Bilash Adhikari	\checkmark		Janajati	53	Literate	Agriculture
5	Bishnu Kunwar	\checkmark		Janajati	36	Literate	Carpenter
6	Akash Ram Adhikari	\checkmark		Janajati	52	Literate	Agriculture
7	Ajit Lal Faneth	\checkmark		Janajati	41	Literate	Agriculture
8	Lok Maya Kafle		\checkmark	Brahmin	55	Literate	Agriculture
9	Bal Kumari Adhikari		\checkmark	Janajati	35	S.L.C	Teaching
10	Tankanath Dahal	\checkmark		Brahmin	45	Literate	Carpenter
11	Hari Prasad Dhungana	\checkmark		Brahmin	80	Literate	Agriculture
12	Yadu Prasad Kafle	\checkmark		Brahmin	35	Literate	Agriculture
13	Krishna Kumar Dhital	\checkmark		Brahmin	30	M.A	Service
14	Maheswar Karki	\checkmark		Chhetri	40	B.A	Agriculture
15	Dhanan Jaya Chaudhary	\checkmark		Janajati	36	S.L.C	Wage labour
16	Bijaya Adhikari	\checkmark		Janajati	30	I.A	Student
17	Raje Adhikari	\checkmark		Janajati	31	Literate	Agriculture
18	Chandika Dahal			Brahmin	35	Literate	Agriculture
19	Prem Bahadur Lama			Janajati	50	I.A	Teaching

S.	S. Name of participant		ender	Caste	Ane	Educational	Occupation
No.		Men	Women	Cusic	Age	level	Occupation
1	Ramji Adhikari			Chhetri	55	S.L.C	Agriculture
2	Bodh Raj Paudel			Brahmin	56	9	Agriculture
3	Nar Bahadur Khapangi			Janajati	40	8	Agriculture
4	Chandra Bahadur Khulal			Brahmin	42	5	Agriculture
5	Dor Prasad Ghimire			Brahmin	48	10+2	Teaching
6	Shankar Ghimire			Brahmin	58	10+2	Service
7	Uddab Ghimire			Brahmin	5 9	9	Agriculture
8	Bhim Prasad Ghimire			Brahmin	55	9	Agriculture
9	Sitaram Ghimire			Brahmin	65	Literate	Agriculture
10	Hira Bahadur Malla			Chhetri	55	Literate	Carpenter
11	Badri Prasad Paudel	\checkmark		Brahmin	41	I.A	Service
12	Devi Prasad Ghimire	\checkmark		Brahmin	42	M.A	Teaching
13	Kumar Bahadur Karki	\checkmark		Chhetri	41	6	Agriculture
14	Pursottam Adhikari			Chhetri	44	6	Agriculture
15	Bidur Ghimire			Chhetri	48	S.L.C	Agriculture
16	Umeswar Ghimire			Chhetri	44	S.L.C	Agriculture
17	Kumar Prasad Satyal			Brahmin	43	S.L.C	Agriculture
18	Dor Kumari Ghimire			Chhetri	43	Literate	Agriculture
19	Indra Bahadur Sinjali			Janajati	43	Literate	Agriculture
20	Man Bahadur Magar			Janajati	50	Literate	Agriculture
21	Kamal Prasad Dahal			Brahmin	43	Literate	Agriculture
22	Thal Bahadur Magar			Janajati	54	Literate	Agriculture
23	Mangal Singh B.K			Dalit	60	Literate	Agriculture

Appendix 12. Focus group participants of Belghari-1,2,3,9

Appendix 13. Focus group participants of Bhimsthan-1,2,3,4,5

S.	Name of participant	Gender				Educational	
No		Men	Women	Caste	Age	level	Occupation
1	Tek Bahadur Manandhar			Janajati	45	S.L.C	Agriculture
2	Nir Bahadur Shrestha			Janajati	45	S.L.C	Agriculture
3	Chandra Prasad Neupane			Brahmin	35	S.L.C	Service
4	Shambhu Prasad Pokhrel	\checkmark		Brahmin	40	10+2	Teaching
5	Jivan Kumari Pokhrel			Brahmin	35	B.A	Teaching
6	Ram Bahadur Roka			Chhetri	35	6	Agriculture
7	Kalyan Pokhrel	\checkmark		Brahmin	26	10+2	Agriculture
8	Durga Manandhar	\checkmark		Janajati	45	3	Agriculture
9	Sabitra Shrestha			Janajati	35	3	Agriculture

10 Basanti Shrestha $$	Janajati 35	8	Service
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		Gender					
S.						Educational	
No.	Name of participant	Men	Women	Caste	Age	level	Occupation
1	Krishna kumar	\checkmark		Janajati	48	Literate	Agriculture
2	Raj Man Dhami	\checkmark		Janajati	40	S.L.C	Agriculture
3	Dev Narayan Kumar			Janajati	41	10	Agriculture
4	Parmeshwar Dhami	\checkmark		Janajati	45	Literate	Agriculture
5	Budhi Lal Sada	\checkmark		Dalit	46	Literate	Wage labour
6	Kusum Sada		\checkmark	Dalit	45	Literate	Wage labour
7	Man Bahadur Dimali	\checkmark		Dalit	40	Literate	Wage labour
8	Pawani Kumar		\checkmark	Janajati	35	Literate	Agriculture
9	Jit Narayan Dhami	\checkmark		Janajati	38	Literate	Agriculture
10	Utim Bahadur Budathoki	\checkmark		Janajati	45	Literate	Agriculture
11	Sita B.K			Dalit	28	Illiterate	Wage labour
12	Lalo Sada			Dalit	26	Illiterate	Wage labour
13	Sitali Kumar			Janajati	36	Illiterate	Agriculture

Appendix 14. Focus group participants of Tandi-1,7

Appendix 15:Questionaire

Details of focus group participants

Name of VDC:

Name of river:

Name of the Conservation Committee:

Ward covered:

Date of discussion:

		Gender		. .			
S.No	D Name of participant	Men	Women	Caste	Age	Educatio nal level	Occupation

Details of riverbank conservation

Name of VDC:

Name of river:

Name of the Conservation Committee:

Ward covered:

Situation before riverbank conservation

Total area of cultivable land eroded by flood (ha):

- (a) Total private land with certificate (ha):
- (b) Total private land without certificate (ha):

Total public land eroded (forest, riverbank etc):

Number of HHs affected directly:

Number of HHs affected indirectly:

Date of conservation start (A.D):

Total area under conservation (ha):

Total area rehabilitated (ha):

Major crops cultivated:

Number of HHs directly benefited:

Number of HHs indirectly benefited:

Details of Conservation Committee:

Name of the Committee:

Total member:	Women:	Men:

Major problems, challenges and remarkable changes during riverbank conservation

Major challenges	Activities addressed

- 1. Name and address of the Conservation Committee:
- 2. Name of river:
- 3. What were the main problems and challenges during conservation?? What were the activities addressed to solve those??
- 4. What were the remarkable changes occured after riverbank conservation?? (community and individual level)

Appendix 16:Photographs



Discussion with focus group participant



Identifying plant species



Measuring biomass



Transcent walk



Gittho, used as food found from conserved forest



Forest guard