Original Article

Perception of Climate Change Vulnerability and its Impact on Sexual and Reproductive Health and Rights in Khutiya and Banganga River Basins

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ABSTRACT

Background: Nepal is one of the most vulnerable countries to climate change. The drivers of climate risk include its topography, ecological diversity, climatic variability, natural resource dependency, under-development, and socioeconomic vulnerabilities. Climate change affects women and girls in unique ways. Research conducted in Asia Pacific region highlight negative sexual and reproductive health outcomes from climate change-related stressors such as droughts, floods, and air pollution, factors also linked to decreased SRH services utilization, increased maternal mortality rates, and repercussions on women's mental health.

Methods: This is a mixed methods study conducted in two river basins including household surveys with 384 females ages 18-49, 12 focus group discussions, and 22 key informant interviews. We conducted descriptive and thematic analysis.

Results: More than half relied on agriculture for income (66%). Despite one-third being heads of households, land ownership was low (13%). Climate change perceptions included rising temperatures (88%), increased heat wave (70%), drying water source (99%), and delayed monsoons (83%), impacting agriculture and increasing women's workload (61%) due to displacement and male migration. 64% reported disturbances in antenatal and postnatal care visits . Inaccessible healthcare facilities during the rainy season increased maternal mortality risks. Heavy river flooding hindered female community health volunteers access leading to childbirth complications. 82% of women feared being unable to protect their children post-climate events. Moreover, 21% of women faced gender-based violence during or after climate disasters.

Conclusions: Our findings suggest clear impacts of climate change on women and the communities. Thus, climate adaptation efforts must be designed to address the unique impacts of the crisis on women and girls, making space for their increased participation and leadership.

Keywords: Climate change; gender based violence; malnutrition; migration; sexual and reproductive health and rights.

INTRODUCTION

Along with impacts on physical and mental health, the consequences of climate change for sexual and reproductive health and rights (SRHR) are becoming increasingly apparent across the globe.[1] Children, women and girls, pregnant women, the elderly, and people with disabilities are disproportionately impacted[2], causing increased mortality and morbidity.[3]

Women and girls face socioeconomic, health, political, infrastructural and communication challenges in the aftermath of climate-induced disasters.[4,5] Female survivors are more likely to face decreased life expectancy, mental health disorders, gender-based violence (GBV), and forced migration. Furthermore, they are more likely to be deprived of reproductive healthcare, leading to increased complications in childbirth.[6]

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Although the disproportionate impact of climate change on women and girls' health and socioeconomic well-being is well documented[7], the linkages between climate change, gender, and SRHR have received less attention, including in Nepal. This study aims to establish these linkages in climate vulnerable communities in Nepal.

METHODS

We aimed to identify the immediate and long-term impacts of climate change on women and girl's SRHR in two river basins in Nepal, focusing on the effects of rising temperature, changing precipitation patterns, and climate-induced disasters. We employed a cross-sectional, phenomenological study design using mixed methods. We purposively selected study sites in two river basins of the Chure range, the youngest mountain spreading from across eastern Illam to West Kanchanpur, which covers approximately 13% of Nepal's 37 districts. This included the Khutiya river basin in Kailali district and the Banganga river basin in Arghakhanchi and Kapilvastu districts. Both rivers flow from the Mahabharat range through Chure to the flat plains of Terai and are prone to climate induced disasters like flood and landslides. Communities inhabiting the study sites are mostly indigenous and marginalized people dependent on natural resources, with a total population of 4755. Data collection occurred in 2022 after receiving ethical approval from the Nepal Health Research Council (NHRC). To explore all potential impacts of climate change in the study sites, we included people living upstream, midstream, and downstream of each river basin.

We used the formula ($Z^2a*p*(1-p)$ / ME^2)[1] to compute the target sample size of 384 women and girls. Females were eligible to participate in the survey if they were 18-49 years old and a continuous resident of the study site for at least five years. Households were selected using systematic random sampling. All eligible women in each selected household were recruited. We conducted 12 focus group discussions (FGDs) of 8-10 women each and 22 key informant interviews (KIIs) based on saturation principles for qualitative sample size[8-10]. These participants were sampled purposively based on their experiences with climate change impacts. Six FGDs were conducted with women of reproductive age (15-49) and six were conducted with women above 50 age group to capture intergenerational experiences. We obtained informed written consent for all the participants. The interviews were recorded in Nepali and Tharu and then transcribed and translated into English. We conducted descriptive analysis of survey results using SPSS and a thematic analysis of interview transcripts using Excel. This research is one part of a bigger study and other content will follow in subsequent publications without duplication of data.

RESULTS

More than half of survey respondents belonged to age group greater than 30 years. The most common ethnic group was Hill Janjati (34%, Table 1). Two-thirds (66%) relied on agriculture for income. More than one third of the sampled population are heads of their household, however only 13% owned land. Half of the respondents (N=196, 51%) had a saving account in a formal institution and were associated with formal and informal saving groups (data not shown). Nearly all women (93%) were married. One in four respondents were associated with social and community groups like health mother's group, community forestry user's group, agriculture and livestock group, adolescent group, drinking water management committee, and others (data not shown).

Twenty-two key informants included five health personnel, six female community health volunteers (FCHV), four local government representatives (Ward chairpersons), and six community forestry user groups members. Focus group participants included fifty women and girls ages 15-49 and fifty-seven women ages 50 and above.

1 α = .05; p = .5 (for unknown prevalence); ME = 10% of p, i.e., 0.05

Table 1. Household survey participant characteristics by residence.

Participant characteristic		Name of river basin					
		Khutiya river basin (n=183)		Banganga river basin (n=201)		Both river basin (n=384)	
		N	%	N	%	N	%
Age	<30	69	37.7	89	44.3	158	41.1
	≥30	114	62.3	112	55.7	226	58.9
Education	Nonformal and illiterate	89	48.6	28	13.9	117	30.5
	Basic	67	36.6	106	52.7	173	45.1
	Secondary and higher	27	14.8	67	33.3	94	24.5
Ethnicity	Brahmin / Chhetri	16	8.7	59	29.4	75	19.5
	Hill Janjati	30	16.4	99	49.3	129	33.6
	Hill Dalit	41	22.4	33	16.4	74	19.3
	Tharu	96	52.5	10	5.0	106	27.6
Religion	Hindu	151	82.5	201	100.0	352	91.7
	Buddhist and Christian-	32	17.5	0.0	0.0	32	8.3
Head of household	Yes	77	42.1	80	39.8	157	40.9
	No	106	57.9	121	60.2	227	59.1
Occupation	Agriculture	168	91.8	85	42.3	253	65.9
	Others*	15	8.2	116	57.7	131	34.1
Marital status	Currently Married	170	92.9	189	94.0	359	93.5
	Unmarried or widowed	13	7.1	12	6.0	25	6.5
Land ownership	Yes	35	19.1	16	8.0	51	13.3
	No	148	80.9	185	92.0	333	86.7
Lives near a primary or outreach health clinic	Yes	35	19.1	55	27.4	90	23.4
	No	148	80.9	146	72.6	294	76.6

* Other occupations included homemaker, daily wage laborer, salaried job, business owner, etc.

Table 2 presents reported changes in local rainfall and temperature patterns. Among respondents, 88% had observed an increase in summer temperature and 53% observed decreasing winter temperature. Key informants explained:

“Summer heat waves and temperatures have increased since 2015, earthquake. Recently, four cases of dengue were also reported.” - KII, midstream, Banganga

"Because of increased temperature, we have observed mosquitoes for 7-8 years along with vector borne diseases with compulsory usage of mosquito net." - KII, upstream, Khutiya

Seventy percent had observed an increased heat wave compared to around 20-25 years ago. One informant described the impact:

"*The plant like banana dries and dies due to excessive heat and less rain during Baisakh and Jestha (pre monsoon season). Use of cooling devices like AC and cooler increased and even affected the fish farming. KII, downstream, Khutiya*

Perceptions of cold waves varied; 53% noted that cold waves have decreased, but more than two thirds of the respondents of Hill Janjati and upstream of Khutiya river basin witnessed an increase. FGD participants similarly described increasing cold waves upstream and decreasing cold waves downstream.

Most women (93%) in Khutiya basin reported that monsoon onset is not on time. Farmers used to depend upon the monsoon rain for agriculture, which was enough, but now they use a pump set to irrigate their land directly from the river. With erratic and variable rainfall patterns, crop production has decreased compared to 5-10 years ago.

"Rain does not fall during the monsoon season; Last year it occurred during the flowering season of paddy, causing all of the paddy to fall and get soaked in rainwater. The rain does not occur when needed in the month of Asadh/ Shrawan", KII, midstream, Banganga

Eighty three percent of the respondents said that the rainfall duration has also increased with no fixed season. Seventy eight percent women felt that intense rainfall occurs in short duration which brings flash floods in downstream and landslide in upstream and midstream.

"The winter rainfall does not occur. As winter rain is delaying, the timing for wheat harvesting is also changing", KII, upstream, Khutiya

Women have observed that water sources like springs and hand pumps are drying up due to decrease in rainfall. Eighty-six percent said that drought has increased, with impacts observed more acutely upstream.

Table 2. Observed changes in climate variables among survey respondents.

Observed temperature changes		Total survey respondents (N=384)		Observed rainfall changes		Total survey respondents (N=384)	
		N	%			N	%
Summer temperature	Increased	336	87.5	**Monsoon onset**	On time	10	2.6
	Decreased	16	4.2		Not on time	358	93.2
	No change	32	8.3		No change	16	4.2
Winter temperature	Increased	114	29.7	**Rainfall duration**	Increased	318	82.8
	Decreased	204	53.1		Decreased	38	9.9
	No change	66	17.2		Cannot say/ No change	28	7.3
Heat waves	Increased	268	69.8	**Rainfall intensity**	Short duration of heavy rainfall	301	78.4
	Decreased	51	13.3		Short duration of low rainfall	30	7.8
	No change	65	16.9		Long duration of heavy rainfall	51	13.3
Cold waves	Increased	118	30.7		Long duration of low rainfall	2	0.5
	Decreased	203	52.9	**Water availability**	Increased	122	31.8
	No change	63	16.4		Decreased	153	39.8
					No change	107	27.9
				Drought	Increasing	329	85.7
					Decreasing	41	10.7
					No change	14	3.6

Table 3 presents reported impacts of climate change. Ninety percent of women observed increases in new pest infestation in agricultural land. These pests are infecting major crops like paddy, maize, and mustard. Farmers are therefore compelled to harvest their paddy while it is still unripe.

"Due to the introduction of new types of insects in our agricultural land, we are compelled to use insecticides and pesticides to protect our crops which in turn is affecting our health" KII, midstream, Banganga

Similarly, 95% of the total population said that invasive species have been denser in both agricultural and forest land,

depleting the production of crops. Women explained various health impacts while manually removing the invasive species.

"The invasive grasses are now visible in our agricultural field. We need to uproot those grasses from our land which causes pain in the backs and knees, swollen legs, and skin allergies", FGD, downstream, Banganga

Table 3. Reported impacts of climate change in study sites.

Reported impacts of climate change		Total survey respondents (N=384)	
		N	%
Drought-related health impacts	Yes	315	82
	No	69	18
Experience with invasive species	Yes	375	97.7
	No	9	2.3
Decline in crop production due to invasive species	Yes	348	90.6
	No	36	9.4
Invasive species-related health impacts	Yes	203	61.5
	No	127	38.5
Change in pest infestations	Increase	343	89.3
	Decrease	19	4.9
	No change	16	4.2
	Cannot say	6	1.6
Pesticide use-related health impacts	Yes	118	66.3
	No	60	33.7
Increased food insecurity within household	Increased	215	56
	Decreased	30	7.8
	No change	139	36.2

Table 4 presents the impact of climate change on women's roles and work. Climate change-induced displacement leads to increased workload for community members, particularly women and girls. After climatic events, agricultural production is insufficient, and employment opportunities decrease. Forty-one percent women said that they are the head of their household (Table 1), responsible for everything inside and outside the house. Women's workload increases when their male family members migrate in search of income. Sixty one percent did extra work at home after a climatic event, such as caring for children and cattle as usual plus additional tasks like managing firewood (99%) and walking long distances to collect water (59%). Most women (93%) are also involved in manually removing invasive species. Women also reported increased household cleaning necessitated by river flooding doubled agricultural workload compared to other times.

Houses with only women, children and elderly people are also particularly vulnerable while evacuating during climate disasters. While running or crossing rivers, women must carry their children, unlike men who can run alone and are often not even present in the house at the time. Women must risk their lives to save children and food for their family. During monsoon season, women from downstream have the constant fear when the flood will come and wash their house, property, livestock, land, children, and themselves away.

Although women experience disproportionate impacts from climate change, their access and participation in climate action was limited. During relief distribution following climate disasters, only 38% women said they were involved in decision making while receiving support from local government and other stakeholders. Seventy-six percent of the respondents shared that it was difficult for them to receive external support. Qualitative data reflects that SRH services are deprioritized during times of disaster.

Table 4. Climate change impacts on women and girls.

Impacts of climate change on women and girls		Total survey respondents (N=384)	
		N	%
Employment opportunities (N=384)	Decreased	258	67.2
	Increased	37	9.6
Extra work at home (N=384)	Yes	234	60.9
	No	150	39.1
Among those with extra work at home- extra work for firewood collection (N=234)	Yes	231	98.7
	No	3	1.3
Among those with extra work at home- extra time for water collection (N=234)	Yes	139	59.4
	No	95	40.6
Involvement in risky work environment (N=384)	Increased	114	29.7
	Decreased	136	35.4
Violence faced (N=384)	Yes	81	21.1
	No	303	78.9
Fear of protection of children due to climatic events (N=384)	Yes	316	82.3
	No	60	15.6
	Not applicable	8	2.1

Table 5. Impacts on gender and SRHR from qualitative interviews.

Immediate impacts	Long term impacts	Illustrative quotes
Limited access to health services	Disturbance in regular antenatal and postnatal care (ANC/PNC) Deprived of vaccination Fear for protection of children Unintended pregnancy due to lack of contraception	*"During rainy season, as the condition of road was poor, one woman had to walk to health service during her labor time. She could not reach the hospital on time and unfortunately the outcome was still birth."-FGD* upstream, Khutiya. *"During the time of natural disaster, people didn't have access to health services, because of which they didn't have contraceptives to use which resulted in unintended pregnancy."-FGD* downstream, Khutiya. *"Couples don't want to have children during the time of calamities, but the risk of unwanted pregnancy is increased as both male and female stay at home."-FGD* downstream, Khutiya.
Displacement-internal and external migration	Increased workload Difficulties in decision making Low confidence and will power	*"More men go to foreign countries or city area to support the livelihood of their family."-FGD* Upstream, Khutiya. "*Because of the workload there are many cases of miscarriages in the community and women faces uterine prolapse."-KII*, midstream, Kailali. "*If our men were present during disaster time, then we would have less to worry, and our work could be divided."-FGD* downstream, Khutiya. "*When the river enters the house, our workload increases as we need to carry the floodwater outside the house; and as the river washes the field, we have to clear the sand from the paddy and uproot the grasses from the field."-FGD*, downstream, Khuitya.
	Decrease in food production due to invasive species Increased food insecurity Involvement in risky work environment Constant stress Health impacts	"*Production of crops was sufficient for selling purposes but now production has been reduced making it difficult for household use also*"-KII, Upstream, Khutiya. "*The grinding mill is on the other side of the village, so previously in case of flood, we could not even go to grind our grains and had to sleep empty stomach*"-FGD, downstream, Khutiya. "*One lady delivered when there was flood in the village and her house also drowned. Quickly she and the baby were transferred to a safe place. As the food and crops kept at home were soaked, she could not eat nutritious food for several days*"-FGD, downstream, Khutiya.
Gender based violence	Domestic, sexual, societal and financial violence	"*Some abusers see the natural calamities as the opportunity to do sexual harassment*."-KII, downstream, Khutiya. "*Conflict arises at home during flood when resources are limited which leads to disturbing environment within the house*."-FGD, midstream, Khutiya. "*In Dalit community, the new mother is not touched for 11 days (about 1 and a half weeks) by anyone which makes it more difficult during disaster*."-FGD, downstream, Khutiya.

Participants reported disturbances in regular antenatal and postnatal care (ANC/PNC). Interrupted access to healthcare was due in part to the geographical terrain and physical infrastructure along excessive rainfall, flood, and landslides. Sixty-four percent reported destruction of transportation infrastructure after climatic event (Table 3). During the rainy season, floods in Arghakhanchi and landslides in Kailali made it impossible to cross the river, even in a vehicle, preventing ANC check-ups. Due to poor infrastructure like road and bridges, women having labor pain had to be carried to the hospital on a stretcher, delaying timely healthcare and increasing risk of complications and death. Though 83% women indicated that it takes less than half an hour to reach to nearest female community health volunteer's home, heavy river flooding prevents FCHVs from reaching patients' houses. Road closures similarly cause cases of childbirth on the way to the birth center and increased incidence of maternal and neonatal mortality.

Eighty-two percent of women reported fear of being unable to protect their children after climate events (Table 4). FGD participants explained that they lose access to immunization for newborns during monsoon season. Decreased employment opportunities and

disaster-related restrictions on movement, men are increasingly staying idly at home. This phenomenon combined with low or interrupted contraceptive use results in more unintended pregnancies.

Changing precipitation patterns and resulting decreases in water availability (40%) (Table 2), increases in invasive species (98%) and pest attacks (89%) (Table 3), and declining crop production caused increased food scarcity. Floods, riverbank cutting, cold waves, and hailstorms are similarly limiting agricultural production. Because of the reduced food supply at home, 30% of women shared that they are involved in risky work environments like catching and carrying heavy woods swept by the flood (Table 4). Women must carry heavy loads of water, grasses and other materials and need to do all household activities while pregnant and after delivery. They are in constant stress on how to manage limited resources for the family. This food scarcity impacts children, pregnant women, and lactating mothers most. Adolescent girls are also impacted, deprived of nutritious food during their menstrual cycle.

One in five women (21%) faced gender-based violence at their home, another's home, in the forest, or while moving around during or after a climate induced disaster (Table 4). Climate disaster-induced resource scarcity causes conflicts within the home. There might be reproductive issues internally, but they are not noticed or shared. These coupled impacts are changing women's fertility preferences like delaying child bearing or limiting total children.

DISCUSSIONS

This is the first study in Nepal which helps to understand the interlinkages of climate change, gender and SRHR to our knowledge. Extreme weather conditions which include increased and decreased in temperature during summer and winter respectively and changes in the monsoon season is evident in Nepal. Similar climate patterns have been observed in other countries.[11-13] This study elucidates how women and girls are disproportionately affected by climate change. The adverse effects include landslides, floods, and riverbank cutting causing destruction to health facilities and disruption of sexual and reproductive health services, clearly pointing to the need for climate resilient infrastructure.

These findings parallel previous researchers' conclusions about SRH need post-disaster. A scoping study conducted by Stephens et al[14] found increases in sexually transmitted infections, risky sexual behavior, and low availability and uptake of contraceptive devices post-disaster, resulting in unintended pregnancies; they recommend that SRH services be made available post disaster. Husaini et al[15] similarly found increased cases of unsafe abortion due to unintended pregnancy and maternal death during delivery during crisis settings, recommending access to contraception and safe abortion services be made available during disasters. Thus, programs and interventions to enhance community understanding about the climate change and its effect on sexual and reproductive health of women at community level is necessary.

Climate change is contributing to lower agricultural productivity, drying up of water sources, and outmigration (of men in particular). This in turn has increased the workloads of women and girls, exacerbating the gender inequality, a finding consistent across the literature regarding gendered impacts of climate change.[16] Furthermore, travelling long distances with heavy loads increases stress, causing women to suffer from uterine prolapse and miscarriages, also consistent with previous research in Nepal.[16] This study shows that women experience gender-based violence post-disaster due to economic crisis, loss of home and land, and added stress. These impacts on women and girls' SRHR and experiences of SGBV have also been linked with mental health issues[17], further supported by this study's findings that climate disasters are increasing women and girls' stress and fear levels.

This is the first mixed method study in Nepal to document the intersectional linkages of climate change and its impact such on productivity, women's roles, GBV, sexual and reproductive health, and mental health. A limitation is the cross-sectional design and limited generalizability beyond the two river basins. This research highlights the need to include integration of SRH and climate change across policies and programs. The findings also point to a need to investigate existing strategies and gaps in supporting local, provincial, and national level climate action policy, strategies, and programs.

CONCLUSIONS

Climate change has affected all dimensions of society and differentially affected women and girls. It is observed that there are changes in temperature, rainfall patterns resulting in flash floods and landslides and droughts in recent years which has resulted in limited access to maternal health care, unintended pregnancy, and maternal and neonatal mortality. It is evident that

women and girls has experienced more gender-based violence because of climate change, due to increased workload and high-risk work environments. Thus, this study has clearly established the linkages between climate change and SRHR, which needs to be addressed through appropriate climate adaptation plans with active engagement and leadership of women.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

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