

## Gender Differences in Perception and Awareness of Climate Change in The Suru Valley of Western Himalayas, India

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### Abstract

The Suru valley of the Ladakh region in the Indian western Himalayas has a cold-arid climate and semi-desert landscape. Any change in climate in this fragile landscape will impact the lives of local communities in the region. The region has limited weather monitoring stations due to which changing climate pattern is not well understood. Understanding gender differential perceptions of climate change will help us in critical engagement and support of local people for action on climate change. This study analyses the gender differences in perception and awareness of climate change in the region. The study involves 270 households where male and female respondents were interviewed in an equal ratio in the nine villages of Suru valley of the western Himalayas, India. The data were analysed using descriptive statistics. The results reflected that climate change awareness was higher for the men respondents due to their better education and access to mass communication than the women respondents. The perceived climatic changes like high temperature and low snowfall have impacted more on women as water and agriculture are the most affected environmental components. There is a need in creating awareness about climate change impacts through better education among the people especially women in the region. Prioritizing villages having the highest impact in terms of water scarcity, flash floods, avalanches and landslides will help the government and other stakeholders in better implementation of programmes and policies in the region.



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### Introduction


There is a lot of evidence of climate change, which is frequently related to increases in carbon

dioxide levels in the atmosphere. According to some projections, this rise might result in a 1 to 3.5°C warming at the Earth's surface during

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the next century.<sup>1</sup> Climate change is projected to have a profound influence on both the biophysical environment of the Earth and human existence as a long-term trend.<sup>2</sup> Climate change is a major concern in the communities of the Himalayan region and it is affecting the water supplies, glaciers, agriculture and ecology.<sup>3,4</sup> The Himalayas are thought to be undergoing fast climate change, which will have major environmental, socio-cultural, and economic implications for more than two billion people.<sup>5</sup> The region faces a significantly higher rate of increase in temperature and precipitation than the plains.<sup>6</sup> Also these regions are highly climate change impacted ecosystems due to their fragile ecosystem, higher dependence on traditional economies, and low level of development.<sup>7,8,9</sup> The changes in temperature and rainfall have led to a higher number of flash floods, floods, cloud bursts, droughts, and landslides in the region.<sup>10,11</sup> Ladakh region has very less studies on climate change and has experienced rising temperature, decreased precipitation and depletion of mountain glaciers which is affecting various water resources and has led to a higher incidence of dry seasons.<sup>12</sup> Because of high rates of groundwater extraction in the region, several natural springs have also dried up.<sup>13</sup>

Climate change related to science and policy can gain from indigenous knowledge about climate change held by local populations.<sup>14,15</sup> The significance of understanding climate change from people's social view point has grown as a result of poor communication of climate science findings to the communities.<sup>16</sup> For ages, local communities have been dealing with environmental change. As a result, they frequently possess valuable information about environmental change and methods for dealing with its implications.<sup>17,18</sup> Although having less scientific data on communities' climate change awareness, people still feel the consequences of climate change on their livelihoods, wellbeing, and natural resources.<sup>19</sup> Most people agree that climate change is real while climate change perceptions and opinions vary as to how, where and when it is caused and their influence on an individual's adaptation to it.<sup>20,21</sup> Several research have looked into what factors influence climate change beliefs, as well as how such perceptions influence behaviour and policy support.<sup>22,23,24</sup> However, the types of climate change beliefs that these research

measured and analyzed differ substantially.<sup>25</sup> This makes it difficult to compare and integrate results in order to obtain a comprehensive picture of climate change perspectives. People's perceptions of climate change's actuality, causes, and effects can have a big impact on their behaviour and support for policies to mitigate and adapt to it. Increased awareness of people's views of different environmental changes may also lead to precise findings and feedback in framing policy for climate change adaptation approaches, whereas local communities' knowledge may support scientific research.<sup>26</sup> Therefore, peoples' awareness and understanding of changing climate are of great importance to improve coping strategies, leading to better adaptation to climate change impacts.<sup>27</sup>

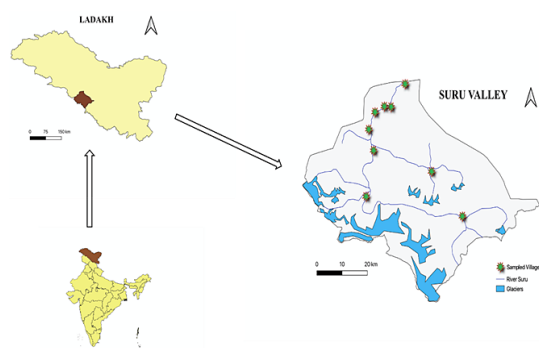
Climate change perception and its impacts vary between men and women. Individuals who have been personally impacted by different unusual climatic events tend to report that the likelihood of such an event occurring again is rather high and can alter or shift their impression of climate change.<sup>28</sup> Women and men have different perspectives on climatic and environmental change in the global setting, which has been well documented.<sup>29,30,31</sup> Women and men experience the changing climate differently, due to their socially defined gender work, duties, rank and personalities and differently placed position in a given society.<sup>32</sup> The social and cultural identities and gender roles assigned to women and men also determine their capability to act in the changing climate.<sup>33</sup> Men and women also perceive disaster risk differently because of their different roles of productive, reproductive, and community responsibilities. The social expectations of different assigned gender-specific performances are evidenced by the fact that community perception varies by different socio-economic groups like age, sex, occupation and economic status. People in communities, for example, form opinions about climate change based on the effects it has had on their roles and duties.<sup>34</sup> A lack of understanding of gendered components of climate change perceptions may make it difficult to recognise gendered needs and awareness in various environmental and social management. Failing to recognise women's needs can lead to an increase in women's vulnerability and ineffective response policies to climate change. So it becomes crucial

to understand women's and men's view points as sources of information in climate change awareness. Taking this into account, this study analyses the gender differences in perception and awareness of climate change in the Suru valley of the Ladakh region in the western Himalayas. The key purpose of the current study is to know how men and women in the region perceive climate change, its potential hazards to their day to day life. The study could be useful in designing men's and women's needs in climate change policies which will help in appropriate climate change adaptation strategies.

**Data Source and Methodology**

**Study Area**

The study is based on 270 respondents from the nine sampled villages of Suru valley of Ladakh region in the western Himalaya-India, with altitudes ranging from 2400m to 5000 m (Figure 1). The valley is located between the Great Himalayan range in the south west and the Indus valley in the northeast. The valley is extended from Kargil town in the north to Rangdum village in the south and is inhabited by the Suru river. The valley is characterized by a semi-arid landscape, with vegetation cover only along the water stream where almost all the streams are glacier-fed. These streams serve as a source of water for domestic needs and irrigation purposes, which comes from the river Suru and its tributaries.



**Fig. 1: Location of nine surveyed villages of Suru Valley, Ladakh**

**Selection of Samples**

A household (HH) was chosen as the sampling unit in this study. A total of 270 structured interviews were carried out across nine villages in Suru valley,

Kargil District of Ladakh.<sup>30</sup> Households were chosen in each village, by implementing a systematic random approach after the total house listing of villages. 1 adult male and 1 female adult member of the household was interviewed at the alternative interval. The study referred to the National Family Health Survey (NFHS- 5) sample size estimation.<sup>35</sup> According to the NFHS-5 survey, for every 20 HHs, 1 HH was selected for the survey. Applying this method, the Suru valley of the Kargil district is comprised of 3 blocks consisting of a total of 5144 HHs.<sup>36</sup> Applying the above procedure of selecting 1 HH from every 20 HHs, gave the total sample size of 257 for 5144 HHs of Suru valley. So, in our study, we consider 270 HHs was well above the required sample to represent the whole Suru valley. Another inclusion criterion was an adult from the sampled household had to be aged 18 years or above. A total of 135 adult women and 135 adult men from 270 different house holds were surveyed in achieving the aim of the study (Table1). The field survey was conducted from June up to November 2019. Since the study was entirely based on primary data and includes human respondents, it was ethically approved by the Students Research Ethics Committee of the International Institute of Population Science, Mumbai, India (reference no IIPS/SREC/201123/2019).

**Table 1. Sampling distribution of Households (HHs).**

Village	Gender	
	Men	Women
V <sub>1</sub>	15	15
V <sub>2</sub>	15	15
V <sub>3</sub>	15	15
V <sub>4</sub>	15	15
V <sub>5</sub>	15	15
V <sub>6</sub>	15	15
V <sub>7</sub>	15	15
V <sub>8</sub>	15	15
V <sub>9</sub>	15	15
<b>Total Sample</b>	<b>270</b>	

**Data Analysis and Methodology**

All the data were entered into Microsoft® Excel. Descriptive Statistics were performed to accomplish

the study objectives. The quantitative data analysis was performed using STATA v15.1 and Microsoft excel.

**Results and Discussion**

**Background of the Respondents**

The respondents were in equal numbers 135 (50%) men and 135 women (50%), selected from 270 sampled households (Table 2). About two-thirds of the respondents (70.37%) belonged to the active working-age group of 25- 54, while the other one-third belonged to early working (22.96%) / late working (6.67%) age groups. The number of men was slightly higher in the active working-age group (71.85 %) than women (68.89 %) while more women (8.89%) were in the late working age group. In terms of education, more than one-third of the women had no formal education (38%) while more than one-third of men had attained higher education (39%). Thus in terms of education, men were more educated than women. As education plays an essential role in climate change knowledge and adaptation, this means that women are more exposed to the effects of climate change.<sup>37</sup> In terms of faith, most of the respondents belonged to the Muslim (89%), followed by the Buddhist religion. The primary occupation of most of the respondents was agriculture and livestock rearing (40%), and the rest were engaged in daily wage jobs, govt. service etc. It had been observed that most of the

livelihood activities like agriculture, livestock, and other daily wage work were seasonal and is of very short duration starting from the months of May, June, July, and August. Cold and harsh climate winters deprive the region of growing crops all around the year. It is interesting to note that women were more involved in agricultural and livestock activities (55%) while men were more involved in daily wage workers, government jobs and business, etc (63%). Previous studies show that agriculture is highly sensitive to climate change than any other sector in the Himalayan regions.<sup>38,39</sup> This means that the agriculture sector which is mostly dependent on climate is highly affecting women in the region. More than half of the respondents (55% ) had an income of below 50000 INR, while about 40% have income between 50000 INR- 5 lakhs INR and only about 5 % have an income of more than 5 lakhs. When we segregate income between gender the disparity can be seen more where 68 % of women have income less than 50000 INR while only 42 % of men lie in this category. Only 3 % of women have an income of more than 5 lakhs while in the same category 8 % of men have an income of more than 5 lakhs. Capital in terms of income is an important factor in decreasing climate change impacts vulnerability and increasing adaptation.. Thus women's lower income means women are less likely to adapt to the changes in climate-induced impacts and thus increase their vulnerability.

**Table 2: Characteristics of the household respondents (n = 270; m = 135 and w = 135).**

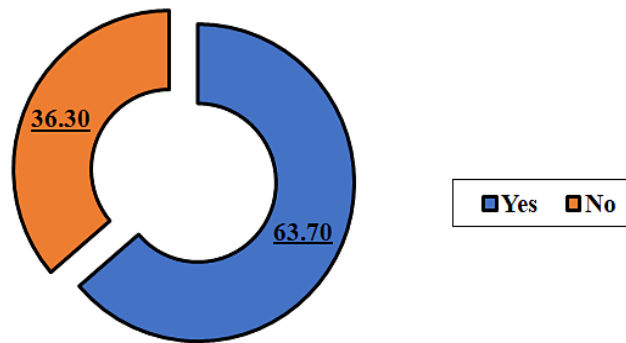
Background Characteristics	Women (%)	Men (%)
15-24	30 (22.22)	32 (23.70)
25-54	93 (68.89)	97 (71.85)
55-64	12 (8.89)	6 (4.44)
No education	52 (38.52)	36 (26.67)
Primary	29 (21.48)	29 (21.48)
Secondary	22 (16.30)	22 (16.30)
Higher	32 (23.70)	32 (23.70)
Muslim	120 (88.99)	120 (88.99)
Buddhist	15 (11.11)	15 (11.11)
Agricultural Activity	50 (37.04)	28 (20.74)
Livestock Activity	24 (17.78)	12 (8.89)
Daily Wage Worker	15 (11.11)	35(25.93)
Business	0.00	12 (8.89)
Govt. employee	22 (16.30)	38 (28.15)

Not working	24 (17.78)	10 (7.41)
Below 30k	14 (10.37)	2 (1.48)
30k - 50k	78 (57.78)	55 (40.74)
50k- 1 lakh	24 (17.78)	35 (25.93)
1lakh- 5 lakh	15 (11.11)	32 (23.70)
Above 5 lakh	4 (2.96)	11 (8.15)

**Perception of Climate Change in the Study Area.**

People in the region understand and interpret the term climate change in terms of the identifiable climatic events that occur in their villages and their surroundings. Figure 2. shows the percentage of respondents who had ever heard about climate

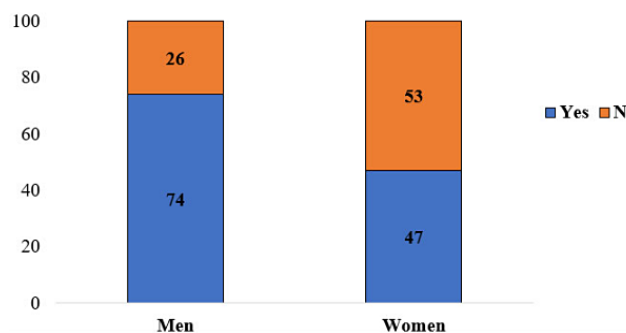
change. The study found that about two-thirds of the respondents (63.70%) heard about climate change, while there was still more than one-third of the people (36.30%) who never heard about anything on Climate Change.



**Fig. 2: Climate Change Awareness in the Region (in %).**

There are gender differences in awareness of climate change. Men were more aware of the term climate change in the study area than women. Among the 63.70% of respondents who said yes,

74 % of them are men while only about 47 % of them were women (Figure 3). Thus, we found that climate change awareness was more among the men than the women in the region.



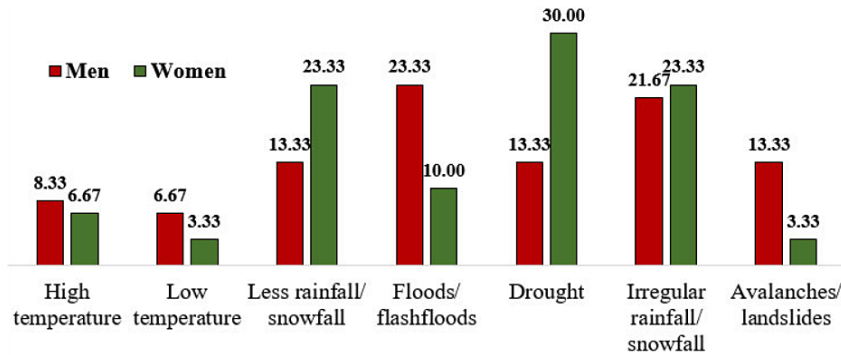
**Fig. 3: Percentage distribution of gender differential perception of climate change in the region (in %).**

Both men and women in the region reported changes in temperature, rainfall, snowfall, and extreme events (Figure. 4). Respondents reported that temperature, floods, and flash floods have increased while rainfall and snowfall have decreased in the region

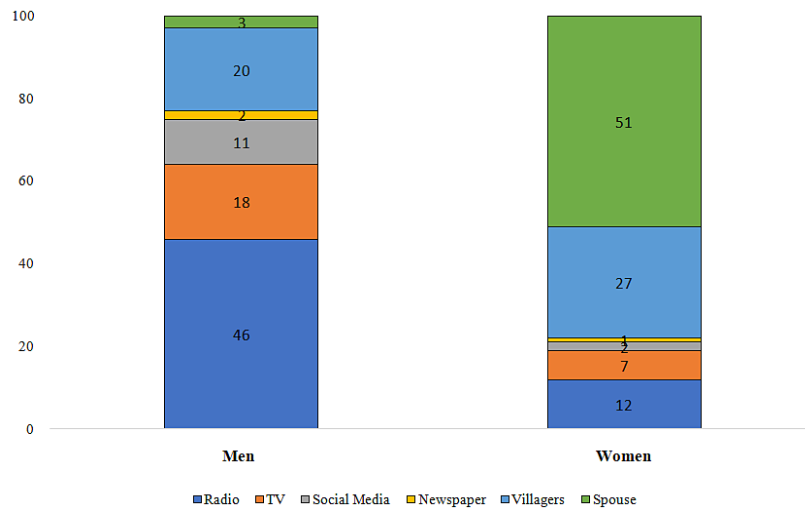
over time. Women perceived drought (30%), less rainfall/ snowfall (23.33%) and irregular rainfall/ snowfall (23.33%) as change in climate while men mostly perceived floods/ flash floods (23.33%), irregular rainfall/ snowfall (21.67%) and avalanches/

landslides (13.33%) as change in climate. The findings signified that drought and rainfall/snowfall have the highest impact on women while floods/ flash floods and irregular rainfall/ snowfall have impacted men the most in the region.

Similar studies on gender perspectives on climate change discovered that both men and women were aware of the phenomena of climate change and the negative consequences of climate change on their livelihoods.<sup>40</sup>



**Fig. 4: Percentage distribution of men and women as to how do they perceive climate change (in %).**



**Fig. 5: Source of information on Climate Change.**

Results indicate that temperature and extreme events have increased; rainfall and snowfall have decreased over time. Men and women perceive climate change as per how these climate events affect their livelihood. There are many sources of climate change information particularly weather information is of great importance during the time of disaster and unwanted weather events. Providing timely weather forecasts helps in disaster warnings and weather updates for people mostly farmers and travellers in the region (Figure 5). However, everyone does not have the same access to

climate information. Men were more aware of climate change than women. Most of the men receive climate information from radio (46%) and television (18%) while 51 % and 27 % of women get the same information from their spouses and villagers respectively. Community bonding seems to be very strong where we found that 20 % of men and 27% of women said that they heard about climate change from the village members. Radio, Television, and Social media are widely used by men in the region. Women have very less access to these communication channels. So there is a need to create

more awareness among women regarding climate change information by making these communication channels available to women also. Similar studies have found that disaster warnings are frequently delivered by media such as television, radio, or mobile phones, which are utilized more frequently by men than by women.<sup>41</sup> Newspaper is very rarely a source of information in the region as the villages have no access to any newspaper in the region. Women in the region lacked the same information and access to information on climate forecasts as compared to men. Men used radio, while women preferred information given by their husbands on climate forecasts and information.

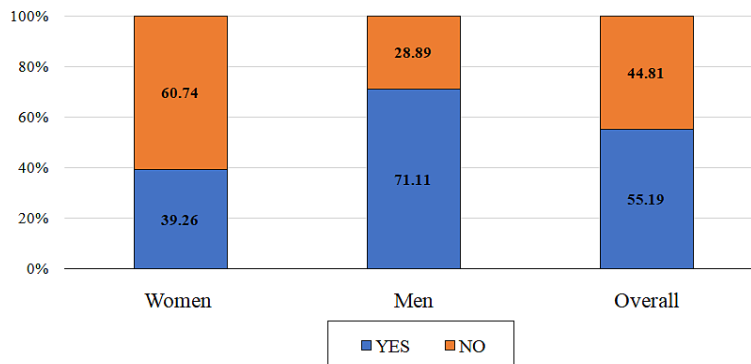
**Community Ranking of Hazard**

People in the region were asked to rank the five most important hazards that affected their livelihood. Water scarcity, less snowfall, flash floods, avalanches, and landslides were listed as the top five hazards that affected people's livelihoods (Table 3). Out of a total of 135 women and 135 men, about 76 % of women identified water scarcity and less snowfall as the

most important hazard affecting women's livelihood while 38 % of men identified flash flood as the most important hazard affecting their livelihood followed by water scarcity (24%) and less snowfall (22%) respectively. The impact of water scarcity and less snowfall are more perceived by women as compared to their men counter parts. Less snowfall during winters have impacted agriculture production in the region and water shortages have increased women suffering more as they are responsible for fetching water for household and livestock. Whenever there is an increase in scarcity of water, women tend to travel further to fetch water from the glacial stream. This makes women more vulnerable because they have to travel further and take dangerous paths en route. So the gender differential impacts were also seen in the perception of different hazards that affected the people. Similar results were also found in Vietnam, Ethiopia, and Senegal, where women were severely affected and had to collect water further and further from water sources as each drought season resulted in the drying of water sources.<sup>42,43</sup>

**Table 3: Most severe impact of Climate Change reported across gender categories.**

Impact of Climate Change	Men (%)	Women (%)
Water Scarcity	33 (24.22)	60 (44.14)
Less Snowfall	30 (22.12)	43 (32.23)
Flash Floods	51 (38.17)	22 (16.22)
Avalanches	14 (10.34)	3 (2.32)
Landslides	7 (5.15)	7 (5.09)



**Fig. 6: Percentage of men and women in solving climate change problems.**



**Peoples’ opinion on solving Climate Change problems.**

Out of 270 respondents, 149 (55.19%) believe that they can solve climate change problems while the other 121 (44.81 %) respondent believe that they cannot (Figure. 6). When we look at the gender differential we find that 71.11 % of men believe that they can solve climate change problems while only 39.26 % of women believe the same.

When asked about their opinions on the strategies to combat climate change men believed that spreading awareness (95.83%), assistance from society/ community (92.71%), and government policies and programs (88.54%) can solve a major part of the climate change problems. The responses were recorded on more than one answer where a particular question had more than one answer recorded. This way we allowed the respondent to express freely their opinion on solving climate change problems. Women in the study area also believed that assistance from society/ community (96.23%), government policies and programs

(94.34%), and spreading awareness (88.68%) can solve climate change problems. It was least for the percentage of women ( 41.51 %) and men (46.88%) that believe climate change problems can be solved by assistance from Non-Governmental Organisations. One of the reasons could be that the region has very few NGOs working on climate change and other environmental issues on the ground level. It is interesting to see that overall 44.81 % still believe that they cannot solve climate change. Out of 121 respondents who said they cannot solve climate change, 82 respondents were women while 39 respondents were men. Among the men respondents who believed that they cannot solve climate change, 61.54% of them stated that climate change was a too big problem for them to solve. Among the women respondents who think that they cannot solve climate change, 39.26 % of them believe that they didn’t feel the necessity to do anything (Table 4). When further probing the question about women believing in not solving climate change we found that most of them believe that is the power and will of God so we cannot change or solve it.

**Table 4: Opinions on the percentage of women and men to the strategies to combat climate change.**

Opinions	Women(%)	Men(%)
<b>Respondents who believe they *can* assist in solving the climate change issue at the individual level</b>		
Self-resilience	60.38	78.13
Spreading awareness	88.68	95.83
Assistance from society /community	96.23	92.71
Govt. policies and Programmes	94.34	88.54
Assistance from NGOs	41.51	46.88
<b>Respondents who believe they *cannot* assist in solving the climate change issue at the individual level</b>		
Don't know what to do	34.07	28.21
Didn't feel the necessity to do anything	39.26	10.26
It's too big problem for me to solve	26.67	61.54

**Conclusions**

This study provides the first comprehensive assessment of local people's perception of climate change from the Suru valley in the western-Himalayan ecosystem. The results from the study indicate that the local human population in the

Suru valley appears to have a broad understanding of climate change and its perceived impacts on agriculture, drainage basins, glacier regions, and related livelihood patterns. Climate change adaptation methods must incorporate both men's and women's differing capacities to deal with the



irreparable consequences of climate change in bringing some system change in place. Individuals and community members can work together in bringing climate change awareness among the people and can become active agents in community initiatives to promote social development. Local peoples' knowledge and traditions in support of long-term climate change adaptation will help in addressing climate change impact effectively. Women being more agriculturally active in the region may be a reason for their better understanding of issues related to climate change. Women and men do not perceive the impacts of climate change as the same. Thus, understanding the awareness of the men and women of climate change helps to comprehend a particular weather event and later can help in establishing successful strategies for policy formulation in climate change. The communities' adaptive reactions should focus on the expertise of local communities in responding to dealing with the impacts of climate change. It should also include women's needs and understanding of climate change. Incorporating women's needs and assisting them in combating climate change impacts are important in minimizing uncertainty arising from climate change.

The scarcity of research literature from the Himalayan region and the study area in specific is one of the primary obstacles in decision making and policies. The study could be useful for researchers by serving as a piece of baseline information and policy makers to take into consideration the perception of local communities and will help in planning better main

stakeholder-led adaptation actions to lessen the consequences of climate change in the region. There is a need in creating awareness about climate change by providing better education and knowledge dissemination to the people (especially women) and organising climate change campaigns in the region. Government agencies, NGOs and other stakeholders working in the region should bring a holistic sustainable approach, in bringing advanced disaster warning and preparedness and should also provide better income opportunities, health facilities, road connectivity, advancement in agriculture etc to assist communities better adapt and deal with climate change impacts in the region. The study will help at regional and sub-regional levels in prioritizing the local communities and villages' needs, targeting the specific villages in terms of water scarcity, flash floods, drought-prone villages and so on.

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#### Conflict of interest

The authors declare they have no conflicts of interest that are relevant to the content of this article.

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