

# Gender Differentials in Perceiving Climate Change Impacts in the Kaligandaki Basin, Nepal

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## Abstract

*The global climate system is changing faster than earlier projections with variable rates across the geographic scale. The impacts are also perceived heterogeneously across the places and communities. This study explores gender differentials in impact-perception in the Kaligandaki river valley in central Nepal. Research used primary data collected from 360 households, 75 Key Informants and 24 Focus Groups Discussion as well as through construction of nine Historical Timeline Calendars from three clusters – Meghauri (lower basin), Lumle (middle-part) and Upper-Mustang (upper-basin). The impact perception was assessed under seven social-ecological variables in the unipolar Likert Scale. The impact perception does not significantly differ across the gender of respondents while testing the means of perception scores and probably it is due to the impacts that have been experienced at profound level. The test of independence of gender to level of impacts indicates no significant association. This research also tried to check if other social-economic variables such as age of respondents and landholding size of household as well as self-reported economic status of households were significantly associated with some of the impacts. However, the number of cells with expected counts less than 5 in chi-square test turned to be more than 20 percent so they were considered to be invalid. Nevertheless, impact perception is significantly associated with the places of residence or study clusters, which indicates that local social-ecological system matters in climate change impacts. The qualitative information however, suggests otherwise that women*

*feel higher level of risk and impacts, and is related to their concern over the welfare of family members and livelihood resources. Since risk perception is found to be related to spatial characteristics, this research recommends for development and implementation of targeted and localized adaptation policies. None the less, those policies must also recognize the women's concerns on climate change impacts.*

**Keywords:** Climate change impacts, gender, Kaligandaki basin, Nepal, perception

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## Introduction

Global climate changes have caused anomalous weather events along with changes in climate process. The heat waves and drought, floods, cyclones and hurricanes related extreme events are becoming more frequent and their magnitude reaching new heights. Such events have implicated every aspects of life system in the earth. Nepal is experiencing an abrupt level of warming, with considerable variation across the spatial clusters (Shrestha, Gautam & Bawa, 2012), ranging from as little as i.e.  $-0.006^{\circ}\text{C}$  per year in the case of maximum temperature of Jomsom while the same station experienced increase of  $0.1^{\circ}\text{C}$  per year in the case of extreme minimum temperature (Pandey, 2016a). The climate sensitive ecosystems of small islands, dry lands, and high mountains are of more concern and Nepal is listed as the fourth extremely vulnerable countries to climate change impacts<sup>1</sup>. Furthermore, the Himalaya defies all types of generalization because of its uniquely diverse topography induced local social-ecological systems. The impacts of climate change could also be heterogeneous across the geographic scale and social-economic and demographic characteristics of inhabitants across the globe and it has been already recognized by scientific studies (IPCC, 2012:786). Many factors such as place-specific physical environment, availability of resources to cope with and recover from crises, health status of individuals, age and sex composition and size of a household together with, educational status variably influence community vulnerability (Cutter, Boruff & Shirley, 2003; Cannon & Müller-Mahn, 2010). The complexities in climate change impacts created by social, economic and economic spheres warrant for location-specific studies before macro-level generalization could be made. In this context, this research explores gender differentials in perceiving climate change impacts in the Kaligandaki Basin, Nepal.

Among the several intersectional elements of society, 'gender' is seen as an issue requiring greater attention in the study of climate change impacts (IPCC, 2012; WHO, 2011).

1 <https://maplecroft.com/about/news/ccvi.html> Accessed on 14th July 2017

The class, gender and spatial units have specific environmental nexus. However, studies on climate change impacts are often studied in isolation to socio-economic, politico-institutional and geo-environmental drivers (Bhattarai, Beilin & Ford, 2015; Goli, Najafabadi & Lashgarara, 2020). This sort of isolation compartmentalizes various interlinked contextual conditions (Gay-Antaki, 2020; Gurung-Goodrich, Prakash & Udas, 2019) and it is more so in the social-ecologically diverse mountain regions such as the Himalaya (Bhadwal, Sharma, Gorti & Sen, 2019; Pandey & Bardsley, 2015). In such contest, this research has chosen gender to analyse perceived climate change impacts, together with other elements such as age of respondents, landholding size, perceived economic status as well as spatial cluster of households (the diverse environment) within the Himalaya for an academic inquiry. The gender in this study is focused particularly because of the fact that poor recognition of gendered needs in social and environmental management increases the vulnerability of already deprived section of population i.e. women.

Different theoretical postulations variably look gender and climate changes. The socialization theory teaches women to perceive the environmental risk higher and worry more to their effects (McCright & Sundström, 2013) through their gendered roles (Allison, 2017). This makes them perceive more climate change risks (van der Linden, 2015). Inequitable policy-institutional systems that prioritise women's need at lower level and exclude their engagement in policy making ultimately increase women's suffering (Kenney, 1996; Mersha & van Laerhoven, 2019). There are evidences that men and women suffer differently from disasters because post-disaster responses are rarely gender-friendly. WHO's analysis (WHO, 2011) showed more women than men being killed during the disasters and it is further supported by other works such as CARE (2010) as it reports 61% of the total 130,000 death or missing in Myanmar during the Nargis cyclone in May 2008 being the women. The vulnerability theory too, shows women's lower level of access to and control over resources as the cause of women's vulnerability (Onwutuebe, 2019; Thomas et al., 2018). The evidence found in the developing countries demonstrate that women are more likely to be killed or injured in disasters than men. Disproportionate distribution of health related impacts of flooding onto women, children, people with disabilities and the elderly is common to the (Few et al., 2004) and it is reported to be as high as 14 times for women during the disasters that 70% of the total dead in the 2004 Asian tsunami were women and the victims of Hurricane Katrina in 2005, were predominantly the African American women (SIA, 2008). These forms of losses are often associated with poverty and marginalization in general, however, it is not appropriate to

generalize or homogenized women as a subjugated group (Demetriades & Esplen, 2008).

Males often demonstrate themselves as 'heroes' that force them towards risky behaviour so they suffer more because of the lack of assessment of danger, resulting upon higher loss. It is also observed that men perceive normal to major climatic and environmental changes, which actually could be extreme and beyond coping ability. Kovats (2008) reported men in UK are found to be much more at risk of drowning than women, although it is not clear if 'heroic' behaviour had implications. Scholars have also noted women's limited decision-making power and waiting for males permission or assistance to respond to the disaster as a serious issue that puts them towards vulnerability (Alston, 2015; Bradshaw, 2010). They may also look for their children, livestock, assets, or partner before deciding to leave for safer places while the situation of disaster may become beyond the limits of coping or avoiding. Chodorow (1978; 1995) noted women's behaviour that they generally do not prioritise their wellbeing over their children and partners, which increases their victimization from disaster more. Gender norms or expectations of different society and culture can also present hindrances to women to learn some important life skills required to cope with disasters (Aguilar, Araujo & Quesada-Aguilar, 2007). These evidences suggest that interaction between climate change impacts and gender is complex and context-specific. Considering these facts, feminists claim that it is not only the women but many sections of societies experience environmental injustice because of belonging to the neglected groups (Gay-Antaki, 2020; Owusu, Nursey-Bray & Rudd, 2019). Therefore, the need is to priorities intersectional issues in the study of climate change from gender perspective. Feminism pays attention not only to women's lives and gendered structural constraints and opportunities but also to the cultural symbols that promote inequalities across the intersections (Gurung-Goodrich, Udas & Larrington-Spencer, 2019; Tanyag, 2019). Therefore, feminism is not only a women's issue, rather it is the way of interconnecting women, gender minorities, oppressed classes and sections in environmental hazards analysis.

The critical theory also advocates for context specific explanation of social life in relation to gender issues in climate and environmental change so it uncovers the assumptions that limits humans to approach to a full and true understanding of social world (Crossman, 2020; Djoudi et al., 2016). Power structure prevailing in the society and the culture affect the lives of people, but the social forces such as ideologies and cultural norms at the same time prevent them to think freely and understand the real world. As critical theory ignores prevailing assumptions, it hints that women are not necessarily the group who perceive higher impacts

and risk of climate change but the contexts, if any, make them perceive the risk variably. There are some sort of overlaps between feminism and critical theory, which advances the theory to critical feminism. Yet, literature has taken it only from socialization, vulnerability, and institutional prospective and grossly ignored the critical and feminist approaches, particularly while researching in Nepal and the Himalaya.

Literature from Nepal and the Himalaya has documented gendered- perceptions of environmental change and risks in different events (McCright & Dunlap, 2013). Climate change impacts in parts of Nepal is increasing vulnerability and reducing resilience of every social-ecosystems through losses in crop- livestock production system associated with diseases and pathogens, as well as farm weeds and invasive species (Bhatta, van Oort, Stork & Baral, 2015; Paudel, Acharya, Ghimire, Dahal & Bista, 2014), while reduced farm-output is leading to farmland abandonment in the communities (Chapagain & Gentle 2015; Pandey 2019a; Paudel, Tamang & Shrestha, 2014). These impacts might have gendered implications however may be invisible since Nepali women lack their traditional gender identity, rather, they shoulder additional burden of works of performing cross-gender roles when majority of males migrate in search for cash income (Pandey, 2019b). The female-headed households of disadvantaged social groups in the Melamchi watershed in Nepal are found to be more vulnerable to climate change impacts because of their higher dependency in climate sensitive livelihood resources, and lower stock of alternatives (Sujakhu, Ranjitkar, Schmidt-Vogt, Su & Xu, 2019). However, Gurung-Goodrich, Prakash & Udas (2019) noted varying, but context specific gendered differences in vulnerabilities to different drivers of change in the Hind Kush Himalaya. However, these complex phenomena of gender-environmental nexus are rarely recognized by environmental policies.

It is clear from the review of environmental policy from gender perspective that the efforts of almost a half century that focused on gender mainstreaming for equality, has only a ‘marginal effects’ (Arora-Jonsson, 2014). The IPCC (2014, p. 7) also noted that ‘people who are socially, economically, culturally, politically, institutionally, or otherwise marginalized in society, are often highly vulnerable to climate change and responses to it.’ Scholarly works indicate existing social norms in relation to roles and responsibilities as well as entitlements and capabilities of women influence perceptions of shocks and susceptibility of climate change impacts on lives and livelihoods (Bhadwal, Sharma, Gorti, & Sen, 2019).

As we have noted above, there is a rich work in gender and climate change globally, and also in Nepal. However, it should be noted that many of them have been written without

adequate scientific data, published in the form of reports or working papers, and without peer review. Even serious issue is that they do not cite the sources when they make any claims. Rather, they are mostly aiming for policy advocacy from a gender perspective, which is not adequate to understand gendered dimensions of climate change impacts. Considering this, scholars such as Arora-Jonsson (2011) have raised the question of the credibility of gender researches. Therefore, despite having a rich literature to explain the gender dimensions of environmental change and effects of disasters, and demonstrate the evidences of gender variability, they have not adequately been recognized in policy responses. It is probably warranting for further research and advocacy. Röhr (2007), has also listed some of the rationale of doing climate change research from gender lens quite early, although they are still valid:

- ***Women and men – in their respective social roles – are differently affected by climate change*** –because of differing responsibilities for care work and income generating work; level of dependency on natural resources and related access to environmental services; differences in access to education and information ...
- ***Women and men differ with regard to their respective risk perceptions*** and women perceive higher risk than men because they have a higher concern over environmental change (Campbell, Bevc & Picou, 2013; Flynn, Slovic & Mertz, 1994).
- ***Social roles and responsibilities of women and men lead to different degrees of dependency on the natural environment.*** Women in developing countries are usually the one who engage in household subsistence activities and have the responsibility of maintaining daily household chores, thus they suffer the most due to climate change induced degradation of forests, watersheds, and agricultural land.

A majority of works in gender and climate change have treated gender as a dichotomous variable distinguishing men and women, although intersectional issues than the gender, play roles in climate change impacts (Gay-Antaki, 2020; Gurung-Goodrich, Udas & Larrington-Spencer, 2019). Carr and Thompson (2014) have seen inadequacy of adoption of conventional or binary approach in deeper understanding of gender relations and intersectional processes of impact and adaptation responses in agrarian societies. In the next section, I elaborate the concept of gender further that would justify the rationale of incorporating other intersectional issues in addition to gender, to explore climate change impacts in Nepal and the Himalayas.

### **Conceptualizing the Gender**

Mainstream understanding of gender i.e. socio-culturally allocated roles, identities, norms,

relations, responsibilities and opportunities for men or women (West & Zimmerman 1987; WHO, 2011), is a very general idea. There are different tendencies of using the concept 'gender' – particularly of three types: 1. as synonyms to 'women'; 2. as binary categorization of men and women; and 3. as challenging the customary expectations rather, performing cross-gender roles. Scott (1989) recognized 'gender' as an important concept in women's studies and feminist theory. The binary categorization of men and women, and a social stratification in relation to access to power and experience of marginalization mostly derived identity politics is adopted in gender from unequal power-relations. In this approach, 'gender' is defined as a socio-culturally constructed list of behaviors, customs and attitudes for males or females that make one gender powerful in the cost of subordination of another. This definition generally universalizes the 'gender' and ignores the cross-cultural dimensions of gender, however. Nevertheless, there is no universally agreed gender roles, behaviors, and attitudes because performing cross-gender roles is common and is expanding in Nepal (Pandey, 2019b). Therefore, gender, as Alston (2013) argued, can be viewed as a relational concept that expects context specific behavior, attitude and performance of men and women. While discourses show 'gender' as not being synonymous to 'women', it is common that many studies conflating gender with women, and is it often associated with the power relations and marginalization of women. It has also been interpreted as a psychoanalytic and cultural category (Goldner, 1991) of individuals' understanding on to sex or gender categories. Since gender-based discrimination and subordination required to be eliminated through politico-institutional mechanisms of interventions, in both forms i.e. structural and functional, 'gender' has been an 'strategy' of identity politics. According to MacKinnon (1989), the sexual objectification of women that considers masculinity as sexual dominance and femininity as submissive, creates the meaning of sex or gender. In this respect, 'gender' is associated with 'dominance' (power relations), which is priori to 'difference' - traits, behaviour and roles (MacKinnon, 2006). Inequalities between male and female do exist in households, communities, cultures and in state mechanisms despite the lack of reliable basis of distinguishing male and female biologically. The historical, social, and cultural differences between women and men are often treated to convince women's subordination that promotes the use of the term 'gender' to 'women' in every-day life. A bit of varying opinion is expressed by Chodorow (1978; 1995) that 'gender' is a matter of having feminine and masculine personalities that is developed in early infancy and is associated with prevailing parenting. The variable power relations and influence produce inequality in access to and control over productive resources, and thereafter

on to decision making. Hence, subordination of women justifies binary categorization of men and women as ‘gender’ and makes it an analytical category. Consequently, this paper adopts ‘gender’ as an analytical category to identify the gendered differentials in perception of risk or impacts of climate change.

## Data and Methods

This study was conducted in the Kaligandaki Basin<sup>2</sup>, Central Nepal (Figure 1). Since the basin is extended in several ecological zones of Nepal and human settlements are located between 300 to 3900 masl., three clusters at different elevation range with cluster-specific weather extremes such as floods in the sub-tropical Tarai (Meghauri), heavy rain in the warm-temperate Middle-Mountains (Lumle), and cold desert in the Trans-Himalaya (Upper-Mustang<sup>3</sup>), are selected to represent the drainage basin.

Meghauri cluster is located at an elevation of around 300 masl. The Narayani River (Lower Gandaki Basin) is in the South-West while the Rapti River, located to the South-East, are the major sources of floods in the cluster. The Gandak barrage constructed few kilometers downstream from the cluster is also causing drowning and inundation in the area. The means (1970-2010) of maximum and minimum temperatures and precipitation at the nearest meteorological station (Rampur) are around 35° Celsius, 15° Celsius and 2050 mm, respectively (Pandey, 2016b). Major economic activities and sources of income of the inhabitants are agriculture further supported by tourism (home stay hospitality), poultry, fishery, and remittance obtained from labor migration abroad.

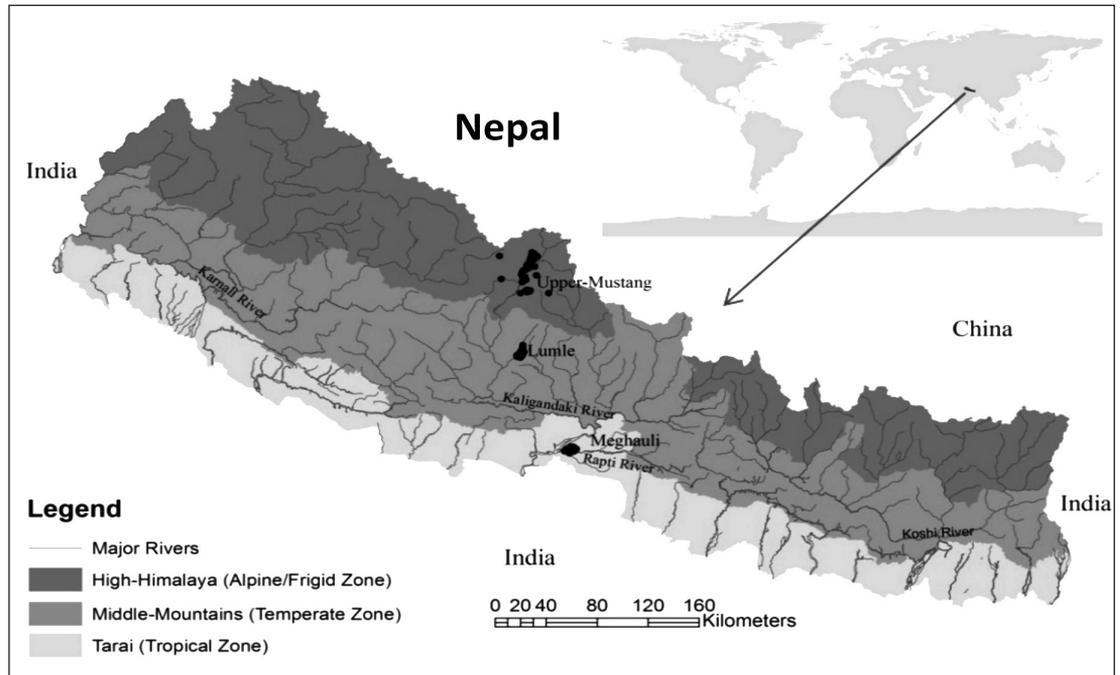
Lumle cluster is located in the middle-mountain and has warm temperate climate. The place gets heavy rain in the summer that is over 5000mm/year. The cluster is a hill with north-west slope that is drained by the Modi Khola (River) to the West, while the Fewa watershed lies to the Eastern slope. The human settlements in the cluster are ranged between 800 – 1800 masl. Long-term weather records at the Lumle meteorological station (1970-2010) show around 20° Celsius maximum temperature, and 15° Celsius minimum temperature, and 5400 mm annual rainfall (Pandey, 2016b). The inhabitants are engaged in agro-livestock activities

- 2 Hot/wet below 300masl, Tarai; cool/wet temperate in between 1200–1800masl - Middle-Mountains; and cold/dry 3000-4000masl Trans-Himalaya
- 3 Upper-Mustang (in terms of elevation, above 3000masl, and located within the Upper Kaligandaki catchment was selected purposively; although the term ‘Upper-Mustang’, which is also regarded as the ‘Forbidden Kingdom’, is different than the term used here. For instance, Muktinath and Zhong VDCs are not the part of ‘Forbidden Kingdom’.

followed by tourism (hospitality) business, small enterprises, service and remittance from retirement (mostly from the British and the Indian Army), as well as labour migration abroad. The cluster is about 25 km away from Pokhara, one of the prominent cities of Nepal.

### Figure 1

*The Study Areas of Meghauri, Lumle and Upper-Mustang in Nepal*



Upper-Mustang is located in the upper Kaligandaki Basin, above 3000 masl., yet human settlements are limited to 3900 masl. The long-term average of maximum temperature at Jomsom (nearest meteorological station) is about 15°C and minimum temperature is about 8°C with annual average rainfall of only 270 mm (Pandey, 2016b). The region has the cool-temperature arid climate that is frequently hit by mid-latitude high pressure belts and extreme blizzards, particularly in winter. Upper-Mustang has mostly barren and rugged topography and has only one growing season. The region is one of the remote areas of the country so is sparsely populated and lacks many basic services such as health and education. The area is hardly connected with a recently constructed seasonal unpaved roads from Jomsom en-route to Beni Bazaar (town) in the south. This research adopted descriptive research design that analyses the responses using descriptive statistics and tests the relationships among the variables. Multi-method approach was adopted to collect and analyse the data.

The research adopted multi-stage sampling. At the first, Meghauri, Lumle and Upper-

Mustang were purposively selected considering the cluster-specific weather extremes. In the second stage, 360 households were sampled using probability sampling from the total households ( $N = 4849$ ) of 3 clusters using  $e = 0.05$  (5% error), significance = 0.05 (95% confidence level), and estimated probability of success ( $p$ ) = 50% values (Dixon & Leach, 1978, as cited by Kitchin & Tate, 2000). The obtained sample size was further divided into 3 study sites using proportional representative sampling. The proportional representative sampling indicated 224, 77, and 55 households for Megghauli, Lumle, and Upper-Mustang. However, considering internal homogeneity in Megghauli and higher diversities in Lumle and Upper-Mustang, the sample size was controlled by reducing the sample of Megghauli to 70% and adding the remaining samples to Lumle (70%) and Upper-Mustang (30%). By adoption of such control sampling, actual sample sizes were 153 households in Megghauli, followed by 141 and 66 households in Lumle and Upper-Mustang, respectively. A 10% of reserved sample was assigned to replace the earlier sample in case of refusal of respondents to participate in research or in case the sampled respondent is not identified or not available during the field visit. The respondents were randomly selected at first and controlled later to ensure at least 30% women respondents. Hence, the third sample in each set of 3 random samples was assured to be women informant through controlling it if there was not a women-headed household in each set of three households. It is practiced so because despite women being the *de facto* household head, Nepali culture has a practice of reporting a senior male member of the household head. A list of households was prepared at first in each of the clusters in assistance of the officials of local councils, i.e. Village Development Committees (VDCs) to sample the households. There were quite a little cases of refusal to participate in the research and limited cases were in Upper-Mustang. A few respondents who were absent at their home at the time of visit were replaced by the reserved sample, particularly in Upper-Mustang. The data on seven impacts related variables, together with social economic characteristics of sampled households have been collected using face-to-face interview schedule. Altogether seven climate impacts-related items in the last one decade, along with households' socio-economic characteristic, were asked to the head of household i.e. 106 women and 254 men, during the face-to-face interviews.

The household information was further complemented by the information collected in 24 focus group discussions and with 75 key informants. The prominent farmers of communities, environment activists, NGO workers, community leaders, government representatives were selected for KII. Addition to them, general community people aged 30 or over were the FGD participants in general. The checklist for both of the tools was developed to guide the interview

and discussion on the theme of the research. A rich literature was entertained to design the household questionnaire and checklist. As stated earlier, the data were collected for a larger project, only the data and information related to the theme of this paper are entertained here.

Multiple effects of weather extremes, as of the fragmented memories of community people, were also documented by constructing nine Historical Timeline Calendars. All of the field instruments were pre-tested in Lumle and Megghauli in August-September 2012 and finalized later. The detail fieldworks was done from April to September 2013 by four persons, graduated in social sciences, and were closely supervised and monitored by the author. The author himself edited, computed and analyzed the data. This research followed all the ethical concerns by adopting the National Statement on Ethical Conduct in Human Research and the Australian Code for the Responsible Conduct of Research. The research obtained ethical approval from the research ethics committee of South Australia (joint committee of the University of Adelaide, University of South Australia, and Flinders University, Australia) with the Approval Number HP-2012-046.

The unipolar Likert Scale ranged from 1 (the least) to 5 (the most) was adopted to scale peoples' perceptions on climate changes impacts. Different level of impact perceptions (1 to 5) were transformed into a single category to normalize the response using 'Normalize Response (%) = (Total score of actual response / Total of the highest possible score) \* 100 formulae. Here, the 'Total score of actual response' refers to cumulative score of particular level of response from all the respondents (sum of the number of respondent \* level of responses); the 'Total of highest possible score' denotes the total score of all the respondents if they have scaled their response to '5' in particular question (Total respondents multiplied by the highest score 5); whereas 100 is the 'constant' applied to calculate percentile. The results are presented mostly in charts showing descriptive statistics. The difference between the level of overall responses of women and men respondents in all the seven variables have been tested using independent sample t-test, followed by the Levene's Test for Equality of Variances. The research has also performed test of association between the level of impact perception in specific question and gender, age-group of respondents, spatial clusters in which the households are located, landholding size and self-reported economic status of the households, using the chi-square test. The chi-square test having up to 20% cells with expected count less than 5 were accepted to be valid. Although other demographic and social-economic variables such as age of respondents, level of education, and occupation as well as self-reported economic status and landholding size were also considered during the test of association, however, they have

been left from interpretation since none of them have shown significant association and most of the test turned to be invalid because of having over 20% cells with expected count less than 5. Qualitative data are narrated, as required, to justify the results of quantitative data analysis.

## **Results and Discussion**

### **Socio-economic Characteristics of Households**

The household size in Kaligandaki Basin is 5.9, which is even higher in men-headed households (6.3 persons) against of 4.9 persons in women-headed households and almost a third of total population being young-adults i.e. 15-29 years (Pandey, 2016b). Although underlying causes behind such variations are unclear, distribution of population and labour force differ by the gender of household head. The proportion of under 5 male-children is notably less (6.3%) than that of female children (9.2%) and older children (5-14 years of age) and economically active male population are slightly higher in women headed households (Pandey, 2017). The higher proportion of adult males in women-headed households hints for increasing women's role in household management, the basin has notable gap in level of education by gender (males having better education) and the gender gap is markedly higher in women-headed households (Pandey, 2017). Climate change disproportionately affects different sections of population such as the elderly, the sick, young children, and women, in particular, those who are under reproductive process (Kasperson & Kasperson, 2001; McCarthy, Canziani, Leary, Dokken & White 2001) because they neither can respond quickly and independently to evacuation emergencies nor can cope with weather extremes, rather are subject to rescue and rehabilitation related health complications (O'Brien & Mileti 1992). Population of the study area is dominated by children and elderly, and are also suffered from various health problems that indicates the probability of higher impacts of climate change in the basin. Total reported cases of illness in the Kaligandaki Basin is 434 persons from 106 women headed households (more than 4 persons sick in a years in a household in an average) and 1335 persons from 254 men headed households i.e. more than 5 persons sick in a years in a household (Pandey, 2017). The higher number of individuals suffered from health problems in men-headed households might have been linked to inadequate care to the needy one while large number of people suffering from health problems increases care burden to women.

Literature also claimed that the poor and marginalized people suffer the most from weather extreme because they live in the place where the risks and hazards are concentrated

(Burton, Kates & White, 1993; Fitzpartrick & LaGory, 2000; IPCC, 2001; Pandey, 2008). Economic poverty in rural Nepal is acute and wide-spread (Subedi, Subedi, Dawadi & Pandey, 2007); women and girls neither own adequate productive assets nor have a sufficient income to maintain a decent living. Within such circumstances, their engagement in unpaid nurturing and caring works within the household makes them dependent to other household members, particularly an adult man. Literature also noted women having less time to contribute in community level decision-making (Pandey, 2019b) in the basin. The basin has predominance of self-reported middle-class (71.4%), followed by poor (18.1%) and upper-middleclass (8.3%) and there are no notable differences in proportion of households in reference to economic status by gender (Table 1).

**Table 1**

*Self-Reported Economic Status of Households in the Kaligandaki Basin by Gender of Household-Head (n = 360).*

Self-Reported Economic Status	Women-Headed Households (n=106) Number	Men-Headed (n=254) Number	Total (n=360) Number
Rich / Affluent	2 (1.9)	0 (0.0)	2 (0.6)
Rich / Upper Middle class	5 (4.7)	25 (9.8)	30 (8.3)
Middle class	76 (71.7)	181 (71.3)	257 (71.4)
Poor	21 (19.8)	44 (17.3)	65 (18.1)
Ultra-Poor	2 (1.9)	4 (1.6)	6 (1.7)
Total	106 (100)	254 (100)	360 (100)

Note: figures in the parenthesis denote percent

Exploitation of natural resources, particularly the land, is the primary source for livelihoods in the Kaligandaki Basin. However, the same is most sensitive to climate change. The inheritance practices in the country provided access to land to 70.6% households but 51.86% are owning less than 0.5ha and 94.9% owning less than 2ha (CBS, 2013). The access to land to the studied households of the basin is 97.2% for women-headed households and 98% for men-headed households. However, access to land in terms of ownership for women is limited to 11.7% household in the Kaligandaki Basin and it is less than the national average of 19.71% (CBS, 2012). This data indicate women's miserable access to productive resource. Land ownership under women's name is even poor in men-headed households that less than 3% household has registered some land in the women's name, while it is above 14% in women-

headed households (Table 2). The situation indicates that women get ownership right when there is no adult male-member at the household (Pandey, 2019b). The proportion of small land holders in the basin is notably high i.e. 45.3% and the proportion of marginal holders is higher in women-headed households i.e. 69.8% against of 44.1% in men-headed households. Only little-over three percent of the households own medium size of holding that is 2 to 4 hectares and studied households lack large holder having the land larger than 4 ha. This has clearly indicated higher prevalence of land-poverty in women headed households in the Kaligandaki basin, even worse than in the country.

**Table 2**

*Landholding Status of Households by Holding Categories and Gender of Household Head in the Kaligandaki Basin (n = 360)*

Holding Categories	Female Headed	Male Headed	Total (n=360)
	Households (entitled to 97.2%) (n=106)	Households (entitled to 98%) (n=254)	
Marginal Holders (<0.5ha)	74 (69.8)	112 (44.1)	186 (51.7)
Small Holders (0.5-2ha)	31 (29.2)	132 (52.0)	163 (45.3)
Medium Holders (2-4 ha)	1 (0.9)	10 (3.9)	11 (3.1)
Total	106 (100)	254 (100)	360 (100)

Note: figures in the parenthesis denote percent

As it is observed that there is variability in demographic, health and economic status of women and men headed households in the basin, their experience of climate change impacts are discussed below.

### **Gender Dimension of Climate Change Impacts in the Kaligandaki Basin**

Women of the Kaligandaki Basin generally have lesser access to, and control over, productive resources that lead them towards higher vulnerability compared to men. Researchers such as Alston (2015) reported social and cultural norms induced gendered division of labour, controlled physical mobility and unequal entitlement to decision-making that disadvantaged women. Since the status of resources and dependency over them influence perception on the impacts of environmental changes, this section explores gender-differentials in perceived impacts of climate change in the Kaligandaki Basin. The differences on responses of women and men respondents under following seven types of impacts are analyzed (Figure 2) and the variations are tested statistically using an independent sample t-test and the chi-square test of associations.

### Increased Duration of Water Shortage

The Himalayan environment has experienced shifting rainfall patterns (Pandey, 2016a), increased rates of evaporation and melting of glaciers (Wiltshire, 2014), and water scarcity in the vicinity (Sullivan, 2011). As women and children are intrinsically linked to collecting, storing, protecting and distributing water, they suffer more due to water scarcity. Inadequate water for household consumption compels households either to compromise hygienic practices or increase the use of dirty water. The compromised use of water may lead to a number of water-borne health problems such as diarrhoeal and associated morbidity (WHO, 2011). The situation in turn increases women's burden of taking care of affected household members and finally losing working days and associated incomes.

Consistent to the background knowledge, notable proportion (normalized proportion of 69.5%) the households of the study area have reported reduced availability and reliable supply of fresh water (Figure 2). While looking at specific response scale, it is identified that almost 43% respondents have chosen 'clearly observed the shortened the duration of water availability'. The normalised proportion of over 83% respondents think that the duration of water shortage is increased. Data indicate differences between women and men reporting different levels of changes. While normalised proportion of 87.7% women reported increased duration of water shortage, the corresponding proportion of men respondent is 81.3%. An independent samples t-test was performed to compare the means of perception level of women and men and result showed slightly higher level of perception of women ( $M=2.59$ ,  $SD=1.77$ ,  $N=104$ ) than that of men ( $M=2.52$ ,  $SD=1.63$ ,  $N=253$ ). However, these means do not differ significantly  $t(355) = .331$ ,  $p > .05$ , two tailed (Table 3). This finding indicates that women and men of the basin perceive increased duration of water shortage in the similar way. The differences in the number of respondents who perceived a high level of shortage ('clearly observed' category of response) is relatively higher (47.1%) for women followed by 41.1% men. This generally reflects that women, probably due to their gender roles and attachment to water, are more concerned with the impacts so have felt higher level of water shortage. This is also supported by the information collected during the group discussion in various locations that women are more concerned with reduced flow or shortage of water. The chi-square test that examined the association between the gender of respondent and the level of response categories, however, failed to demonstrate significant association,  $\chi^2(4, N=357) = 5.269$ ,  $p > 0.05$ .

### **Annual life of Water Sources Decreased**

Increased duration of water shortage is associated with decreased annual life of water sources. In other words, the natural sources of water in the Kaligandaki Basin are either drying up early or have reduced the volume of discharge, and over three-fourths respondents have reported such change (Figure 2). The normalised proportion of 83.5% respondents reported decreased annual life and flow-size of water sources. Almost a half of the respondents 'clearly observed' the change. The proportions of women and men who perceived decreased annual flow volume and life or duration of flow of water sources are almost equal, while there is a little variation (women = 55.8% and men = 46.2%) in normalised proportions of respondents. The independent samples t-test performed to compare the means of perception level of women and men respondents on 'decreased annual life of water sources' indicated no statistically significant differences  $t(355) = -.396, p > .05$ , two tailed, although there is a little variation since men feel higher level of decrease in annual life of water sources - men ( $M=2.25, SD=1.5, N=253$ ) and women ( $M=2.18, SD=1.58, N=104$ ). Nevertheless, the community people in each of the study clusters reported that women are more concerned to the duration and volume of water discharged from natural sources because of their traditional gender role of fetching water, which might have implicated into their higher level of reporting the decrease. The decline of flow or life of the sources of water in the Tarai (Megghauli) is reported in reference to deepening the ground water.

### **Increased Forest Fire Incidents**

Figure 2 also shows perception on increased forest fire incidents in the Kaligandaki Basin in the last decade. Increase in forest fire incidents are predicted with a rise in global temperature (Hughes & Steffen 2013; Cruz, Harasawa, Lal, Wu, Anokhin, Punsalma, Honda, Jafari et al., 2007). NDR (2013) documents yearly average death and injury of 34 and 32 individuals, respectively, in Nepal in between 1971 and 2012 due to annual average of 167 fire incidents. However, according to the respondents of the Kaligandaki Basin, the fire incident have not been a serious issue yet. Only little over a-fifth of respondents reported increased forest-fire incidents while other 73% disagree with the opinion. Majority of community people claimed that it is decreased due to community's efforts to control accidental fires in the forest. In total, higher proportion of men than that of women have reported increased forest fire. Since the forests of the study area are protected under nature conservation program (Chitwan National Park in Megghauli and Annapurna Conservation Area in Lumle and Upper-Mustang), the participants of group discussion reported that women keep less care about the forest situation

because of the poor access to forest resource. The consequence is that over 80% women respondents do not think that incidents of forest fire are increased. It is, however, indicated significant association between the perception of women and men (gender of respondents) on to the ‘increase of forest fire incidents’  $\chi^2(4) = 9.422, p < .05$ .

### Plants Shifted Up-ward

Ecological regime shift is reported with the course of climate change (Bardsley & Wiseman, 2012; Wrathall, 2012). Figure 2 demonstrates peoples’ observation on spatial, particularly altitudinal, shift in plant species. Majority of respondents (71.4%) reported that the plants, which were predominantly found in the lower altitudes, are shifted upward in the Kaligandaki Basin. The normalized proportion of little over four-fifths respondents have seen the evidences of upward shift of plants. There is little difference in the proportion of women and men having similar opinion. Women respondents seem to perceive higher level of changes in species distribution since their proportion of reporting ‘a clear change/shift’ is 49% against of 37% for men. The independent t-test showed no statistically significant differences between the means of the level of responses of men and women respondents. In the same way, the level of response on ‘up-ward shift of plants’ is not significantly associated with the gender of respondents, The research participants on the other stated that women who collect fodder and forage, have noticed new plant species in the course of their daily works that men do not notice.

### Changed Plant Phenology

With the changes in seasonal temperature and rainfall pattern in the Kaligandaki Basin (Pandey, 2016a), plants have changed their phenology. Little over a-third respondent of the basin reported such changes (Figure 2). They give examples of changing flowering and fruiting seasons that:

... The *Rhododendron* blooms some two weeks earlier in the Middle-Mountains and some three weeks earlier in the Trans-Himalaya than that of ‘usual’ seasons...

... Fruit trees (mangoes, jackfruits, lychees) in the Tarai have been blooming some two weeks earlier in recent years...

... Changes in flowering and fruiting seasons had been seen also in peach, pear, apricot, mangoes, *kafal* (bay-berry/box myrtle: *Myrica esculenta*), *Aaiselu* (wild raspberry: *Rubus ellipticus*) in Lumle and Upper-Mustang (mostly below 3500 masl), with most of the early blooming leading to unsuccessful fruiting ...

The independent t-test failed to show significant difference between the means of men’s and

women's perception levels and the means for men ( $M=3.70$ ,  $SD=1.59$ ,  $N=253$ ) and women respondents ( $M=3.69$ ,  $SD=1.55$ ,  $N=104$ ) are almost the same. The test of independence also indicates no significant association between gender-specific response. Nevertheless, as in many of the other elements mentioned by the community people, the level the women see the change, is reported to be higher than that of men, indicating women being more concerned to the change in plants' phenology.

### **New Diseases and Insects in Crops and Livestock**

Warming facilitates growth and spread of disease vectors and peoples in the Kaligandaki Basin reported increase in crop-livestock diseases (Figure 2). Remarkably high proportion of respondents (over 80%) have seen new diseases in crops and livestock. Among the total, 46.8% respondents have perceive such increase in quite a high rate. There is some differences between men (77.9%) and women (85.6%) respondents reporting new diseases and insects in crops and livestock. The t-test result indicated no statistically significant differences, despite the mean of response of men ( $M=2.28$ ,  $SD=1.48$ ,  $N=253$ ) is higher than that of women ( $M=2.0$ ,  $SD=1.28$ ,  $N=104$ ) in perceiving increased level of crops and livestock diseases and insects invasion in the Kaligandaki Basin. The proportion of women respondents who have seen higher severity of problem, is higher than that of men, indicating that women, who are closely looking at crops and livestock, as they are the care-takers of both, have observed the problem being intense.

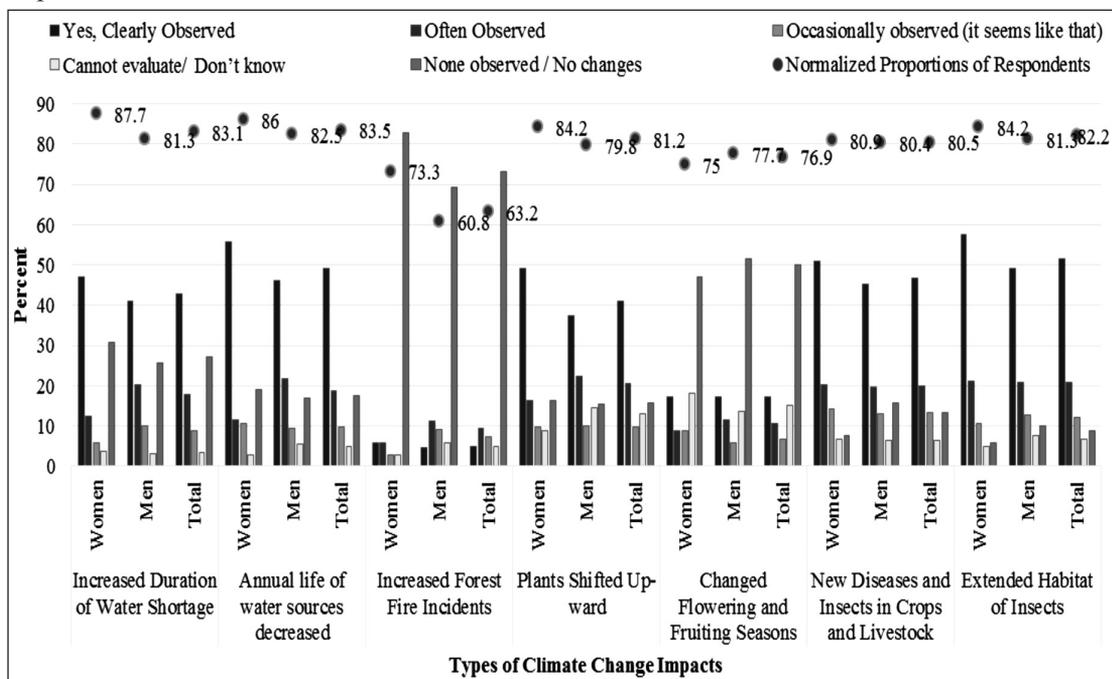
### **Extended Habitat of Insects (Longer Duration /Up-ward adaptation)**

With the changes in climate system, not only new diseases and disease vectors in crops and livestock are increasing, but also their habitat has been extended to a larger spatial unit and across other seasons. Of the total 84.6% respondents reported the extended habitat of insects, both spatially and seasonally (Figure 2). Over a half of the respondent report 'a clear expansion' of habitat. As quite a high proportion of respondent reported extended habitat of insects, there is a little variation in the level of response and the gender of respondents. The test of means of the level of perception by women and men on 'extended habitat of insects' lacked significant differences. The chi-square test statistics also failed to show significant association between the gender of respondents and their level of response on 'extended habitat of insects. Nevertheless, as relatively higher proportion of women respondents i.e. 57.7% against of 49% men reported 'a clearly extended habitat' of insects, which is consistent to the participants of focus group discussion who claimed insect species have been surviving across the year and are adapted to higher altitude.

This work also performed the test of association between level of response in specific question and gender identity of respondents as well as other social-spatial and economic characteristics of respondents. However, the number of cells with expected counts less than 5 in chi-square test turned to be more than 20 percent (making the chi-square test invalid) in all the social-demographic characteristics except for gender, and spatial cluster of the study. It is probably due to the inadequate number of responses in different strata as age-group, educational status, land holding, and self-reported economic status had 4, 4, 4, and 5 strata, respectively. The statistical test results discussed above indicated gender not being associated with the level of perception of impacts, this study further tested the association of the level of impact perception with the place or study cluster. It is found that the geography or the study cluster, where the respondents are living, is significantly associated with perception on various impacts. The chi-square statistics for spatial cluster to 'Increased Duration of Water Storage' is:  $\chi^2(8, N=357) = 48.103, p < .001$ ; to 'Annual Life of Water Sources Decreased' is:  $\chi^2(8) = 30.314, p < .001$ ; to 'Increased Forest Fire' is:  $\chi^2(8) = 16.844, p < .05$ ; to 'Plants Shifted Up-ward' is:  $\chi^2(8) = 95.043, p < .001$  and the Phi and Cramer's V value = .516 and .365, respectively; to 'Changed Flowering/Fruiting Season' is:  $\chi^2(8) = 58.310, p < .001$  and the Phi and Cramer's V value = .404 and .286, respectively; to 'New Diseases found in Crops and Livestock' is:  $\chi^2(8) = 51.736, p < .001$  and the Phi and Cramer's V value = .381 and .269, respectively; and to 'Extended Habitat of Insects (Longer Duration/Up-ward adaptation)' is:  $\chi^2(8) = 43.773, p < .001$  and the Phi and Cramer's V value = .350 and .248, respectively. These statistics indicate that the climate change impacts have spatial characteristic.

**Figure 2**

*Experience of 'Climate Change Impacts' by Gender of Respondents in the Kaligandaki Basin, Nepal*



**Table 3**

*Independent Samples Test by Gender of Respondents and Level of Response in the Kaligandaki Basin, Nepal*

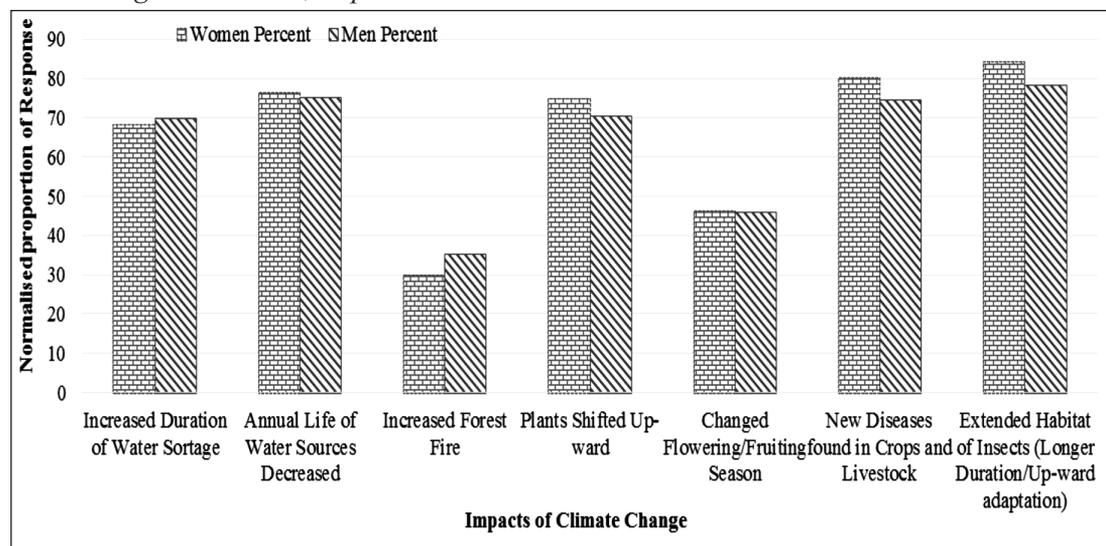
Variables	Group Statistics				
	Sex	N	Mean	Std. Deviation	Std. Error Mean
Increased Duration of Water Storage	Female	104	2.59	1.771	.174
	Male	253	2.52	1.639	.103
Annual Life of Water Sources Decreased	Female	104	2.18	1.581	.155
	Male	253	2.25	1.501	.094
Increased Forest Fire	Female	104	4.51	1.166	.114
	Male	253	4.24	1.266	.080
Plants Shifted Up-ward	Female	104	2.27	1.534	.150
	Male	253	2.48	1.492	.094

Changed Flowering/Fruiting Season	Female	104	3.69	1.546	.152
	Male	253	3.70	1.587	.100
New Diseases found in Crops and Livestock	Female	104	2.00	1.277	.125
	Male	253	2.28	1.479	.093
Extended Habitat of Insects (Longer Duration/Up-ward adaptation)	Female	104	1.80	1.169	.115
	Male	253	2.08	1.344	.085

on above presented the results and discussed the findings of gender and perceived impacts of climate change in the Kaligandaki Basin. Majority of the respondents have experienced different impacts, however, there is no significant implications of gender in level of risk and impact perception, except in the case of ‘increased forest fire incident.’ Here, the summary of various level of responses transformed into normalized responses illustrated in the Figure 3 shows nearly two-thirds of respondents reporting various impacts in the basin. However, no notable variation in the level of impacts is identified by the gender of respondents. The information collected during the KII and FGD indicated that women, in general, feel higher level of impacts since the environmental components listed to understand the impacts were mostly related to rural livelihood resources of which, women are the primary or de facto managers.

**Figure 3**

*Summary of Normalized Levels of Experienced Impacts on various Environmental Elements in the Kaligandaki Basin, Nepal*



Since gender has not been found as an element that is associated with the level of perception in various impact variables, this sort of intersectional analysis has many advantages for a comprehensive study of gender, although it has not yet been well recognized in the study of climate change impacts (Djoudi, Locatelli, Vaast, Asher, Brockhaus, & Basnett-Sijapati, 2016).

Although the perceptions on climate change impacts do not differ much within the community and by social strata, they are significantly differ, in aggregate, with the geographic location of the settlement. This study has not assessed the effects of micro-geographies in climate change impacts within the clusters, however, the level of responses across the study clusters are significantly associated with. This can be interpreted as: not the social-demography, but geographic environments have major roles in climate change impacts, at least in the Kaligandaki Basin. This sort of finding could be associated with the higher level of impacts that everyone can invariably perceive them. Nevertheless, the meaning given to the impacts vary considerably over geographic environments. For example, people of cool climatic area such as Upper-Mustang and Lumle might give inadequate attention to the impacts brought by the warming (as it would be mostly positive, so are favorable for the community), while for the people of Tarai, the impacts might be observed as higher since most of the impacts would be negative. Also means of local livelihoods / dependency on primary livelihood options might implicate into impact perception.

It is like a conventional practice in the study of climate change impacts that gender is applied as in a dichotomous context. A large majority of scientific works claim that women perceive the risks more, affected by, and vulnerable to implications (see in section 1 and 2) and many research ignore the role of power and social and political relations in determining impacts (Djoudi et al., 2016). In the context of the findings of this study that failed to detect the variation in perceiving impacts in the Kaligandaki Basin by gender of respondents, the study area demonstrate grossly powerless. The majorities of respondents of the basin are poor and belong to farming households who entitled very small parcel of farmland. Therefore, their perception to climate change risk and impacts do not differ much. This is also reflected from the standard deviation of perception score that is not more than 1.5 in most of the variables. Hence, the findings illustrates that labeling women as climate victims may not be true always, however, in some cases (coping to extreme weather events, women being poorer, both in terms of land holding and educational attainment, as well as in formal employment, in the Kaligandaki Basin), it is rather true.

## Conclusions

Research evidences have illustrated major alteration in global, regional and local climate systems which are interrupting scale-specific social, economic, political and environmental spheres. Understanding climate change impacts from 'gender' perspective is one of the important research theme, however, generalizing women as a victim is not necessarily true. It is also argued that men and women perform different roles in society, which are linked to the gender-specific impact perception (Babugura, Mtshali & Mtshali, 2010; Mnimbo, Mbwambo, Kahimba & Tumbo, 2016). The studied households have remarkable proportion of children, elderly, poor, and sick, they are sensitive to climate change impacts. Higher sensitivity to the impacts may resulted into their higher level of impact perception. Women, probably due to their gender roles and attachment to water, forest, fodder, and taking care of farm and livestock, are more concerned with the impacts. On the other, lack of access to forest resources due to nature conservation programs, they generally do not care for forest fire, labeling it 'their forest' (Pandey & Bardsley, 2013). Nevertheless, this study does not detect significant variation on the level of overall impact perception since Levene's Test for Equality of Variances has a p value of 0.896. Additionally, there is no significant association between gender of respondents and their perceived level of impacts. This result refers that gender is not necessarily influence impact perception, particularly when the impacts are severe or profound.

The incorporation of other intersectional aspects such as age of respondents, landholding size, and self-reported economic status of households are also not strongly associated with the perception of impacts. Yet, they are turned to be invalid for the test due to higher proportion of cells having expected counts less than 5. It might also because of the fact that such a severe level of impacts are noticeable to all inhabitants, women in general, perceive higher level of impacts because of their higher concern over the welfare of their partner, children, and family members as well as impacts on livelihood resources. These finding are consistent to Chodorow's statement that women do not specify their need and priorities from those of their partners and children (Chodorow, 1978; 1995). Men on the other hand are more concerned about overall implications into wider social-ecosystems such that they care for forest fire while women ignore it because of the denied access to even for sustainable harvest of forest products. Therefore, the issue of intersectionality becomes an important component of this research that dichotomous categorization of gender not necessarily justify women's vulnerability. Rather there are social-economic, political and technological powers interplaying in the Kaligandaki Basin that determine the level of impact perception. If we look at the study clusters, which are

located in different social-environmental conditions, the level of perceptions are significantly different. This indicates spatial characteristic of climate change impacts so warrants for a localized response or adaptation planning.

Gender has been one of the key issues of development and environmental discourse and political-policy negotiation for the last half century. It has substantially helped to increase women in positions of power. However that is not necessarily ensured women's wellbeing. Therefore, Gay-Antaki (2020) stressed for a careful audit to the assumption that a critical mass of women will automatically generate gender friendly climate policies. Furthermore, seeing women either from vulnerability (poor women of the south) or from virtuousness (pro-environmentalist women of the North) perspective is also problematic since such a narrow explanation forces women accept additional responsibility without corresponding rewards and deflects the attention of gender policies (Arora-Jonsson, 2011). Therefore, to control the inappropriate policy narrations to the mentioned assumption, gender should be considered as a conditional element of the society, which is dynamic and is constructed through social processes (Jerneck, 2018). Since it has been clear from the analysis above that gender is a critical social category, its inclusion in climate change research enriches the very understanding of climate change impacts and responses (MacGregor, 2017) - together with gendered-reasoning for policy and practice. However, gender studies must not be segregated from several intersectional issues while constructing in-depth understanding on climate change impacts.

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