



Himalayan Adaptation, Water and Resilience (HI-AWARE) Research on Glacier and Snowpack Dependent River Basins for Improving Livelihoods

HI-AWARE Consortium Report 2018

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Executive Summary

HI-AWARE's overall goal is to enhance the adaptive capacities and climate resilience of the poor and vulnerable women, men, and children in the mountains and plains of the glacier and snowpack-dependent river basins of the Hindu Kush Himalaya (HKH), focusing on the Indus, Ganges, and Brahmaputra river basins, through the development of robust evidence to inform people-centred and gender sensitive climate change adaptation policies and practices for improving livelihoods. The current reporting period covers Year 4 of the implementation of HI-AWARE. The initiative is divided into three parts - generating knowledge, research uptake and strengthening expertise.

Under generating knowledge, HI-AWARE's cumulative research outputs stands at 24 research in top peer reviewed journals including a paper in Nature- Climate Change. This is 4 papers more than the total end of project target of 20. Apart from, this 17 working papers have come out till now. Our research is also appearing in two special issue focussing on gendered vulnerability and urban water issues in Environmental Development and Water Policy journals. These papers focus on high quality and policy and practice relevant research on climate change impacts in HKH region; the drivers and conditions leading to vulnerability; and innovative climate change adaptation approaches and practices.

Our research uptake aims to promote evidence-based and tested innovative adaptation approaches and practices with relevant communities and institutions at various levels. The effort is to improve policies and practices that help vulnerable populations adapt to climate change. Under this component, three pilot initiatives were planned that focussed on solar powered irrigation pump, eco-san toilets and flood resistant housing. In the recent 2017 monsoon floods in Nepal and Bihar (India), numerous people were affected with reported property losses, including in HI-AWARE's pilot areas in Gandaki River Basin in Bihar where eco-san toilets are being implemented. During floods, sanitation becomes a particular problem as people have reduced means of maintaining personal hygiene, especially with regard to defecation. Open defecation only adds to the contamination of ground water, which then affects those who use it for household uses. Ecosan toilets provided respite to people who were inundated. Earlier, the government of Bihar recognized and extended financial approval for ECOSAN as a sanitation facility for flood affected regions where HI-AWARE Partner MPA is working. In Pakistan, the aim of establishing solar pumping systems along with a climate smart agriculture package was to sensitize farmers and that at least ten farmers would adopt the technology. Since the establishment of the HI-AWARE pilot and demonstration many farmers have been visiting the site to gain knowledge about the interventions. Currently, approximately 10 farmers have installed the solar pumping system and related smart agricultural practices at their farms.

The third component of HI-AWARE focuses on strengthening expertise of HI-AWARE research community for conducting high quality research on adaptation issues and communicating and using research results strategically. The six PhD candidates fully supported by HI-AWARE are progressing well with their research and would be completing their PhD by 2018-19. While the first batch of 16 MSc students at the six universities with which HI-AWARE has signed a contract have completed their MScs and the rest are finalising their research and would graduate in 2018.

We are pleased to report that the major project output and outcome targets have been achieved by the HI-AWARE consortium as of April 30, 2018. Below, we provide a table that gives a glimpse of the target and achievement of the programme and few research papers for which the work is ongoing.

Outputs and indicators	Cumulative end of project target (Sept 2018)	Progress as on April 30, 2018
Output 1, indicator 1	1. Two scientific papers (2) (monitoring of high mountain, upstream-downstream linkages) Cumulative targets: - Datasets: 10 + as per	Cumulative – 10 peer reviewed journal articles, 3 working papers; 9 data sets published For other outputs, please see annex 2 of this report

	<p>demand</p> <ul style="list-style-type: none"> - Scientific papers: 9 - Touch table application: 1 - Reports: 2 - Data sharing platform: 1 - Documented public-domain models: 2 - Equipment procured and installed: 4 	
Output 1, indicator 2	<ol style="list-style-type: none"> 1. One synthesis journal article on river basin specific differential vulnerabilities. 2. One synthesis journal article on interrelations and interplay of socio-economic and bio-physical drivers of vulnerability (linking RC2 and 1). 3. One dialogue process in one of the Study Basins to facilitate regional cooperation. 4. One journal article on gender and climate change vulnerabilities. 5. Regional workshop on adaptive strategies for gender inclusive climate resilient development organized and report produced. 6. Cumulative: 4 peer reviewed journal articles 7. Cumulative: 7 Working Papers 	<p>Cumulative: 9 peer reviewed journal article (forthcoming - (see details in Annex 2 of this report) , 5 book chapters (forthcoming), 1 peer reviewed journal article published in EPW, 6 working papers published + 1 working paper on socio-economic drivers is in editing process</p> <p>For other outputs, please see annex 2 of this report</p>
Output 1, indicator 3	<ol style="list-style-type: none"> 1. Review of CC policies of 4 partner countries. 2. Piloting of three climate adaptation practices successful. 3. Four CISCAs established and up and running. 4. Six peer reviewed outputs accepted 5. Four policy briefs published. 6. Two book chapters published. 7. Field monitoring database published (based on CISCAs and springs research). 	<p>Working papers (7) no <u>3</u>, <u>5,6,13, 14, 16, 17</u></p> <p>Peer reviewed Journal articles - 8</p> <p>(11 peer reviewed journal articles on urban water is forthcoming in Water Policy (see details in Annex 3 of this report and for all other outputs)</p>

Output 1, indicator 4	<ol style="list-style-type: none"> 1. Methodologies for assessment of critical moments developed and tested. 2. 12 surveys / workshops conducted to identify critical moments and ATPs. 3. Sector specific and spatially explicit quantification tool for ATPs and identification of hot spots in each basin developed. 4. Two peer reviewed papers on CMs, ATPs, methods, tools and field realities. 5. Mapping of ATPs in the four Study Basins and validation by stakeholders 	<p>Cumulative 5 working paper (1 published, 4 in pipeline), 3 journal articles published</p> <p>For outputs, please see annex 2 of this report</p>
Output 1, indicator 5	<ol style="list-style-type: none"> 1. Synthesis report on stakeholder driven and gender inclusive adaptation pathways. 2. Eight stakeholder meetings on APs 3. 3 reports 4. 2 journal articles 	<p>Cumulative 3 peer reviewed journal articles published 4 peer reviewed journal article and 2 working papers in pipeline</p> <p>For other outputs, please see annex 2 of this report</p>

Apart from the research outputs, the project has achieved major the desired outputs 2 and 3 as per the log frame.. The status of these outputs and outcomes are presented in detail in annex 4 of this report. Below, we provide few highlights of our progress during the current reporting year:

- An article titled '*Impact of a global temperature rise of 1.5 degrees Celsius on Asia's glaciers*' (Kraaijenbrink, et al. 2017) was published in Nature. The article, partly based on HI-AWARE research, shows that a global temperature rise of 1.5 °C will lead to a warming of 2.1 ± 0.1 °C in the Hindu Kush Himalayan (HKH) region, and that the glaciers in the HKH will lose 33% volume by the end of this century in a 1.5 degree world.
- HI-AWARE, together with other organizations, supported the national adaptation plan for Nepal. It has directly supported the study of observed climate trend analysis of Nepal and HI-AWARE data has been used for the projection of climate trends. The report has been launched in February 2018. HI-AWARE was requested by Ministry of Population and Environment (MoPE), the nodal ministry of climate change in Nepal to help in preparing for forty-sixth session of the IPCC scheduled during 6 – 10 September 2017 in Montreal, Canada. HI-AWARE prepared a note for the secretary which was used during the IPCC sessions.
- HI-AWARE provided technical inputs to '**Climate Change Strategy and Action Plan**' of Gilgit-Baltistan', Pakistan. Further, it contributed to a background paper on mountain economy of BIMSTEC (Bay of Bengal Initiative for Multi-Sectoral Technical and Economic Cooperation) region. The paper was submitted to National Planning Commission (NPC) of Nepal. Based on this background paper, NPC prepared a draft concept note for BIMSTEC secretariat for future policy

actions. HI-AWARE data, information and all major recommendations were considered in the concept note. This is a direct policy input to the government Nepal and regional organization BIMSTEC having five of ICIMOD's member countries.

- To gauge this strengthening of research capacity, HI AWARE conducted a capacity building survey across the consortium to assess gains and losses in individual and institutional capacity through the project timeline, based on the perceptions of the researchers involved. The survey was designed on the lines of CARIAA's capacity self-assessment that was conducted in 2015 across CARIAA consortia. It shows that respondents perception of the importance, interest and abilities related to producing high quality adaptation research have increased, not just for them as individuals but also for the institutions to which they belong to. A significant percentage of researchers showed increased capacity. This capacity is also reflected as two of HI-AWARE researchers have been selected as CLA in the IPCC special report on ocean and cryosphere. A lead researcher from TERI, HI-AWARE Co-PI, have been selected for special report on land. Further, HI-AWARE supported two more researchers to be chapter scientists for this report and one contributing author to this report. We are happy to report that 4 HI-AWARE researchers have been selected as lead authors in the IPCC 6th Assessment report.

1.0 Research Problem

The basic rationale for the consortium's research as contained in HI-AWARE's full proposal and Inception Report remains unchanged. The overall goal is to enhance the adaptive capacities and climate resilience of the poor and vulnerable women, men, and children in the mountains and plains of the glacier and snowpack-dependent river basins of the Hindu Kush Himalaya (HKH), focusing on the Indus, Ganges, and Brahmaputra river basins, through the development of robust evidence to inform people-centred and gender sensitive climate change adaptation policies and practices for improving livelihoods.

The main research question for the consortium remains as follows: How to develop timely adaptation measures and approaches to respond to rising temperatures, seasonal shifts in glacier and snowmelt induced runoff, and increased frequency of extreme events in the HKH mountains and floodplains in order to improve the resilience of the livelihoods of the poor and vulnerable women, men and children in the region?

The research activities of HI-AWARE revolves around the main research question described above. In order to answer the main research question, the work is divided into three packages:

Work Package 1 focuses on high quality and policy and practice relevant research on (i) climate change impacts; (ii) the drivers and conditions leading to vulnerability; and (iii) innovative climate change adaptation approaches and practices. All consortium members contributed well to implementing the five Research Components in WP1 and research is now well underway as we head into the final year of HI-AWARE.

Work Package 2 aims to promote evidence-based and tested innovative adaptation approaches and practices with relevant communities and institutions at various levels in order to improve policies and practices that help vulnerable populations adapt to climate change. HI-AWARE has pursued an active policy and stakeholder engagement right from the start, and focused on further developing its KMC and RiU strategies in this reporting period with the active contribution of all consortium members.

Work Package 3 focuses on strengthening the capacity of the HI-AWARE research community for conducting high quality research on adaptation issues and communicating and using research results strategically. The six PhD candidates fully supported by HI-AWARE are progressing well with their research, while the first batch of 16 MSc students at the six universities with which HI-AWARE has signed a contract are completing their course work and starting their thesis research.

2.0 Research Activities and Findings

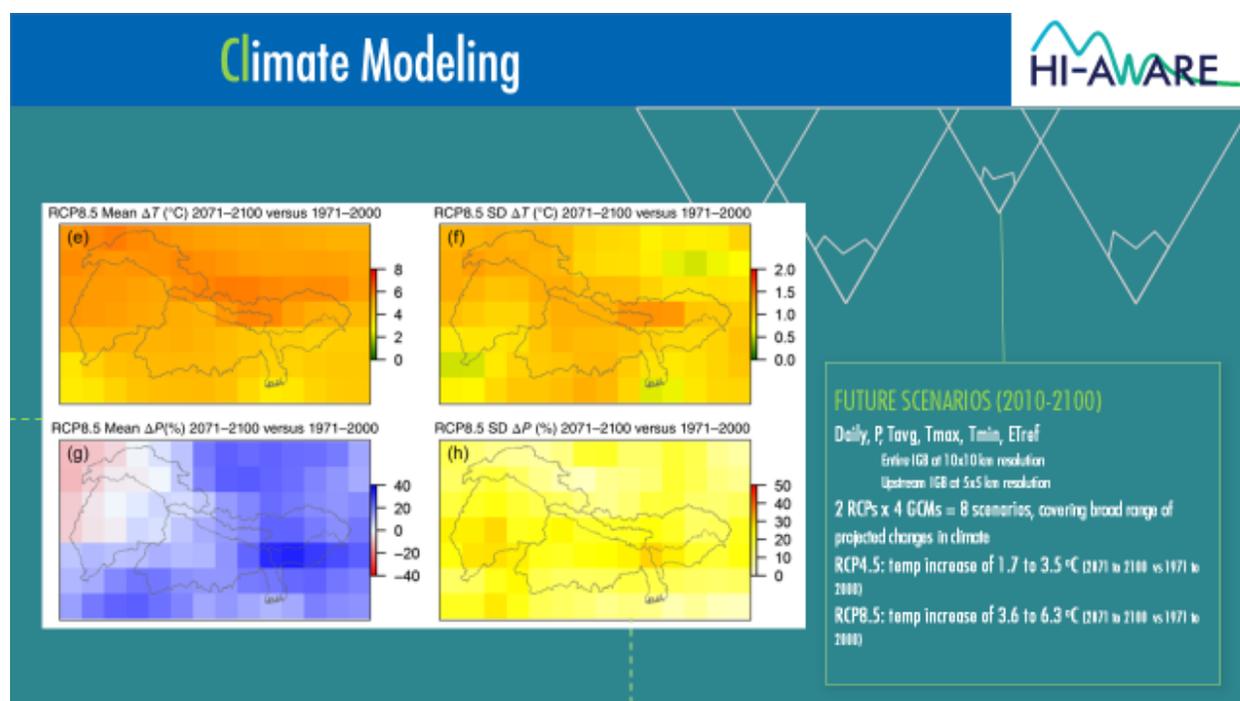
In this section, we would report on work package 1 which is subdivided into five research components (RC1). Work Package 1 of HI-AWARE focuses on generating knowledge through conducting high quality and policy and practice relevant research on [1] climate change impacts; [2] the drivers and conditions leading to vulnerability; and [3] innovative climate change adaptation approaches and practices. The research is divided into five research components to cover these three objectives. This section reports on the major results of the HI-AWARE research based on Output 1 of the logical framework and describes the main research activities (for more details, please see annexure 4 – RC wise output table) .

2.1 Bio-physical drivers and conditions leading to vulnerability and climate change impact (Research Component (RC1) :

The main objective of this research component was to generate scientific knowledge on climate change impacts, vulnerability drivers, and adaptation policies and practices from biophysical perspectives. Accordingly, we studied mountain-specific and basin-scale climate change scenarios, impact of climate change on water availability in the IGB river basins, and climate change impacting extreme temperature and precipitation. We consolidate the major learnings from each of the three components. In total, these new insights are important for global policy issues such as a 1.5 degree world. At the local and national level, it helps in building future scenarios and policy implications for sectors like agriculture and hazards like floods and landslides in HKH region.

2.1.1 Mountain-specific and basin-scale climate change scenarios: It is known that mountain topography and the variability in climate over short horizontal distances makes development of climate scenarios specific to smaller regions very difficult. However, HI-AWARE led a study that resulted in a novel high-quality and high-resolution reference climate dataset (Lutz and Immerzeel 2016) covering the IGB river basins with a particular focus on improved representation of high-altitude precipitation. Covering a 30 year period from 1 January 1981 to 31 December 2010, this dataset was used for the downscaling of the 8 GCMs (4 GCM each for RCP4.5 and 8.5) to analyze future projections for the period of 2016-2045 (representing 2030s) and 2036-2065 (representing 2050s) for the National Adaptation Plan process of Nepal. The draft report is ready and will be launched soon by the Ministry after this has been approved. A new precipitation dataset was developed by Lutz, et al. (2016) which, for the first time, assessed shifts in seasonal water availability in combination with changes in hydrological extremes at basin scale for the Upper Indus Basin. It concluded that despite large future uncertainties in terms of climate and long-term water availability, basin-wide patterns and trends of seasonal shifts in water availability are consistent across climate change scenarios (see figure 1). Analysis of future hydrological extremes reveals that increases in intensity and frequency of extreme discharges are very likely for most of the Upper Indus Basin. It called for sound basin-wide adaptation strategies to be developed across sectors to account for the growing population in the downstream that is dependent on increasingly uncertain water resources.

Figure 1: Future Climate Scenarios



From PARC, an article titled “**Adjustment of Measurement Errors to Reconcile Precipitation Distribution in the High-Altitude Indus Basin**” has been accepted in the International Journal of Climatology. This paper focuses on the precipitation in the high-altitude Indus Basin governs its renewable water resources affecting water, energy and food securities. However, reliable estimates of precipitation climatology and associated hydrological implications are seriously constrained by the quality of observed data. The results showed more significant increases in precipitation of individual stations located at higher-altitudes during winter months, which are consistent with previous studies. The study recognized that the higher river flows than the corresponding precipitation estimates by the previous studies are mainly due to underestimated precipitation. The results can be useful for water balance studies and bias correction of gridded precipitation products for the study area.

The hydrology, vegetation and crop production model LPJmL has been coupled to the mountain hydrology model SPHY in early 2017. Later in the year (within this reporting period) WENR have added the supply through irrigation canal systems in the IGB to the model, as well as the explicit representation of cotton, which is an important crop, especially in the Indus basin. WENR has developed grid specific land use change scenarios, derived from projected increases in population, GDP, dietary changes, productivity and global trade. These projections are derived from global scenarios (SSPs, Shared Socio-Economic Pathways) (Doelman et al, 2018) and downscaled to the required grid level. In this way we ensure to be consistent with projections of developments at global scale, but translated it to the regional context. In an analysis on the drivers of the future water gap, in which all RC1 climate data and model development comes together, we show that the future water gap will mainly be driven by socio-economic developments, leading to increased water demands for agriculture and other sectors, and increasing pressures on non-renewable groundwater reserves, that act as buffer when surface water supply is insufficiently available. Next to addressing the problem, we are now analysing where and to what extent adaptation measures could help in decreasing the gap or lowering the pressure on water resources.

TERI has generated scenario information to enhance knowledge and understanding in mountain regions over the HKH region for selected RCPs using the WRF model to assess the changes in the climate. The dynamic downscaling of climate data is being carried out by TERI for two time periods, one in the past and the other for a future time period, 2000-2009 and 2020-2029 respectively. The research activity contributes to development of mountain and river basin scale climate change projections to be able to assess its impacts on water supply in the HI-AWARE study basins. Ten years baseline (1996-2005) of control

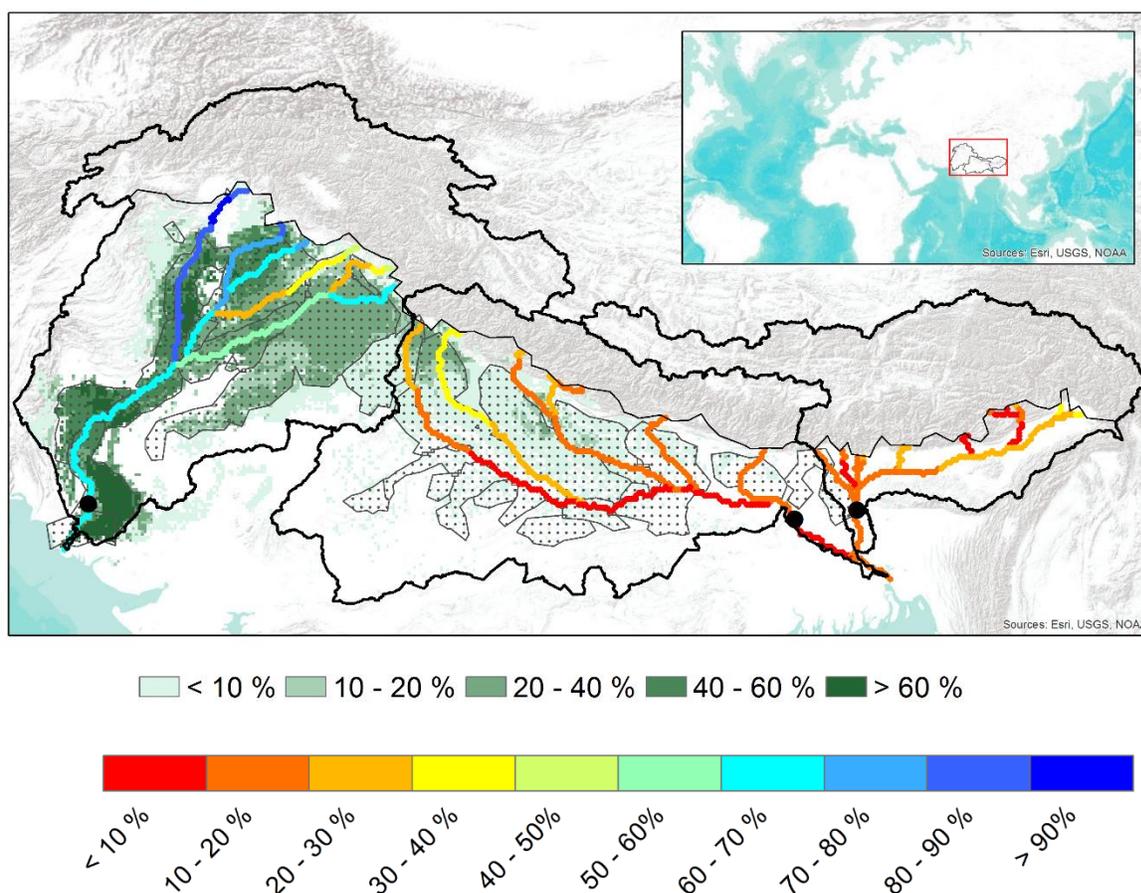
simulations and 10 years future simulations (2020-2029) of future simulation has been completed using CCSM4 The Community Climate System Model (CCSM) version 4 is a coupled climate model for simulating the earth's climate system with initial and boundary conditions. The initial analysis shows a huge bias in mountain regions in the reanalysis baseline simulation data compared with the modelled data. As suggested by the consortium members, the model has re-run for the baseline period 1996-2005 using CCSM4 initial conditions. Currently model simulation has been completed and model post processing is going on to analyze the future changes in rainfall and temperature over four study areas.

A rich database has been generated for the Rathang glacier and is in process of being collected for the Pindar glacier. The deliverable for this component was generation of datasets which is in continuity for the mentioned glaciers where TERI is operating. An automatic weather station (AWS) was installed in Upper Indus Basin at the Mountain Agricultural Research Centre (MARC), Juglot in Gilgit. With the aim to get the weather data and monitor the changes in the weather pattern for assessing the possible impacts on agricultural activities, this weather station is being used. The data from these stations will be valuable for assessing the impacts of climate change on the glaciers and meltwater regime.

2.1.2 Climate change impact on water resources: An article titled '*Impact of a global temperature rise of 1.5 degrees Celsius on Asia's glaciers*' (Kraaijenbrink, et al. 2017) was published in Nature. The article, partly based on HI-AWARE research, shows that a global temperature rise of 1.5 °C will lead to a warming of 2.1 ± 0.1 °C in the Hindu Kush Himalayan (HKH) region, and that the glaciers in the HKH will lose 33% volume by the end of this century in a 1.5 degree world. For survival of high mountain glaciers, it is essential to minimize the global temperature increase driven by policy decisions. Lutz, et al. (2016) published a paper on an approach ensuring that the selected GCMs represent changes in average and extreme climatic conditions well and at the same time reasonably simulate the past climate, with a particular focus on monsoon dynamics. The ensembles of selected GCM runs for RCP4.5 and RCP8.5 show that the uncertainty of future climate in this region is very large. Projections of mean air temperature indicate an increase ranging from 1.7 °C to 6.3°C during 1971-2000 and 2071-2100, averaged over the IGB river basins, with stronger warming at higher altitudes. A report/ working paper presented an extension of the envelope approach where the selected models will span the entire range of possible futures, e.g., dry-cold, dry-warm, wet-cold, and wet-warm.

WENR, ICIMOD and BCAS contributed to a scientific paper titled "**What does a 1.5°C global temperature increase imply for the Indus, Ganga, and Brahmaputra river basins?**" which showed that even a 1.5° warmer world has major implications for South Asia, and especially in the mountains where the temperature rise will be much higher. The impact was analysed using HI-AWARE's own ensemble of climate change projections that were developed earlier (Lutz et al, 2016). In the paper we show that even with a 1.5 degree global temperature rise, the number of warm nights will increase dramatically. These findings help to raise awareness regarding the impacts of climate change, even when very ambitious goals regarding greenhouse gas emissions will be achieved. It stresses the urgency of taking adaptive measures in this region. The paper was submitted in October 2017 to Regional Environmental Change in time to be included in the IPCC special report on 1.5 degree impacts.

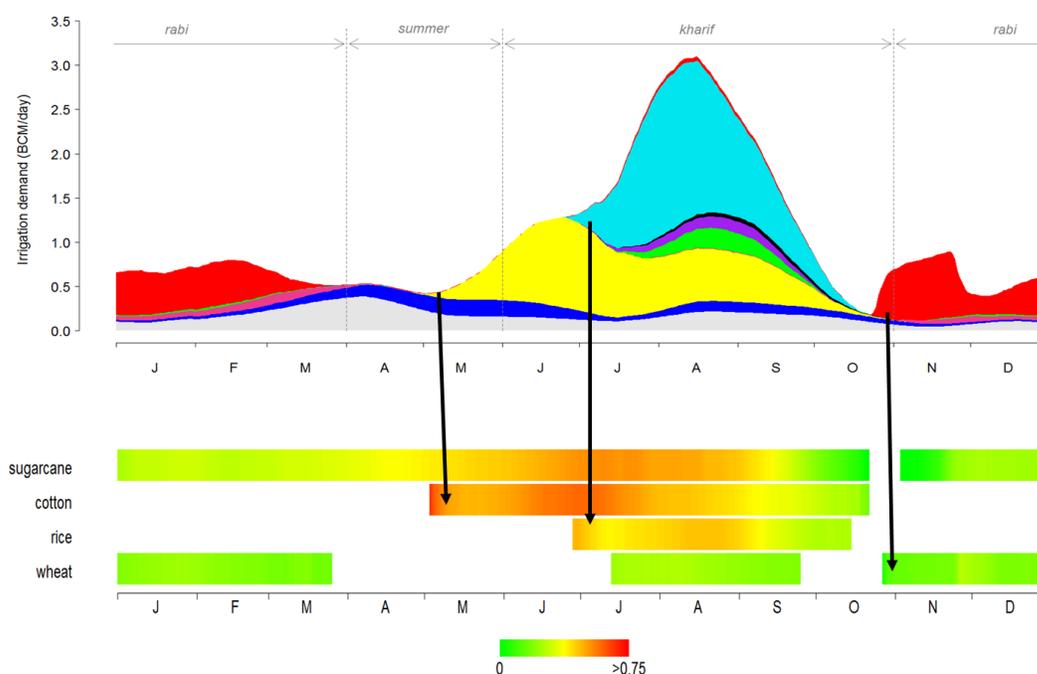
Figure 2: Contribution of snow and glacier melt to downstream discharge and irrigation supply



Source: Biemans et al., 2018 Forthcoming

WENR also estimated the future water gap in South Asia and improved the understanding of drivers behind it, using the HI-AWARE climate dataset ([paper submitted and online](#)). The paper used a combination of all models and products developed over the past years (climate change projections, socio economic developments and corresponding water demand scenarios, the improved mountain hydrology and cryosphere model and the improved hydrology and crop production model for the plains) to increase our insight in current and future water gaps: the first is a scientific paper analysing the drivers behind the current and future water gap in South Asia. The most important outcome of that paper is that the **main driver behind the future water gap in South Asia is the socio-economic development**. Especially the water demand of households and industry are projected to increase at high rates. As the climate projections all show some increase in precipitation, this might compensate for part of the water gap. Since these projections are done with state-of-the-art models and data, they provide the most realistic scenarios possible. The results are very fresh and not yet discussed with policy makers - except for being presented at the CCAPS conference in Pakistan. Usually, scientific work is taken up by policy makers after the publication. We will ensure to put a lot of effort in the dissemination and communication of these results and messages once published. This will be done through various channels, like press releases, blogs and potentially a small movie. To what extent it is taken up by journalists and policymakers is partly beyond our control. The second analysis focuses on the upstream-downstream linkages in the IGB. We analysed where and when crops are depending on water that is generated in the mountains, specifically snow and glacier melt. Figure 2 shows the spatial explicit, mean annual contribution of meltwater to downstream river flows and irrigation supply. We conclude that it is mainly the Indus where meltwater from the mountains plays a very important role in irrigation water supply downstream.

A paper describing the dependency of downstream agriculture on mountain water supply is in preparation. WENR presented this work at the recent CCAPS conference, where it was well taken up by the press (<https://goo.gl/8Pq7yD> ; <https://goo.gl/z3GXVM>) as well as participants. They received one request for a follow up presentation, and 2 requests of people interested to apply the model for their studies.



Subsequently, we took a closer look into the specific crops and time in the growing season when the meltwater is the most important water supply. From the figure below we conclude that **meltwater is an important source of irrigation supply during the warm and dry pre-monsoon period**. Any changes in meltwater availability e.g. a shift towards earlier in the season due to warming, will therefore affect agriculture and require adaptation. A detailed modelling study that increases understanding of current and future water gaps and explicitly links the sources of demand and sources of supply helps in designing the most appropriate adaptation strategies, influencing the water demand, water availability or both. Based on the current results we could suggest to start sowing earlier when meltwater peaks will shift to earlier in the season. Another potential solution is to replace cotton and rice by less water demanding crops.

2.1.3 Climate change impacts on extremes: To understand the hydro-meteorological extremes, a paper titled *Future changes in hydro-climatic extremes in the Upper Indus, Ganges, and Brahmaputra River Basins* has been published in PLOS. The outcomes of this study aim to contribute to a better understanding on the impacts of climate change on hydrological extremes in the HKH region. The study suggests the extremes are likely to increase more than the means. The outcomes may contribute to the development of adaptation strategies to reduce the adverse impacts of changes in climatic and hydrological extremes. The outcomes are sufficiently reliable to extract main trends, but are also subject to many uncertainties, which means the outcomes should be treated with care and improvements are needed in future research on hydrological extremes. Further, WENR has quantified the relationship between upstream water sources and downstream food production (paper in preparation), using the climate-water-food model that has been developed and finalized during the 3rd year of the project. Those analyses were presented during the CCAPS conference in Islamabad, and well picked up by the media present. The model is now ready for use in policy support studies as we have now shown that the model and data is state of the art and covers important processes relevant for South Asian water resources. We are now using the model for outscaling

the effects of adaptation measures in the field of land and water management that result from on-the-ground pilots and mentioned by stakeholders in RC3. E.g. we can evaluate the effect of changing irrigation systems from surface to sprinkler or drip, mulching, changing crops, changing sowing dates, supplemental irrigation on rainfed agriculture. We will do this in the context of climate change and socio-economic developments.

2.2 Socio-economic, governance and gender drivers and conditions leading to vulnerability (Research Component 2):

Vulnerability to climate change is a multi-layered and multi-faceted issue, determined by both biophysical and socio-economic drivers. Socio-economic drivers of change play a role that is equal to if not greater than changing climate in terms of shaping people's vulnerabilities. Further, there are varying gendered differences in vulnerabilities in any context. Not all women or all men are equally vulnerable, nor are they vulnerable in a similar way – vulnerabilities vary in nature and type. However, vulnerabilities to climate change are often studied in isolation and compartmentalization of the various interlinked contextual conditions occurs e.g., social and gender, political, economic and geographical/location, and other socioeconomic drivers of change, such as globalization, urbanization, technological and infrastructure development. This research component looked at three main drivers of vulnerability – socio-economic, governance and gender. We report the major outcomes of these three components.

2.2.1: Socio-economic drivers and conditions leading to vulnerability

Under this component, the focus was on situational analysis and understanding the drivers of differential vulnerabilities in three river basins. This was followed by participatory assessment of socio-economic drivers of vulnerability.

The four situational analysis studies seeking to understand gendered vulnerabilities in the Indus, Upper Ganga, Gandaki and Teesta river basins. These four studies provided very critical insights. The four basins project similar conditions with regard to the impact of climate change on daily lives, where people struggle to pursue age-old farming practices or other livelihoods. These are becoming increasingly threatened by the impact of erratic weather events. In the Indus basin, floods impact agricultural lands of the Punjab province, where communities report increasing frequency of such disasters. The Chaj *doab* is vulnerable to salt intrusions impacting water quality and the crops grown. In the upper part of the basin, capacities of the communities to adapt to changing climate by shifting to newer sources of income requires support from the Government, but policies for adaptation to climate change are yet to be formulated. While the recent flood in Uttarakhand has devastated the entire Upper Ganga basin, destroying basic infrastructure as well as agricultural lands, homes and other assets, it has generated a sense of fear among local communities. Moreover, their dependence on tourism for a large part of the year is slowly turning out to be a bane, as the number of visitors have declined impacting their incomes. Agriculture-dependent communities are further vulnerable as water available for irrigation is declining due to retreating glaciers that impact water sources and overall poor irrigation infrastructure which does not facilitate farming practice. Similar trends are seen in the Teesta, where traditional crops are no longer being cultivated due to warmer weather conditions in the upper part of the basin in Sikkim, India and changing soil characteristics in the lower part of the basin in Bangladesh. In both the countries, drinking water crises are extremely acute during the dry season.

The Gandaki river basin in Nepal and India is particularly threatened by floods and shifting river courses, which wash away arable land and damage water sources. Even in high rainfall areas, people face water scarcity and are turning to rainwater harvesting as an alternative (see the blog by Menaka Hamal – see picture 1) Further, earthquakes worsen the situation as spring sources are damaged, incidences of landslides and mudslides increase and cultivation is impeded. As a result, younger populations migrate to nearby towns and outside the country for employment opportunities. Landslides also destroy forest cover, which contributes to making the land more unstable. The lower part of the Gandaki basin in India is most vulnerable to floods, which cause submergence of land for 4-6 months, creating large-scale unemployment. Communities migrate to other states as agricultural labour leaving their families behind, or they seek work in other local farms where they can be exploited by rich landlords. Support to communities by private agencies is higher in the upper Gandaki as compared to the lower Gandaki, where government initiatives

are minimal and more effective solutions are required. In Bangladesh, rice is being replaced by maize due to the negative impacts of large sand deposits which accumulate during flash floods. Additionally, Bangladesh is impacted by food insecurity during the summer when water tables decline drastically. To help in meeting the nutritional needs of families, policies and programmes have supported vegetable cultivation in homesteads and rearing of livestock and poultry. These are activities in which women are engaged and thus benefit from the policies and programmes. In Sikkim, policies have been successful in building the adaptation capacities of communities through policy emphases on tourism, regeneration of spring sources, organic cultivation, and promoting a green environment, along with the role of DZUMSA-community-based groups that recognize the importance of sustainable growth.

Picture 1: A pipeline connecting the roof of a school building and a rainwater harvesting tank in Damauli, Nepal



Source – [Blog](#) by Menaka Hamal

The first draft of the synthesis report titled “**Participatory assessment of multiple socio-economic drivers and climate stresses leading to differentiated vulnerabilities in the Hindu Kush Himalayan region**” has been shared with the consortium partners for further improvement and comments. The report will be published as a working paper after getting others input and addressing comments. Identification of climatic stressors has been done through hazard mapping and prioritization, seasonality calendar, vulnerability matrix. Data on socio-economic stressors was collected through using tools like village profiles, ethnography, social ranking, social stressor analysis, stakeholder mapping. The synthesis report revealed that climatic factors and socio-economic drivers and conditions are leading to vulnerabilities of marginal groups in all four study basins. The most vulnerable social categories are wage earners, marginal farmers, fishermen, lower caste people, people of low access to politics, char dwellers, women, tea pickers, and migrant families. The study also summarizes the community perceptions on socio-economic drivers and climatic stressors and their impact in key sectors e.g., agriculture and food security; rural employment and wage earning; water, sanitation and health; infrastructure and housing; hydrology, ecosystem and fishing; and tourism, and energy. The detail report can be accessed through [this link](#).

A journal article titled “**Differential socio-economic drivers leading to vulnerability: Evidences from the Hindu Kush Himalaya**” has been drafted. The manuscript considers differential socio-economic drivers leading to vulnerability of communities in 12 study sites in four river basins in the Hindu Kush Himalayas. This study aimed at better understanding of the nature and types of socio-economic drivers in context of increasing climatic stresses in four river basins in the Hindu Kush Himalayas applying different participatory methods involving communities and actors. Climate sensitive natural resources based livelihoods are severely affected across the river basins, while poor and marginal sections cannot take adequate adaptation measures due to lack of capacity, resources and innovation, which push them into greater

vulnerability. These often enhance or reduce the adaptive capacity and vulnerability of the communities. The first draft of the full manuscript can be accessed through [this link](#).

2.2.2 Governance divers and conditions leading to vulnerability

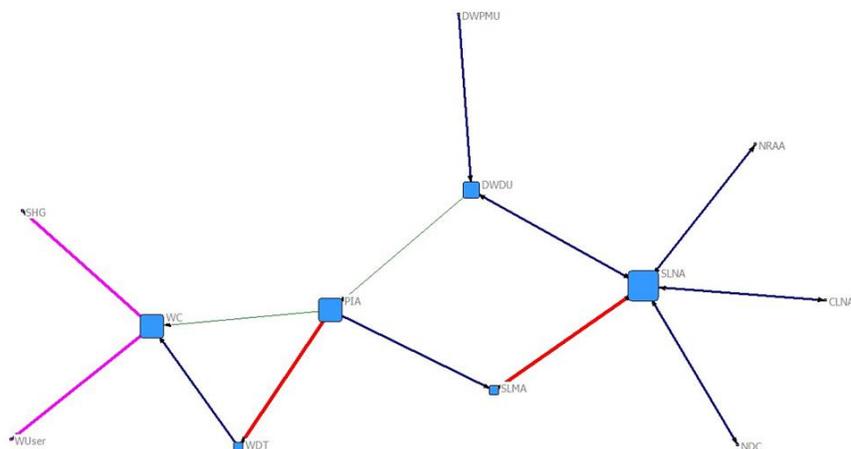
Under this component, the focus was on reviewing existing legal and administrative framework for governance and locating drivers leading to vulnerabilities. Second focus was on understanding existing statutory and customary institutional mechanisms and their strengths and weaknesses leading to vulnerability and adaptation. The third aspects of governance drivers focused on understanding the multi-level transboundary governance structures and mechanisms for regional cooperation. The first two tasks were led by TERI and third task was led by ICIMOD.

For understanding legal and administrative framework, TERI has synthesized a report taking inputs from all partners on reviewing the institutional architecture for water resources in different levels of polities of HKH region around the water sector. The three specific components that were to be reviewed were: 1) Constitutional arrangements in respect to water governance of HKH Countries; 2) State specific water law and institutional arrangement for water governance; 3) Impacts of climate change on water governance – the broad policy response. The major conclusions that came out of the study are the following: 1) Constitutions of all the countries in the region provide a basic framework for water governance. The report is being finalized in April 2018 and will be submitted for publication.

For understanding existing statutory and customary institutional mechanisms and their strengths and weaknesses, TERI as the lead had proposed a case study based framework to understand the statutory and customary institutional around the case studies selected in the study areas. In its study areas, TERI has chosen the Dhara Vikas Programme of the Government of Sikkim to evaluate the Governance surrounding the implementation of the scheme and the various actors involved using Social Network Analysis Techniques and tool named UCINet. The TERI team has collated the findings in the Teesta belt and summarized it in a paper titled **“Unpacking governance structure using social network analysis – A case study of spring-shed management in Sikkim, India”**. The paper is led by a PhD student with contributions from the HI-AWARE team in TERI, students at the University and University Faculty. For Teesta Basin, the institutional analysis of springshed management in hills of Teesta basin (Sikkim) demonstrated how actors like Gram Panchayats are not only a local government organization but also repositories of spring discharge data and actors like para-hydrogeologists and barefoot engineers are not only street level bureaucrats but also important connectors of knowledge and local governance. Thus though schemes like Dhara Vikas Yojana (in Sikkim) are successful today, the sustainability and replicability of such interventions depends on recognition of new positions (e.g. that of data repositories and knowledge connectors in springshed study) and relationships (our study showed that apart from top down relations like funding, information and command among actors of springshed management, a 4th relation of stakeholder need has emerged) that emerge in the course of an intervention period.

Further, a country level network analysis of the various actors involved in the IWMP was done. For Upper Ganga basin, the Integrated Watershed Development Program of Government of Uttarakhand was identified for further analysis. The research aimed to understand the institutional arrangement in Integrated Watershed Development Program of Government of Uttarakhand by mapping the actors involved and the relationship they share among them. The map thus created will help in understanding different aspect of the institutions, which is further analyzed through Network methods. Social network analysis (SNA) is a methodology to understand a given context with an actor- relationship perspective. The network diagram made from UCINet shows that degree centrality of State Level Nodal Agency (SLNA) is high, followed by the Project Implement Agency (PIA) and the Watershed Committee (WC) in comparison to user groups and SHGs who show up as peripheral actors having very low powers. This shows a mismatch in the power distribution in the execution of the programme and highlights the need to engage gram panchayats and user groups locally in the overall management and decision making processes of the watershed program. Another valuable insight is to increase the involvement of non-government organizations with the gram panchayat, other user groups to ensure better operation and maintenance and execution of the scheme on-ground.

Figure 2 SNA indicating the role of various actors in the IWMP and the centrality of powers



Understanding transboundary water governance in HKH

The querulous nature of transboundary water governance is as old as the concept and practice of transboundary water management. Its discourse is now overwhelmed by attempts made and lessons learnt in transboundary water management. Against this background, this paper presents a systematic inquiry into the rationale behind transboundary cooperation in order to reinforce and inform further research on and practice of transboundary water governance in the Hindu Kush Himalaya (HKH) region. Why should riparian countries collaborate with each other to form a transboundary alliance? HI-AWARE's review titled - *Transboundary Water Governance in the Hindu Kush Himalaya Region: Beyond the dialectics of conflict and cooperation* attempted to provide a justification for a pragmatic approach to transboundary water governance that goes beyond the dialectics of conflict and cooperation, particularly for countries in the HKH, where research evidence suggests that such a governance system could have momentous socio-economic as well as political implications. Research dedicated to finding this rationale is restricted to secondary-data analysis based mainly on national and international level research-based perspectives on the need for transboundary water management. The main objective of the review was to aid the understanding of the current status and conceivability of transboundary water management in HKH countries to ultimately help in policy and decision making.

2.2.3 Gendered vulnerability

HI-AWARE's gendered vulnerability research started in 2016 with gender- and social-based perception mapping of climate change impact in the high mountains, mid hills and plains across 12 study basins. There were three components of this study – first to understand Gendered perceptions and vulnerability of climate change shocks. Second to identify the coping and adaptive strategies adopted by men and women to offset the effect of climate change. The third aspect was to look at social networks and collective action. First two tasks were led by ICIMOD and the third task is led by TERI. The fourth component is to plan a dissemination workshop which is scheduled in August 2018.

For the first two tasks, fieldwork was conducted through gender differential vulnerability assessment and perception of climate change shocks. The data were collected in 2017 and from January 2018, these vulnerability assessments and data on perceptions are being compiled into academic papers. The key message coming through is that climate change vulnerabilities are manifestations of interlinkages and an intersecting of the contextual conditions and socioeconomic drivers of change against the backdrop of climate change and therefore these conditions and drivers should not be compartmentalized. The early results of the study show that the impact of climate change is more profound in the HKH and expected to create more disasters and greater destruction. The gender division of labour is highly skewed, and in recent years, with increasing male-outmigration, women's workloads have intensified without corresponding increases in access to resources, decision-making and secure land rights. The empirical research show that manifestations of gendered vulnerabilities in the climate change context is an interplay of external factors such as market forces, consumerism, urbanization, globalization, infrastructure development and technological intervention in a certain place and time combined with internal geo-political -socioeconomic

factors of social and gender structures. These are now captured in a Special Issue of the Journal *Environmental Development - Conceptualizing and Contextualizing Gendered Vulnerabilities in the Hindu Kush Himalayan Region*, forthcoming in August-September 2018 (see Annex 2)

To understand social networks and collective actions, field work was conducted in the plains and mid hills case study villages of Upper Ganga (Uttarakhand) and in high altitude and mid hills of Teesta (Sikkim) – West and North Sikkim. Narratives so far in **Sikkim** have demonstrated that the community retains certain elements of egalitarian practices where both men and women usually have access to control of resources and also have decision making role in important activities like farming, cattle rearing, collection of fuel wood etc. Women are also able to access available education, employment opportunities, information and support from institutions and networks. These factors could better help them manage the impacts of climate change. However, the climate change is bound to affect disproportionately the marginalised communities irrespective of gender.

Narratives so far from **Upper Ganga** have demonstrated that men and women interpret experience and respond to climatic and non-climatic changes concurrently. The division of labour between men and women reflected a strong dichotomy between the ‘house’ (unpaid labour) and the ‘outside’ (paid labour) which is rooted in the intersectionality between caste, class, religion and cultural dynamics. Extreme climatic events, erratic rainfall patterns, human-animal conflict, water scarcity, low agricultural yield were all observed as reasons for a shift from agriculture to adventure tourism or hospitality industry. Since the adventure tourism is perceived as a male domain, men migrated and women were hardly involved in such activities. These villages have been witnessing **feminization of agriculture** where women are involved in all aspects of agriculture, from crop selection to land preparation, to seed selection, planting, weeding, pest control, harvesting, crop storage, handling and marketing. However, they limited access to information and financial resources, as well institutions and social networks

2.3 Monitoring and assessment of climate change adaptation practices (RC3)

RC 3 monitored and assessed the different climate change adaptation practices, in order to promote uptake of robust evidence generated at various scales through the development of synergies between science-based knowledge and adaptation practices of communities and to shape improved policies and practices that help vulnerable populations adapt to climate change.

This component has four tasks. **First** to review existing climate change adaptation practices, **second** to identify and analyses important adaptation practices, **third** to develop robust evidence and **fourth** to develop new approaches to adaptation practices. Below, we report on all the four aspects of this research component.

2.3.1 Review of existing climate change adaptation practices and policies

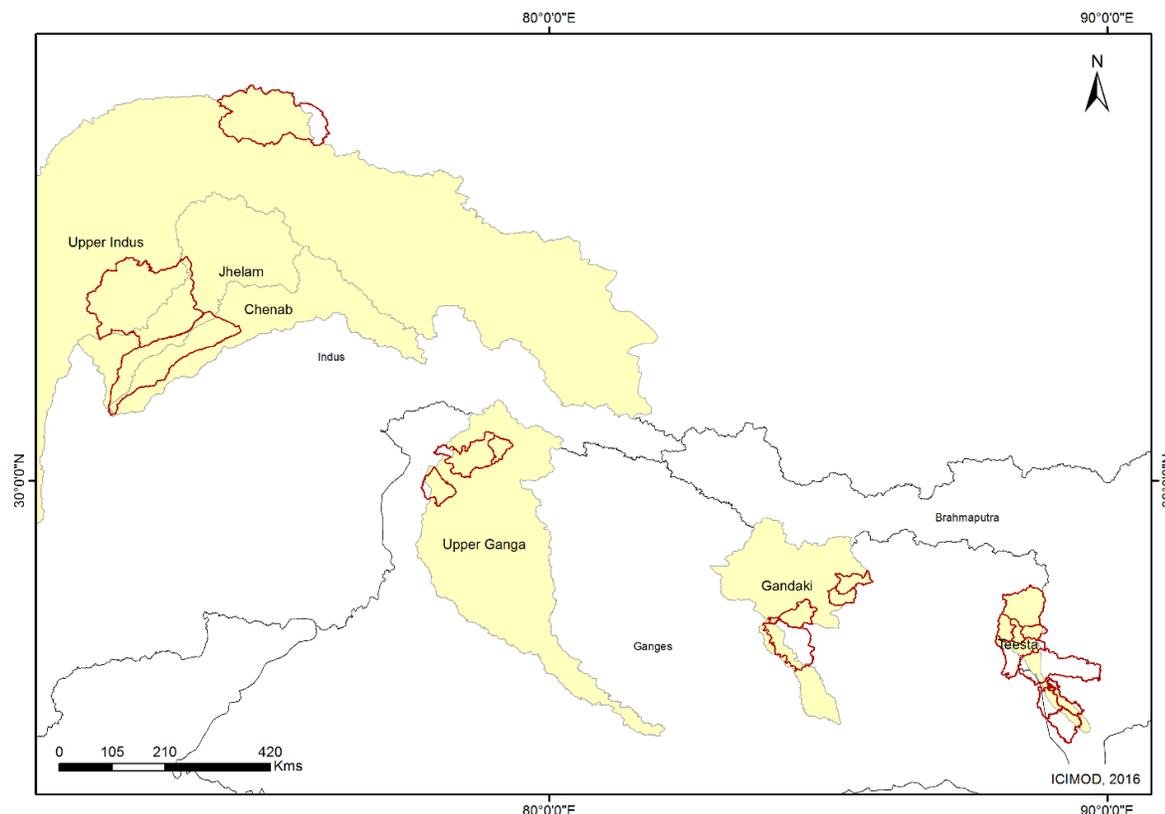
In this component, we focused on systematic review of existing climate change adaptation practices relevant for the HKH region particularly focusing on: (a) agricultural water management, climate change and high altitude livelihoods, with a focus on glacier and snow fed irrigation; (b) climate change adaptation in the hills; and (c) the drying up of springs and domestic and drinking water issues in cities located in the hills and mountains.

A study by Devjit Roy Chowdhury and Sugat B. Bajracharya on *Water Management Technologies for Climate Smart Agriculture in South Asia* reviewed selected agricultural water management technologies positioned as climate smart agriculture (CSA), in South Asia. Using the Delphi process, three technologies were shortlisted - zero tillage (ZT), solar-powered irrigation pumps (SPIPs), and micro-irrigation (MI). The technologies were then evaluated on their climate smart aspects. The analysis showed that introduction of climate smart technologies leads to a rise in productivity, and water and energy savings at the field level. If this is extended from the field to the basin level, widespread adoption of such technologies may increase water and energy consumption, thereby offsetting the initial efficiency gains of climate smart technologies. A lack of rigorous impact assessment of these technologies indicates scope for more internally valid evaluation methodologies.

A study assesses high altitude livelihoods, ***Evolving High Altitude Livelihoods and Climate Change: Insights from Rasuwa District, Nepal*** has been accepted for publication by the journal, *Food Security*. The study is part of a broader HI-AWARE framework on the linkages between high altitude irrigation systems and food security and livelihoods. The study was conducted in four Village Development Committees in the high mountains of Rasuwa District, Nepal and focused on understanding people's responses to and perceptions of the opportunities and threats characterizing livestock and both rain-fed and irrigated agriculture. The study found increasing investment in agriculture in the high altitude study areas. One example of such investment is increased vegetable growing in response to new market opportunities. This study also found that perceptions of climate change impacts are mixed to date: and that people perceive that changes in patterns of snowfall and snowmelt, rainfall, and temperatures have both positive and negative impacts. Data from the study describes household adaptation techniques varying from making changes in cropping patterns, integration of livestock in agriculture and adoption of non-farm income activities. The paper concludes that there is need of further research based on socio-ecological systems and sustainable agricultural ecosystems concepts that would examine the range of agro-ecosystems rather than focusing too narrowly on agriculture.

The study of **springshed management** as a climate change adaptation action in the HKH was commissioned with HI-AWARE's strategic partners to understand the drying of springs and to fill research gaps using a commonly accepted methodology and framework, and to provide recommendations from pilot sites in the Indus basin (North Pakistan), Upper Ganga basin (North West India), Gandaki basin (Mid Nepal) and the Teesta basin (East India) – (see figure 2). The study found that there is increasing scientific evidence that springs are drying up or their discharge is reducing throughout the HKH and as a result communities are facing unprecedented water stress. Springs and their significance for water security in the Himalayas remain poorly understood, as do the livelihood implications of changes in these springs. Moreover springs are generally overlooked in matters of administration and conservation. Both spring drying and its consequences is a regional is cutting across the entire HKH region. In the last decade, the state Government of Sikkim in India along with research partners initiated the "Dhara Vikas Initiative" with a focus on reviving drying springs in dry areas of the state. This has led to raising awareness among relevant researchers, practitioners and policy makers in the HKH to develop skills and share knowledge on this critical topic around the HKH region. Given the regional nature of the problem this research was carried out under HI-AWARE facilitated through ICIMOD with partner organisations. The research findings are under review and will be published in the form of working papers and journal articles. It would also be shared with stakeholders in the region to inform researchers, policy makers and practitioners for the governance and management of springs. The output of the spring-shed work is a synthesis report of each basin suggesting potential recharge areas of reviving springs for local government / administration, practitioners, NGO's and communities living in the areas.

Figure 2: Location of spring-shed management study



Based on an understanding of the vulnerabilities and the various drivers influencing vulnerabilities, amongst the sites that TERI was working in, a suitable site that could justify research on the drying up of springs and water availability issues was identified. It was felt fit to locate this assessment in the Devprayag block covering some of the sites wherein there have been reflections by communities on water scarcity and spring discharge issues. The geological survey indicates, the presence of hard crystalline rocks in the district, Tehri Garhwal, making groundwater an already scarce resource in this part of the mountains. On the top of it, due to recent changes in rainfall patterns the infiltration contribution to groundwater recharge has further reduced. 45% of the chosen springs have been found to be in a critically endangered stage. Water crisis has been perpetual, in spite of numerous existing water supply schemes. Critical springs in the selected site were identified and mapped and the social and governance aspects related to springs were studied. Springs mapped in the identified location include springs that fall in both perennial and seasonal categories. A study on the springs located in the study area of HI-AWARE i.e Murree is being conducted by PARC using four step research methodology and approach on spring-shed management developed by ICIMOD. For this research, field work in Rawat, one of the selected Union Council of Murree has been completed. GIS mapping of the UC Rawat and Urban Murree is completed while hydrogeological mapping of selected springs is in process. 23 out of 29 springs have been identified during the field visit of Rawal, Murree. PARC team is also collecting water samples from springs and analyzing its chemical and biological properties. The final report of this study will be completed by May, 2018 and will contribute towards the indicator 3 of output 1. Feasibility analysis for spring-shed rehabilitation in Dhoke-Chahwan cluster of Sandhian village in Murree has been done.

Melt-Water Irrigation Systems in High Altitude areas of HKH Region: The review of pertinent literature for this study has been completed. The research design had been completed and the research has followed a participatory rural appraisal approach. 13 Focus Group Discussions have been completed in different villages of Hunza and Nagar District (Collectively from the Hunza basin). 23 Irrigation Systems across Hunza basin have been digitized using satellite imagery and GIS tools. Secondary data for vulnerability analysis has been obtained for the irrigation systems under consideration. The working paper for the study

is being populated with the results of the analysis of the collected data. An abstract of the Journal article has been accepted in the Mountain Research and Development (MRD) journal. The full article will be submitted to the journal by June 2018. A blog on irrigation system in Pakistan was published. ([Link](#))

Another assessment of **Hydropower as a renewable energy source in the Hindu-Kush Himalayan region** has been completed and is under review process for publication. Drawing from the case of four HKH countries—Nepal, Bhutan, India and Pakistan, this paper investigates the current status of hydropower generation and related legal provisions/ policies, and attempts to identify the key challenges and opportunities to improve hydropower generation in the region. The study suggests a holistic framework for regional cooperation on hydropower generation in the HKH region. Analysis is based on the reliable official documents and published studies on hydropower development in the selected countries. There are several challenges to hydropower production in the HKH countries such as conflicts on land acquisition, displacement of families, remoteness of potential areas and associated high transmission costs, environmental impacts, displacement of local people, low investment by banks, noise pollution, waterlogging and soil erosion, deterioration of water quality, and loss to animals, birds, and plant diversity as the key constraints hindering efforts to improve hydropower production. For instance, In India, out of 3600 large dams, 3300 have been built after independence, resulting in displacement of nearly 30-40 million people (Sharma and Thakur 2017). In Indian Himalayas, if all under construction or proposed dams (nearly 300) are completed, it may result in extinction of 22 angiosperm and 7 vertebrate taxa (Pandit and Grumbine, 2011). Despite these challenges, hydropower still remains one of the most environment friendly and cost effective option for achieving renewable energy goals in the HKH region. It may contribute to improvement of agricultural productivity through water storage and timely availability in irrigation systems, particularly in drought affected agricultural areas. There are significant complementarities and synergies among the HKH countries for hydropower generation, opening the doors of opportunities for regional cooperation. Number of bilateral electricity exchange initiatives have been started, still waiting for implementation actions.

The study of **urban water issues in Himalayan Towns** started with a review and turned into a broader study with primary data collection as there were very few studies on urban issues in HKH region. We found that unplanned urbanization is causing significant changes in land use and land cover with recharge areas of springs getting reduced. Climate induced changes in the physical environment comprise of increase in rainfall variability and heat stress. Heavy rains are leading to more landslides while increase in average temperature has caused glacier melt and subsequent change in hydrological regimes of the region. These critical stressors – climatic and non-climatic, are adversely affecting the socio-ecology of urban conglomerations in HKH region. Encroachment or degradation of natural water bodies and the disappearance of traditional water systems such as springs are evident. Most of the towns in HKH region meet their water needs using supplies from springs, ponds and lakes which largely interlinked systems. While water availability in these towns has been adversely affected by the climatic and socio-economic changes, demand for water has increased many folds. Some of the towns are major tourist attractions that creates floating population in peak tourist seasons challenging the carrying capacities of the towns. The local residents have to cope with water scarcity as demand of water increases in peak seasons and water distribution through the public water supply systems becomes highly inequitable. The usual challenges of utilities being inefficient applies in these areas too though it becomes much more critical as the sources of water are limited and the local geology hardly supports accessing groundwater unlike in the plains. All these processes are resulting in increased water insecurity for the poor and marginalised in urban towns of HKH. The research fills in an important knowledge gap on grounded research studies from Himalayan towns. The revelations confirm the assumptions from grounded data and that could be considered as a contribution which has implications for future programming.



[Urban water research was presented as a poster in Cities and Climate Change Science Conference at Edmonton, Canada, during March 5-7, 2018 – inset - Dr. Bruce Currie-Alder of IDRC at the conference]

These studies are now accepted as special issue in Water Policy Journal. It covers discussions revolving around the concerns of water insecurity in twelve towns from five countries of South Asia. It focuses on present state of knowledge about water scarcity in these towns and maps future challenges they would face in 'business as usual' scenario. These cases are coming from primary research and address fill an important knowledge gap about the status of water resources and water supplies in the Himalayan towns (see annex 3).

2.3.2. Identification and prioritization of important adaptation practices and approached by stakeholders

Under this section, ICIMOD-HI-AWARE has carried out intensive programme for understanding adaptation needs and options contain a wide variety of interventions, reflecting their multi-faceted nature.

Stakeholder driver prioritization in Gandaki and Indus River Basin

Gandaki River Basin: The study titled - What Constitutes Successful Adaptation Measures? Reflections from the National and Local Context of Nepal identified elements of successful adaptation measures and criteria for evaluating them for which the method of Multi Criteria Analysis (MCA) was used. Participatory methods such as focus group discussions and interviews with key informants were included. District level workshops were organized to collate data and information. The findings showed that elements of successful adaptation options are context-specific, and vary between and among different stakeholder groups and scales of prioritization of evaluation criteria. These criteria also vary on a temporal scale (locally, sub-nationally and nationally). The findings imply that a blanket approach for understanding successful adaptation and evaluating adaptation options is not applicable at all levels. Instead, a context-specific and stakeholder-based understanding and application of the elements of successful adaptation and evaluation criteria will prove more useful for designing effective adaptation options.

Indus River Basin: This study was carried out across the three HI-AWARE Project Sites in Indus Basin, namely Hunza (High mountains), Soan Basin (Mid hill) and Chaj Doab (Flood plains). Both autonomous and planned adaptations have been enlisted after thoroughly reviewing published and grey literature. Some focus group discussions and key informant interviews were also held in order to know about people experiences, perceptions and existing practices that they are carrying out to sustain their livelihood. Current study identified that communities are adopting climate change through diverse adaptation measures in different sectors. These include mix cropping, tunnel farming, solar water pumping, micro hydel, drought resilient crops and different water conservation technologies. The review of literature throughout the Indus Basin shows that communities are coping with both autonomous and planned adaptation measures. But it was identified that households are particularly focusing on short term adaptation measures. The study identified that, there is need of practical based climate change trainings and awareness workshops for vulnerable communities residing in the mountains of HKH regions in Pakistan. The study also documented some planned adaptation measures in the shape of case studies. The case studies shows that these adaptation measures are found more effective and highly helped full in reducing the climate vulnerability and enhancing the adaptive capacities of communities in face of climate change. The present analysis implies that for better competing with the climate change issues, multi-sectoral approach should be considered involving stakeholders from all the major sectors like Water, Health, Energy and Agriculture. Besides, educational institutes and universities should direct their research on these lines. Developing and promoting climate smart technologies in agriculture, alternate energy and water resources will help vulnerable communities to adapt to the changes easily for their sustainable livelihood development.

As part of an extensive review of coping and adaptation measures, both autonomous and planned, a study has been conducted titled "Adaptation Strategies and Practices in Lower Teesta basin in Bangladesh". The first draft has been submitted to HI-AWARE-RC3 working group for incorporating in the synthesis report of the existing adaptation strategies in four river basins in the Hindu Kush Himalayas led by PARC. It has briefly discussed the national, regional and international interventions with regards to existing policies, strategies and action plans. The implications of various policies adopted at national level are not found very satisfactory at the field level since their integration by sectors and ecosystems are not adequately or not at all addressed. However, adoption of Community Based Adaptation to Climate Change (CBACC) approach has got the priority over other initiatives. Hence, higher level research for innovation in the area of adaptation options, new tools and technologies, improvement and promotion of the tested

existing practices/options by sectors and ecosystems are necessary for improvement of the livelihoods of the people of the study area. Flood protection and erosion management scored high in the left bank of case study while agriculture, and health and sanitation were found very important. There are different perspective and priorities based on their working experience, institutional responsibility and global point of views. Finally, community and upazila level people want immediate action to implement but regional level stockholders are thinking in a long-term basis at different views and perspective for planning, capacity building, resource allocation, better implementation and in the long run, achieving sustainability.

A report has been prepared titled “**Stakeholder driver prioritization of adaptation practices in lower Teesta basin in Bangladesh**”. The stakeholders at different levels at village, upazila (sub-district) and division (county) levels identified and prioritized adaptation options. The study revealed that multi-stakeholder driven prioritization of available adaptation practices at sectoral, multi-sectoral, and cross-sectoral levels shows quite robust evidence of evaluation of adaptation priorities which may be taken care of by the government, non-government and international organizations. Differences in vulnerability were reflected by differences in priorities set by stakeholders at different levels across the study areas. The report can be accessed through [this link](#).

A manuscript has been drafted titled “**Cost-benefit analysis of climate change adaptation in the lower Teesta basin in Bangladesh**” as a part of activity 3.4. This study aimed at recording the most promising adaptation practices, their economic cost and socio-economic benefits in the Lower Teesta Basin (LTB) following the methodology developed by WB (2008). Among other things, the study revealed few adaptation practices with higher cost, but generating lower benefits to the farmers and vice versa i.e., high-costs but low-benefits. The first draft of the manuscript can be accessed through [this link](#).

Another assessment of **Hydropower as a renewable energy source in the Hindu-Kush Himalayan region** has been completed and is under review process for publication. Drawing from the case of four HKH countries–Nepal, Bhutan, India and Pakistan, this paper investigates the current status of hydropower generation and related legal provisions/ policies, and attempts to identify the key challenges and opportunities to improve hydropower generation in the region. The study suggests a holistic framework for regional cooperation on hydropower generation in the HKH region. These critical stressors – climatic and non-climatic, are adversely affecting the socio-ecology of urban conglomerations in HKH region. Encroachment or degradation of natural water bodies and the disappearance of traditional water systems such as springs are evident. The paper is under review for publication.

Farm level data collection survey for a Technical study titled “**Cost benefit analysis of citrus farms in Chaj Doab, Pakistan; A comparison between conventional and improved irrigation methods**” was carried out in tehsils of Sargodha, Kot momin, Bhalwal, Sillanwali, Mandi Bahauddin for citrus farms. 30 Farmers practicing flood irrigation with inter-cropping in citrus orchards were visited and questionnaires were filled. Farms using HEIS in citrus orchards were visited and issues were listed.

Meteorological Monitoring Under HI-AWARE - As part of Meteorological data observation and monitoring, TERI has installed two more AWS in their study area in Uttarakhand and Sikkim on May 2nd and on August 1st 2017 respectively. Over this period we have been recording weather parameters of Rainfall, Temperature, Humidity, Incident Solar Radiation, UV Radiation, Wind Speed and Wind Velocity. AWS installed in Upper Ganga Catchment in the pilot site at Huddu village in Rudraprayag district of Uttarakhand State is providing weather information to the farmers in the pilot site where TERI is undertaking certain interventions along with SHARD. On other hand, in Sikkim the AWS installed in 15 acre Cardamom farm in Singtam near Gangtok was done with the objective to co-relate the weather information to the crops grown and undertake research over a longer period of time to study crop-weather responses and interventions needed in policy and practice.

CISCAs were formulated to engage the communities and empower them with information on weather based services and improve the planning. Understanding the needs of the local populace and the preferred communications methods and channels will help improve the effectiveness of the strategies. To this effect, TERI along with ALTERRA has initiated a preliminary participatory research into understanding the usefulness and applicability of the installed automatic weather stations to the communities. This would help

in planning for improved dissemination of the data being collected, making the whole process citizen-centric. Though the eventual aim of this strategy is to help in on-farm, off-farm decision making, limitations currently exist as the data being collected and the forecasts being generated are valid only for an immediate time frame (~12 hours). Therefore, it is still to be assessed how useful is the information at short time-steps to farmers for planning.

Monitoring, Piloting and Assessment of Climate Change Adaptation Practices: In the experiment on improving agricultural practices that TERI is conducting in the high elevation site of Huddu, a series of interventions and local capacity development programmes have been taking place over the period April '17-March '18. In collaboration with the Society for Himalayan Agriculture and Rural Development (SHARD), the first potato harvest on a large scale was witnessed. The total produce was around 7,500 kilograms – harvested in July '17 - and has reaped a significant Rs 1.50 lakhs approximately for the community. During the same period, the local farmers were also trained in agricultural practices, including sowing, managing, harvesting and marketing, of potato, kidney beans and peas that could aide in them capitalising on the opportunity at hand. Post this, a massive exercise of distributing horticultural crop of cardamom to substantiate incomes, was carried out pan-village. A total of 550 saplings of cardamom were distributed amongst the villagers and the locals were trained in its cultivation and harvesting techniques. Towards the end of 2017 and the beginning of 2018, another exercise leading to income augmentation was carried out – keeping in mind the long-term returns that horticultural crops could yield, 6 horticultural saplings (2 each of plum, peaches and apricots) were distributed to 100 families in the village. Additionally, 75 quintals of potato crop (Kufri jyothi and Kufri malini varieties) were distributed towards the end of February 2018, and this has been sowed. Key outreach activities around this intervention include, a radio broadcast on the National Public Radio and an Experts' Meet in the presence of the Indian Prime Minister (discussed below in detail).

2.3.3 Creating robust evidence on the effectiveness and applicability of adaptation practices

HI-AWARE has prioritized the relevant adaptation practices and approaches which are important to be piloted for future up-scaling and out-scaling. The table below gives a short description of the three pilots and two demonstrations undertaken by the respective institutions and the status.

Lead Institute	Description and status
BCAS (pilot)	BCAS is conducting action research on climate and flood resilient (CFR) housing in Teesta floodplains in Bangladesh. The objective of this action research is to create an evidence of improved low cost CFR houses for the poor who are exposed to climate extremes mainly to floods, soil erosion, sand-casting and heat and cold waves. BCAS in collaboration with C4RE Services Ltd. (implementing partner) is conducting this action research in climate exposed areas. So far, 6 houses in two clusters in two villages namely Char Dhushmara and Char Haibat Kha in Kaunia upazila of Rangpur district have been built with plinth raising, house reconstruction, homestead garden, skill development training, poultry and livestock, hedge row plantation for protecting the toe, installation of solar panel, improved cooking stove, sanitary toilets and tube-well. Although only CFR houses may be a better solution for the inhabitants of stable chars, however, it is not a solution for erosion prone areas where an integrated basin level river management would be a better sustainable solution. Only capital dredging, river training, embankment and bank protection structures may enhance water carrying capacity and navigability of the rivers, nevertheless, recurring sedimentation and braiding of the river is a huge basin level problem and mostly driven by dynamic delta processes and human activities in the catchment area. There has to be enough water flow to cater to the increased demand in the upstream and environmental flow of the river. If basin level river management issues are not addressed in holistic approach with regional (basin sharing countries) programs, isolated attempts of river management or CFR housing in Bangladesh would not give sustainable solution.
Alterra (demonstration)	Monitoring of health and heat coping practices: The study sites are - Faisalabad, Delhi and Dhaka: Some of the work done includes installation of centers, detailed household

	<p>surveys on house characteristics and general socio-economic data from each household has been collected. Across each city an AWS has been successfully launched and is being maintained by the local partners. A fixed 'outdoor heat stress measurement route' has been identified along which on a weekly basis data on different heat indices is collected, both during the day and in the evening.</p> <p>Working across three countries, under harsh (hot) conditions, with partners that were new to the topic the type of quantitative measurements required, meant that data collection was not always straightforward, with loggers missing, restarted or in need of replacement. During the last year, Alterra has continued the work on cleaning and analysing the data collected in the field. Additionally, the data collected from the surveys was analysed. We have done a first assessments of results, including statistics some of which was presented and are now in the process of writing it up in scientific research papers, two of which are in preparation. One extra heat stress related activity was initiated; to be able to upscale our transect and indoor results to city level, we could use Local Climate Zone (LCZ) maps. For Delhi, we could acquire an LCZ map from Ms Richa Sharma of National Institute of Urban Affairs (New Delhi). PARC and BCAS are now in the process of deriving LCZ maps for Faisalabad and Delhi</p> <p>One scientific paper ("When do Indians feel hot? Internet searches indicate seasonality suppresses adaptation to heat" by T. Singh et al. is now in revision for Environmental Research Letters)</p>
PARC (pilot)	<p>Complete <i>Climate Smart Technology Package</i> for small farmers having dug-well in Potohar region has been piloted at Chakri Soan basin, mid hill of Pakistan. With small solar pumping system on traditional animal operated dug-well the heart of climate smart package and tunnels for high value off season vegetables, drip irrigation system for tunnel irrigation & boundary orchard , Micro-sprinkler irrigation system for kitchen gardening, mini-sprinkler irrigation system for field crops instead of furrow irrigation just to save limited available water in dug-well and the crop diversification, all integrated in one package, the farmer has experienced a significant improvement in his livelihood. Introduction of solar pumping along different agricultural interventions at HI-AWARE pilot site is helping the farmers to improve their livelihood. This site is also become training & learning site for farmers and professionals. Furthermore policy makers and different development agencies like Punjab government OFWM, ABAD, FWMC has shown great interest in this success story. Punjab government has also started a development project in which they are providing subsidy to farmers on solar pumping system and tunnels. Currently, 45 people have consulted HI-AWARE team for installation of solar pump and around 60 farmers have showed their interest in tunnel farming and consulted HI-AWARE team. A News article (04 Oct-17) on HI-AWARE official website titled "<u>How a HI-AWARE pilot site is helping development professionals learn lessons of adaptation in Pakistan</u>" was published.</p>
ICIMOD (pilot)	<p>Flood Resilient Sanitation – EcoSan Toilets in Lower Gandaki, Bihar, India: Bihar is frequently ravaged by floods and is in fact the most flood affected state in India. North Bihar in particular is home to eight major tributaries of the Ganga that makes 77 percent of the region vulnerable to floods. If building climate resilience among communities vulnerable to floods has to be meaningful, then the concept of flood-resistant habitat is inevitable. August 2017 witnessed the worst flood seen in the past 25 years. With floods set to become more erratic with climate change impacts, the situation demands a solution that takes care of both developmental and adaptation needs, and improvement in sanitation plays an important role in this. ICIMOD and Megh Pyne Abhiyan (MPA) under HI-AWARE are piloting flood-resilient sanitation in Naya Tola Bishwambharpur in Champaran District of Bihar under the larger framework</p>

	of flood resilient habitat to alleviate the effects of poor sanitation in general, and especially during floods.
TERI (demonstration)	Climate Resilient Economic Development: The focus of this demonstration is to ensure that communities are able to adapt to the changing conditions being observed as a result of changes in the climate and are able to maximize the outputs from agricultural land. It is with this objective that TERI along with SHARD undertook a demonstration that aimed at using an integrated approach with a focus on agriculture, horticulture and livestock. As part of this pilot, a range of options were identified, including land consolidation, fencing, testing efficient/improved agricultural techniques to enable crop productivity (traditional and new). TERI has also prepared the baseline survey that has been translated to Hindi, the local language, and has been passed onto the local partner, SHARD, to facilitate its implementation. The season saw a growth and harvesting of potato crops, apart from undertaking sowing of other proposed crops (Mandwa, Jhangora, Strawberry, Cucurbitaceae). All of this will be studied carefully to justify these practices in the context of climate change adaptation and if they are sufficiently innovative. They are documented in the combined learning document

RC 4: Critical Moments and Adaptation Turning Points

This RC aimed to identify and analyse ‘critical moments’ and ‘adaptation turning points’ for different sectors and events and understand how climate change will impact the timing and duration of these critical adaptation moments. During the reporting period, the method to identify critical moments were used in the qualitative study across all the 12 study sites. This method has been applied in the field. A scientific paper on the critical moment assessments in the 12 sites is in preparation. Further Altera has developed a method to identify and analyses adaptation turning points (working paper published), and developed a tool to quantify adaptation turning points visually (in RC 1, but the application to map ATPs in published as deliverable in RC4). A scientific paper on the application of the framework in combination with the model is in preparation (Werners et al.). A second paper where critical moments are combined with climate change perceptions and measured and modelled climate data is in preparation as part of synthesis products (Wester et al). Below, we write some of the work which was undertaken in this component.

- WERN is finalizing two working papers on adaptation turning points and adaptation pathways. This will contribute to developing a methodology and approach to elicit policies more relevant to specific adaptation needs.
- A resource kit titled **‘Critical climate-stress moments: Resource kit’** is being finalized in which BCAS, and PARC are co-authors. The paper provides a literature review of critical climate stress moments experienced by the people in the Hindu Kush Himalayan (HKH) region in India, Pakistan, Nepal and Bangladesh especially in agriculture sector, and due to floods at upstream and downstream area, and heat waves. The first draft of the working paper can be accessed through [this link](#). The chapter 4 summarizes the critical moments of the year due to floods in the downstream in the river basins of Indus, Ganges, Brahmaputra, and Meghna in Pakistan, India, Nepal and Bangladesh. This chapter reveals that each year during monsoon the seasonal floods occur mainly in July. The critical moments concepts helps bridging the gaps between the biophysical science and the social science. We have very clearly seen that the development and visualization of tailored climate scenarios (in RC1, but directly connected to the critical moments) has raised awareness regarding the potential climate change during moments that matter during the year (e.g. nights, e.g. before sowing, or during parts of the growing season. Further details related to the use of this are provided in Annex 4 (output and Impact tables)
- As a result of research activities on **qualitative and quantitative assessment of critical moments in four study river basins**, a draft report on qualitative assessment of critical moments in lower

Teesta basin has been completed. From the assessment, it is clear that there is not a single critical moment in the lower Teesta basin, rather the cascade of critical moments are experienced by the communities per year. Floods are found as the most devastating hazard. However, the lives and livelihood systems of the people are found to be more vulnerable after each devastating flood due to disruption of agricultural production, education, and communication and sanitation facilities. The detail report can be accessed through [this link](#).

- The quantitative assessment of critical moments at four study basins is on progress. A working paper on qualitative assessment and a journal article on both qualitative and quantitative assessment have been planned during the last [meeting](#) on March 19, 2018 where all the consortium members will contribute to the working paper and the journal article.
- A total of 485 surveys spread across elevations have been completed by the team of researchers in TERI, CEDAR and TERI University students in Upper Ganga. Initial analysis of the data is ongoing by the team, mainly based on the perceptions of changes in weather parameters and events and identification of specific critical moments in the annual agricultural crop cycle or tourism dependent livelihoods, depending on case study sites. Besides, qualitative assessments for marking the critical moments in crop calendar have been carried out in Upper Ganga basin by conducting focused group discussions in the case study sites. In the Teesta basin, the data collection for the RC4 critical moments survey is halfway through, with one of the study areas, North Sikkim being completed, while West Sikkim surveys are underway and data forms would be submitted by end of October. The surveys in West Sikkim were put off until now owing to the monsoon in the area. Analysis indicates that **both summer and winter temperatures are perceived to increase across sites in plains, middle and higher elevation regions**. Its effects are manifested in the form of increase in incidences of pest attack, which affects different variety of crops differently and in various stages of their life cycle. The timing of sowing of crops in rainfed areas of Garhwal Himalayas is getting affected as a result of this. The surveys also highlighted that events of short duration high intensity rainfall in all sites and events of hailstorm in plains are perceived to be on rise. Such events affect crops in different stages of their growth cycle, specially the standing crops.

Migration: ICIMOD- HI-AWARE has conducted a large scale survey of 2000+ households in 12 study locations of the IGB basins. The analysis shows that more than 90% of households perceived changes in the climate, but that **only 35% reported undertaking adaptation practices** to reduce the negative impacts of such changes. None of the households reported climatic factors as a direct driver for their migration decision. An important aspect of this study was to understand the process of migration in hill locations. We found that migration can be a successful adaptation strategy if it helps improve the households' existing resource base to spread risk and reduce vulnerabilities. However, **migration is a response of the households to various changes, including climate change and climate variability**. There is a huge variability in migration patterns across the mountains, hills and plains of the Indus, Ganges and Brahmaputra study sites and their impact on household adaptation capacity also differed. Both migration and household adaptation is location specific, but overall migration positively influences adaptation. There are few empirical studies exploring the role that migration plays in household adaptation capacities and processes. Most studies exploring the climate change-migration nexus has focused on exploring the role of climate change impacts on migration decisions. Such 'environmental migrant' focus ignores the important contribution that migrants make to their families back home living in environmentally fragile areas. About 29% of the surveyed households reported at least one labour migrant, and the proportion of migrant households were higher in the mountains than in the plains. A wide **diversity in migration patterns was reported in the study areas - seasonal migration, internal migration, and international migration**. Major driver for migration decision is better economic and employment opportunities. Of the four sectors analyzed, maximum adaptation was reported in water sector (35%) followed by agriculture (30%), livestock (15%) and forest (7%). Some key findings includes [1] Migration positively influences the households' adaptation capacity, particularly in the agriculture sector; [2] Adaptation is much less in mountain areas due to the inherent mountain specificities and most

adaptation measures are autonomous; [3] Access to external stakeholder, information and technology is very important to improve the households' adaptation capacities; [4] Adaptation is highly location specific and so it should be addressed at local level.

Apart from quantitative survey, qualitative survey was done to understand critical moments. All the study reports have been completed and now the same is being synthesized as a working paper and a journal article.

RC 5: Designing Sustainable Adaptation Pathways

A method paper to develop adaptation pathways has been drafted (to be published as working paper), one scientific review paper on pathways development is in preparation and one paper on pathways development for each study basin has also been initiated. A position paper on Sustainable Adaptation Pathway development has been written by Saskia Werners and Suruchi Bhadwal and others. The document is in print to be released as a HI-AWARE working paper. A methodological study of pathways development was realised under supervision of WENR (Garcés, A. S. S., 2017. Exploring Adaptation Pathways with Mountain Communities in Devprayag, India. From coping strategies to long-term actions. Wageningen University). Importantly Alterra coordinates learning lessons about pathway development across the CARIAA consortia, the first results of which were shared at the Resilience 2017 conference. An article entitled "Climate adaptation approaches and key policy characteristics: Cases from South Asia" by Sumit Vij and co-authors is accepted for publication in "Environmental Science and Policy". Further, RC-5 consortium level paper entitled as "**Adaptation approaches in Bangladesh, India, Nepal and Pakistan with special focus on climate change policies**" has been submitted for publication in the International Journal of Environmental Sciences and Policy. A review of regional and national level policies and plans had been done by TERI to determine how flexible, robust etc., are these policies with regards to adaptation to climate change. The purpose being to identify gaps in the policy space which need to be filled using a Pathways approach. A journal paper on regional policies has been published in the Environment Science and Policy Journal to which TERI has contributed. Link to the paper in the open access domain is as follows; <https://authors.elsevier.com/sd/article/S1462901117307839>

4 Consortium Development and Management

Facilitation of Consortium Research Management Team (CRMT) meetings: The expanded CRMT including strategic partners meets every three months via Google Hangout to discuss the issues related to coordination, management and planning of HI-AWARE research. The CRMT and Co-PIs only meetings have continued to work well and have tackled all issues related to coordination and planning. Monthly meetings are recorded and followed up for necessary action. Minutes of all meetings are with the consortium secretariat and are posted on the KM platform for combined viewing. The HI-AWARE Consortium Research Management Team together with held its annual learning review meeting in Kathmandu, Nepal, in April and December 2017. The focus was on synthesis products. All the products are in draft format now which would be finalised in May-June 2018.

HI-AWARE 5th Steering Committee (SC) Meeting was held on Wednesday 28 February 2018 at Islamabad. The following are the key decisions made and action points that came out of the meeting.

Key Decisions	Action point	Responsible person	By When
Remarks given by each member regarding the successful completion of 4th CCAPS conference and the efforts of PARC was highly appreciated. Decision to continue this partnership and start looking for other funding opportunity	The Steering Committee members to meet the European Union delegation in their respective countries.	SC members	June 2018

	International Centre on climate change adaptation in Netherlands needs to be contacted.	Bram de Vos	June 2018
Synthesis of HI-AWARE	HI-AWARE team to finalize the synthesis key messages and share with SC members for discussion	Flip Wester and Co-PIs	April 30, 2018
	Synthesis write shop in April with half day (virtual) meeting with SC members to test the robustness of key messages	Flip Wester	April 30, 2018
CCAPS and SC Meeting at the closing of HI-AWARE	Meeting Planned in August 2018, dates to be finalized and communicated	Flip and Anjal	May 2018

Progress against the Integrated Work Plan and Consortium Log Frame: A status of the activities as mentioned in the work plan and consortium log frame has been compiled in the annex 4 of the document. The cumulative progress is above 90 percent of the revised planned activities. Some of the work is being undertaken as part of the synthesis work and would be completed in July-August before the final dissemination workshop which is scheduled in Kathmandu.

The **HI-AWARE risk register** consists of implementation related risks, research related risks and partnership risks. A thorough review of the risk register was held during partners meet in December 2017. In subsequent meetings of the Co-PIs the risk register was reviewed and mitigation strategies are working well. The following high likelihood/impact risks and challenges were identified, including treatment strategy and residual risk.

HI-AWARE RISK REGISTER 2017018- I: IMPLEMENTATION RISKS March 2018

Risk	Likelihood (L-M-H)	Consequence (L-M-H)	Risk Rating (L-M-H)	Treatment/ Strategy	Residual Risk Rating after Treatment
I1. Lack of coordination among partners to integrate program results leads to missed opportunities for synergy	M - H	H	H	<ul style="list-style-type: none"> Implement initiatives identified during Nov. 16 Work Week Implement the planned integrative studies Clarify the role of the Consortium Coordinator in this regard 	M
I2. Delays in staffing delays implementation	L	H	H	<ul style="list-style-type: none"> No longer a risk as staff are now in place 	L
I3. Staff turnover delays implementation	M	H	H	<ul style="list-style-type: none"> Develop a tailored strategy of incentives with each 	H

15. Issues with absorption of funds delays implementation	M-H	M	H	<ul style="list-style-type: none"> consortium partner, e.g. capacity building An issue for BCAS and PARC Transfer issue has been resolved 	M
16. Late submission of reports delays release of funds	M	H	H	<ul style="list-style-type: none"> Co-PIs to take responsibility more seriously 	H
17. Delays in release of funds delays implementation	H	H	H	<ul style="list-style-type: none"> Be more timely with writing and review of reports 	H
18. Communication gap among members and partners delays implementation	L	H	H	<ul style="list-style-type: none"> More active communication between consortium members and strategic partners 	M
19. Under-performing members or subcontractors delays delivery of quality output	L	H	H	<ul style="list-style-type: none"> Put more emphasis on follow up 	M

HI-AWARE 2017-18 RISK REGISTER – P: UPDATED PARTNERSHIP RISKS as March 2018

P6. Foreign exchange fluctuations impact negatively on local currency budgets, leading to reduction of available funds	H	H	H	<ol style="list-style-type: none"> Lead Partners to raise options to manage with IDRC, or can redistribute amongst consortia Discuss and agree approach at CRMT, to be ratified by Steering Committee Capture scale and impact and report on it. 	H
P7. Inefficient ways of working reduce time available for actual content work and tire people out.	H+	H	H	<ol style="list-style-type: none"> Streamline meetings and limit participation; Explore web and face-to-face opportunities for meetings as an alternative; Meeting agendas – follow guidelines developed at 2016 Partnership Review, and also include and make space for fun/socialising/side-meetings without cramming them over breakfast and late dinner. Consider a ‘team building’ component. Decide who needs to know/participate in each type of meeting. 	H

HI-AWARE 2017-18 RISK REGISTER - R: RESEARCH RISKS as of March 2018.

R1. Lack of partner collaboration affects research and outcome pathways	M	H	H	Building trust through more substantive conversations at meetings	L
R2. Lack of trust with stakeholders leads to lack of information (or inappropriate, misleading info)	L	H	H	Substantial trust has been built in local communities and with relevant stakeholders and this will be built upon through networking and collaboration with strategic and operational partners	L
R5. Lack of sustained interest by stakeholders – research fatigue	M	H	H	Improved planning and strategizing to avoid redundancies. Better integration of proposed field activities – planning board or map of who is doing what, where and when (physical and virtual / web)	M

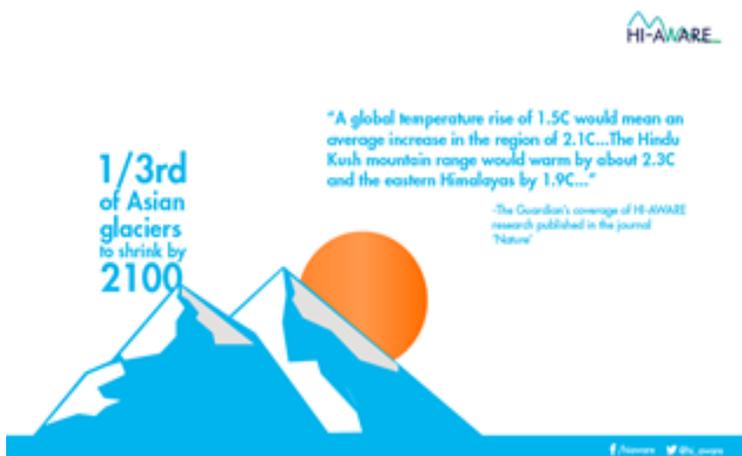
5. Consortium Outputs and Dissemination

An analysis of the HI-AWARE-KMC outputs for the given period of April 2017 to March 2018, shows that the dissemination and output strategy focused on linking its knowledge generating components (WP1) to its larger research-into-use (WP2) and capacity building activities (WP3). During this period, HI-AWARE's communication team sought to build a brand identity that would make its knowledge products instantly recognizable. Simple additions such as logo placements, along with a deliberate choice in design and color elements allowed HI-AWARE products to remain distinct.

Online Engagement

Social Media Graphics: 136; Infographics: 5; Flyers: 3

A key strategy consisted of regular social media updates where the use of social graphics were used to circulate information on publications and key events that HI-AWARE participated in. Other than this, Regular updates from different workshops, trainings and conferences were shared on social media via photographs, infographs, social media graphics and live streaming videos. These represented direct examples of science-policy-practice interface.



Newsletters: Produced – 4; Upcoming: March 2018

Regular updates of the consortium's activities initially shared through an e-news bulletin, have been now consolidated into a quarterly single page newsletter called HI-AWARE Engage. It shares information such as highlights for the quarter along with latest publications and upcoming events. There have been three issues of HI-AWARE Engage so far with an upcoming March 2018 issue.

Videos: Produced – 8; In Production – 3

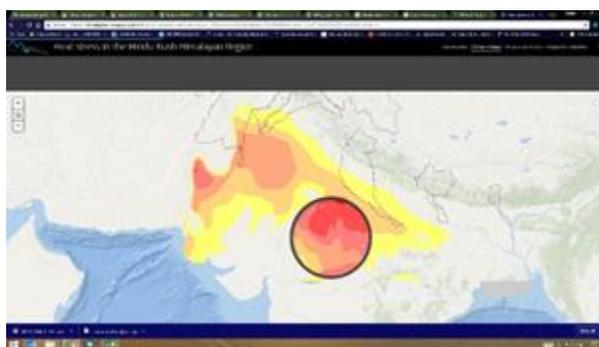
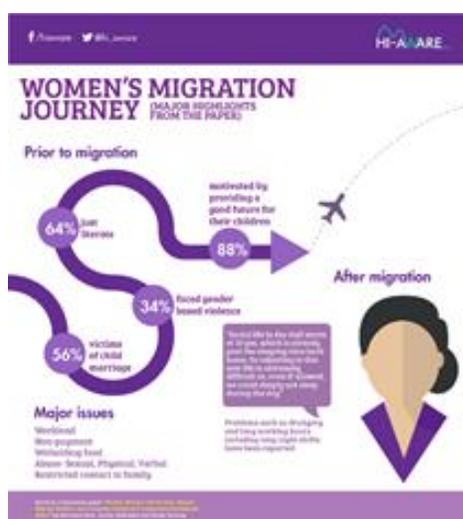
HI-AWARE Spotlight:

- A number of video products have been produced during this period, starting with a video showcasing the students involved with the HI-AWARE Academy. The video briefly profiles the area of focus of each PhD student. The spotlight series has continued with profiles of various researchers within the consortium that represent institutions that are co-consortium members or strategic partners. These videos briefly explain the role of institutions these researchers are linked to, and how they contribute to research in the HKH.
- Knowledge Sharing – Taking the science-policy-practice interface further, HI-AWARE devised an **online Adaptation Solutions Portal** that presents climate projections developed by HI-AWARE in an interactive format for a variety of audiences. The portal's contribution to the initiative was two-fold: 1) address the lack of knowledge gaps in the HKH with a knowledge portal that showcased adaptation measures; 2) to set in a precedence for a community of practice through which sharing of knowledge is encouraged. This was showcased in the Resilient HKH Conference that took place at ICIMOD in Dec'2017. A solutions page has also been developed that allows users to contribute workable solutions in the region. Through this, it is hoped that solutions and interventions that have been or are in the process of being implemented by agencies / organizations/communities, are shared with a wider audience for co-learning and sharing.

Publications:

Working Papers: 10; Peer-Reviewed Journal Articles:21; Photo Books: 2; Blogs: 10

- Gender as a cross-component transcends all work packages within the HI-AWARE research plan. Although many publications have elements where gender is explored along with other factors, one example of a publication that focused on gender was “Neither Heroines, Nor Victims”.
- An M.Sc. grantee’s thesis focused on gender based vulnerabilities in a farmer-managed irrigation system in Nepal.



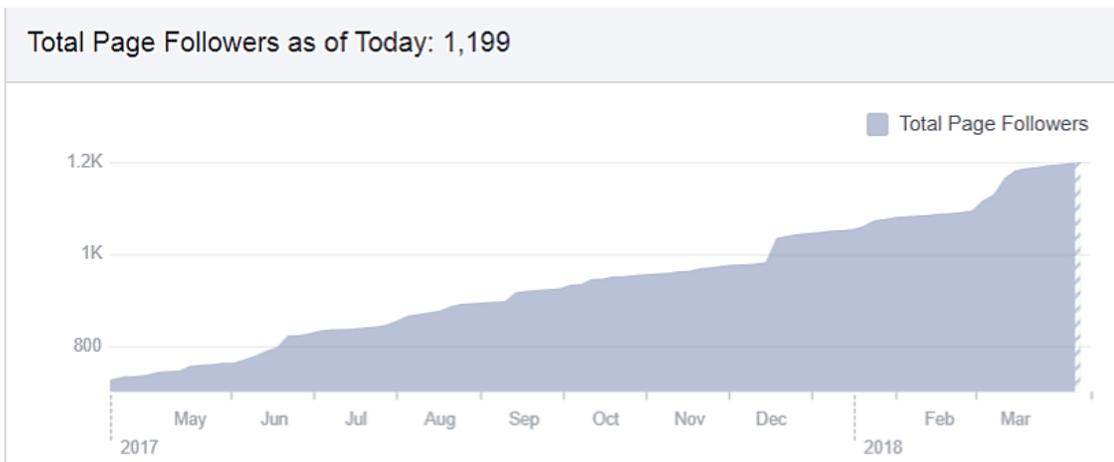
- On occasion of International Women’s Day, a number of colleagues wrote on the perception of gender in research and popular culture.
- Many studies had infographics accompanying them as a means of sharing findings with a wider audience group. “Neither Heroines, Nor Victims” The study conducted by migration and livelihoods specialists at ICIMOD, was later turned into an infograph and was shared on the event of International Migrants Day. The complete list of infographics can be found [here](#).

Social Media Performance

Facebook:

As of March 29th, total page followers stands at 1,199, with a 66% percentage increase since April of 2017.

Page Followers



1. Total number of page likes is 1,192, with a percentage increase of 62% since April 2017.

Page Likes-



Post Reach-

A post reach is the number of people that the post has reached to. Post reaches for HI-AWARE are influenced by certain days, events and the time in which audiences are interacting with the posts. The highest post reach for a single day was on June 3, 2017 at 3,961. The lowest post reach amounts to 1 account. This can be because of Facebook

showing the interaction of a user to an old post.



Posts that have branding associated with them fare better than plain pictures that are posted on the page.

HI-AWARE

May 30, 2017 · 🌐

⋮

On the last leg of our Climate Change Certification Program, the adaptation module of the course has started. For details on the fourth module visit this link to find out more:
http://bit.ly/certificate_prgm

Vishwas Chitale on Twitter

"Adaptation module of #climatechange certificate program kicked off in chitwan!
 @cimod @CollabAdapt"

TWITTER.COM

👤 190 people reached
Boost Post

👤 HI-AWARE, Era Shrestha, Muhammad Taseer Rasheed and 4 others

👍 Like
💬 Comment
➦ Share
⋮

Performance for Your Post

190 People Reached

7 Reactions, Comments & Shares 📊

6 Like	6 On Post	0 On Shares
1 Wow	1 On Post	0 On Shares
0 Comments	0 On Post	0 On Shares
0 Shares	0 On Post	0 On Shares

12 Post Clicks

0 Photo Views	7 Link Clicks	5 Other Clicks 📊
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NEGATIVE FEEDBACK

0 Hide Post	0 Hide All Posts
0 Report as Spam	0 Unlike Page

Reported stats may be delayed from what appears on posts

versus

HI-AWARE is with Ishaan Kochhar and 12 others. ...

August 7, 2017 · 🌐

Another success story!

Talha Mehmood (HI-AWARE Pakistan) has been selected for the prestigious HEC-DAAD scholarship to pursue his PhD in #hydrology at the Universität Würzburg in Germany.

We wish him all the success for this future endeavor... [See More](#)



1,867 people reached Boost Post

👍❤️ 29 2 Comments 2 Shares

👍 Like 💬 Comment ➦ Share ⋮

Performance for Your Post

1,867 People Reached

154 Reactions, Comments & Shares 📊

108 👍 Like	28 On Post	80 On Shares
9 ❤️ Love	1 On Post	8 On Shares
3 😲 Wow	0 On Post	3 On Shares
32 Comments	4 On Post	28 On Shares
2 Shares	2 On Post	0 On Shares

294 Post Clicks

128 Photo Views	0 Link Clicks	166 Other Clicks 📊
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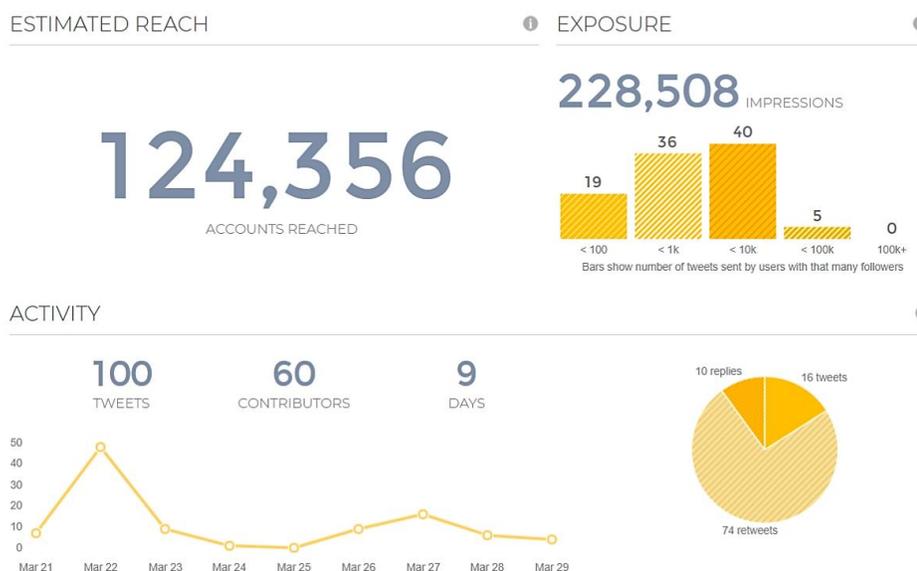
NEGATIVE FEEDBACK

2 Hide Post	0 Hide All Posts
0 Report as Spam	0 Unlike Page

Reported stats may be delayed from what appears on posts

Twitter:

As of March 29th, total tweet impressions stands at 1,633,000. These impressions are subject of change due to the number of interactions, the age of the post, the time and various other factors. For example, based on a snapshot for the last week of March from the 21st to the 29th the estimated accounts reached is: 124,356. However, the numbers change with each day's assessment.



Some key events from the past year, also had tweets that performed well during the events. Of course the performance of this tweets is also dependent on the number of users engaged in

sharing of these messages. In April 2017, ICIMOD hosted its first IPCC interaction. In a few presentations HI-AWARE colleagues also presented at the forum, and one of the standout tweets for April is from the IPCC forum:

Top Tweet earned 4,579 impressions
 Arun Shrestha presents on [#climatechange](#) and prospects of a #1.5degrees rise in [#Himalayas](#) [#climateHKH](#) [@CollabAdapt](#) [#IPCC](#) [@AnjalPrakash](#)
pic.twitter.com/9hCiRJME6d



10 retweets 12 likes

Figure 1 April 2017

Aug 2017 • 31 days

TWEET HIGHLIGHTS

Top Tweet earned 13.7K impressions

Micro-Hydro bridges last mile [#energy](#) gap for [#offgrid](#) communities in the [#Gandaki](#) basin, [#Nepal](#) Click here: bit.ly/2WPSD
pic.twitter.com/fLKJIBwIR



6 retweets 14 likes

View Tweet activity

View all Tweet activity

Our



most recent top

performing tweet was our poster submission to the IPCC Cities conference in Edmonton. The tweet earned **9754** impressions from just **14** retweets.

The news magazine – The Wire, an Indian web based news magazine reported that the Ecosan toilets are making it safer for women to defecate during floods. The Central Government (Govt.) and Govt. of Bihar recognize the EcoSan toilet as an alternative sanitation technology. This has helped pave the way for engagement with government representatives and programs at the district level. Financial support to out-scale the concept will be sought under the Swachh Bharat Mission for the construction of the Eco-San toilets, and the National Rural Drinking Water program for safe drinking water possibilities. At the moment, these pilots are winding up with comparison of baseline and end line reports to understand the process of change as understood by people.

PARC in collaboration with its strategic partner LEAD Pakistan published an article about the HI-AWARE pilot intervention (solar water pumping) entitled as **“Tackling change, one farm at a time”** in DAWN- a well reputed newspaper. ([Link](#))

Documentary under OSF initiative: A Documentary titled **Resilience through Adaptation** has been developed under the PRISE-HI-AWARE OSF initiative. The documentary focuses on climate stresses in three agro-ecologies of Pakistan namely, the high altitude mountains, the rain-fed plateaus and the flood plains of Pakistan. The documentary highlights the contributions of HI-AWARE and PRISE in promoting adaptation and improving resilience of the affected communities in these agro-ecologies and also synergizes the research carried out by the two consortia in Pakistan under the themes of livelihood improvement, capacity building and institutional reforms.

At ICIMOD's flagship conference in December 2017, HI-AWARE launched a working version of its **Adaptation Solutions Portal (ASP)** developed by WENRs subcontractor CAS. ASP is divided into five hazard categories: Floods, Droughts, Fire, Landslides and Heat. The portal uses the medium of story maps in illustrating each hazard through immersive storytelling with the use of various info graphs and short videos. More importantly, a portion of HI-AWARE research has been converted into map data that would graphically represent current versus future scenarios of each hazards. The Adaptation Solutions Portal developed at ICIMOD and the Pilot models were presented to and appreciated by the President of Nepal Ms. Bidhya Devi Bhandari.

Three blogs and a success story based on this study have been published on the HI-AWARE website. The details of these are below:

- a) Published a Blog (23 Jan-17) on HI-AWARE official website titled "*Reviving the dying tradition of dug wells in Potohar*" <http://www.hi-aware.org/index.php?id=270>
- b) Published a Blog (15 May-17) on HI-AWARE official website titled "*Preserving tradition by adapting to the modern in Pakistan*" <http://www.hi-aware.org/index.php?id=294>
- c) Published a Blog (15 May-17) on HI-AWARE official website titled "*Giving dug-wells a new lease of life with solar powered pumps in the Soan Basin, Pakistan*" <http://www.hi-aware.org/index.php?id=293>
- d) A success story "Dug-wells get a new lease of life in Pakistan" and published online. ([Link](#))

Road Ahead

Following IPCC's second assessment of HKH being a data-deficient region, HI-AWARE's scientific contribution comes at an opportune time. Added to this, the need to invest in collaborative partnerships and platforms that increase regional information uptake is also significant. In its final leg, communication efforts from the consortium are now focused around sharing of key messages and recognizing relevant fora in which HI-AWARE's research findings can be contextualized. In this regard, taking the help of strategic partners and CARIAA's extended network becomes key. Along with planned Working Papers and peer-reviewed articles, a **synthesis report** is planned that shows the culmination of research findings at the end of the initiative. Regular social media updates are also being made and a few campaigns have been planned recognizing relevant upcoming events such as World Water Day. However, the KMC team also recognizes the importance of having a set narrative in place that communicates the evolution of HI-AWARE's internal, external communication strategy along with its RiU strategy. For this a retrospective study is planned, where findings will be shared in the final weeks of the initiative.

6. Engagement and Impact

Work Package 2 of HI-AWARE aims to put 'Research into Use' through effective promotion of evidence-based and tested innovative adaptation approaches and practices with relevant communities and institutions at various levels, in order to improve policies and practices that help vulnerable populations adapt to climate change. In this way, it helps in the uptake of robust evidence that is generated under Work

Package 1. In the past year, HI-AWARE was involved in many fora that presented opportunities to engage with policy makers, practitioners, government officials, NGOs and community members among different stakeholders.

a. Consortium Engagement Activities and Impact

Country Engagement

Bangladesh

- BCAS-HI-AWARE team is heavily engaged with Bangladesh Climate Change Strategy and Action Plan (BCCSAP 2009) review team. HI-AWARE team is working on to incorporate lesson learned from HI-AWARE research into the BCCSAP review document and ultimately incorporate into revised BCCSAP. This is the key national policy document which govern national adaptation program and financing; putting them into national planning process.
- BCAS is pleased to report that the Country Level Engagement has been working fine. HI-AWARE-BCAS and DECCMA-BUET teams Jointly organized a national level Research into Use (RiU) "Stakeholder meeting" on 17 January, 2018 at Water Resources Planning Organization (WARPO) Dhaka. Director General of Bangladesh Water Development Board and Director General of WARPO jointly opened the meeting. Institutional Focal Points from different Ministries, Government Agencies and Planning Commission participated in the meeting. Focal point from Ministry of Housing and Public Works; and Director, Department of Local Government shown keen interest in replicating or incorporating the Climate and Flood Resilient Habitat (CFRH). BCAS-HI-AWARE team is continually engaging with these two important institutions on this.

India

- TERI, Jadhavpur University and the Indian Institute of Human Settlements constitute the country engagement group in India. A meeting was organised towards the end of 2017 wherein a decision was taken by all partners and the Programme Director to publish outputs on key topics of Migration, Hotspots and Adaptation Planning. A workshop on Migration was organised on the 19th of Jan 2018 by Jadhavpur University wherein all partners participated and contributed to the discussions on migration emerging from each consortia on the basis of which the draft of the migration document was developed.
- There are 3 documents now drafted on the above issues with key messages for policy and planning in each of the areas identified above for detailing. Few excerpts from the Migration brief indicates that while migration is resorted to for pure economic reasons and in certain cases also driven by environmental factors there are very few studies which have tried to look at the effects of migration from a positive and negative outlook. The Hi-Aware study basically studies migration from the point of enhancing adaptive capacities through remittance economy and the ability to adapt. About 35 % of migrant household in the study sites indicate ability to respond (cope/ adapt). The hotspots approach helps identify critical issues underlying each of the areas in which research is being carried out by various institutions. It indicates the complex nature of the interactions vis-à-vis biophysical and socioeconomic changes that construe and the ultimate implications on increasing vulnerabilities and affecting the poor and the marginalised. The various pieces of research when stitched together present unique findings that are very location specific and require minute screening for formulation of policies and practices. Measures for Adaptation Planning outlined through the various studies, may seem to be already a focus by governments, however, they have been designed without including the risk related to climate change and therefore qualify for business as usual development measures. To be able to contribute to adaptation these programmes and schemes need to be reviewed and restructured to deliver for adaptation. It may be in the lines of scaling up the activity aerially on one hand or on the other enhancing certain components of the programme to deliver the desired results of overall risk reduction.

Pakistan

- HI-AWARE PARC has been engaged with PRISE to develop a Documentary titled “Resilience through Adaptation” under OSF initiative. The documentary focuses on climate stresses in three agro-ecologies of Pakistan namely, the high altitude mountains, the rain-fed plateaus and the flood plains of Pakistan. The documentary highlights the contributions of HI-AWARE and PRISE in promoting adaptation and improving resilience of the affected communities in these agro-ecologies and also synergizes the research carried out by the two consortia in Pakistan under the themes of livelihood improvement, capacity building and institutional reforms.
- PARC in collaboration with SDPI and LEAD Pakistan organized a session with the parliamentarian of Pakistan in Serena Hotel, Islamabad on 28th February. Around 10 parliamentarians from federal, Punjab, KPK and Gilgit-Baltistan present at the session were briefed about the work done by HI-AWARE and PRISE. They highly appreciated the work and suggested that such platforms should also be provided in future to enhance the understanding of the policy makers regarding climate change. Moreover, they emphasized that such interaction are very necessary to devise science and evidence based policies in future. It was suggested that regional level interaction between the parliamentarians working on climate change should be held to minimize the global issue of climate change.

Policy Engagement

HI-AWARE Research component team contributed to UNCEDAW Committee’s General Recommendation 37 on Gender related dimension of DRR in changing climate. The recommendation provides guidance to States parties on the implementation of their obligations under the Convention on the Elimination of All Forms of Discrimination against Women in relation to disaster risk reduction in a changing climate. HI-AWARE researchers have focused on the issue of gendered vulnerabilities and ways to deal with them in a changing climate.

Global Level Engagement: World Sustainable Development Summit February, 2018:

As part of its Research into Use (RiU) strategy, TERI had organised two events to disseminate project outputs to key stakeholders. The events brought a range of speakers (including consortium partners from BCAS, ICIMOD and Wageningen University and Research), and stakeholders onto a single platform to discuss pertinent research issues on upscaling climate action and taking the agenda on heat stress in cities forward. The event “The Third Pole – A melting pot of climate change threats and actions” focussed on disseminating the pilots/experiments carried out under HI-AWARE and subsequently build an understanding on the opportunities and challenges in upscaling climate action in the region. The discussion centered around developing the right technologies that are inclusive and amendable to various contexts

through more research and developing a greater understanding on institutional flux towards mainstreaming climate action. The event was attended by 36 interdisciplinary delegates.

In WSDS 2018, Thematic Track: **Cities and Heat Stress** — a call for Action; Dr. Christian Siderius, from WENR, presented the research findings of the pilot study covering heat stress work of three cities Delhi (India), Dhaka (Bangladesh) and Faisalabad (Pakistan). The research looks at the temporal differences of

Agriculture Mission 2022, 19th and 20th February, 2018

Dr Arindam Datta, Fellow, TERI, interacted with stakeholders in the presence of the Honourable Prime Minister Shri Narendra Modi, Governor of Himachal Pradesh Acharya Deb Vrat, amongst others, at the Agriculture Mission 2022: Doubling Farmers' Income expert's meet here in Delhi on the 19th and 20th of February. The discussions revolved around the work TERI is conducting in Rudraprayag under the Himalayan Adaptation, Water and Resilience (HI-AWARE) research project. An interest in the work was shown with discussion around the potential for such work in some part of Himachal Pradesh. Former special chief secretary (Agriculture), Andhra Pradesh Mr. Vijay Kumar chaired the session and appreciated the project as it highlights the opportunities that farmers in certain regions can capitalise on.

This targeted stakeholder engagement at the highest level of policy-making is also backed by a strong push for doubling farmers' income in India, with this being taken up as a key policy initiative by the incumbent government in India. TERI's experiment under HI-AWARE focuses on substantiating income through targeted livelihood interventions in the agriculture sector and has strong links to the macro policies currently being implemented and planned for, as reiterated by this engagement.

temperature through historical and projected climate information based on AR5 assessment. Also, the pilot study was conducted to measure the indoor heat stress using data loggers at different locality as well as using transect monitoring with mobile weather monitoring device. Huge temperature differences were observed in research conducted for Delhi during 2016. There are significant differences observed in day and night temperature. The lowest temperature observed was 38 degrees making it difficult to reside. Relatively greener areas have also experienced very high night time temperature. Increase in humidity was also observed, which plays an additive role in heat stress. He further talked about mitigation and adaptation options for heat stress management. Types of construction material and roofing are an important area of interventions to reduce indoor temperature especially for low income neighbourhoods. He stressed upon new and innovative adaptive solutions for indoor temperature regulation, improvement in housing and energy efficient cooling and provisioning of ample water supply in poor communities.

Conference of Parties (CoP) 23 at Bonn, 6th to 18th November, 2017: TERI was nominated to present its work at two side events at the India Pavilion at the Conference of Parties (CoP) in Bonn last year. These events were hosted by key Ministries in India – the Ministry of Health and Family Welfare (on linkages between climate change and health) and the Ministry of Science and Technology (on the Himalayan Ecosystem). These targeted events helped highlight project outputs relating to the two experiments that TERI is involved in, in Rudraprayag (on agriculture) and Delhi (on indoor heat stress management), to

varied stakeholders, including Government officials, International NGOs, Academicians, amongst others. The events achieved in aiding a broader dissemination, across multiple jurisdictional levels, reflecting the nature of climate change governance. The event announcement is available here.

REGIONAL

Climate Change Adaptation Science and Policy Conference, Islamabad

The 4th Climate Change Adaptation Policy and Science conference was organized by PARC in Islamabad on DATES. This conference saw active participation from all members of the HI AWARE consortia for whom the event provided an important opportunity to not just showcase research and results emerging from HI AWARE, but also seek inputs and guidance from stakeholders, government officials and parliamentarians who were also in attendance. The event got good media coverage and a separate Pre-Event Media Briefing was held in Serena Hotel, Islamabad. This took the messages to a wider public. The inaugural session saw more than 450 people in attendance and the rest of the conference engaged around 300 participants from different sectors including INGOS, government, public institutes, universities and private sectors. The two day CCAPS conference comprised of six different technical sessions in which eminent international and national scientists, practitioners, policy makers and journalists joined as the panellists. Around 10 parliamentarians from federal, Punjab, KPK and Gilgit-Baltistan were present at this session. They highly appreciated the work and suggested that such platforms should continue to enhance the understanding of the policy makers regarding climate change. Moreover, they emphasized the importance of such interactions in devising science and evidence based policies in the future. It was suggested that a regional level interaction between the parliamentarians working on climate change should be held to minimize the impact of global climate change. The conference was followed by a visit of national and international participants of the conference to Chakri – one of HI AWARE's pilot site. Details of the media coverage of CCAPS is provided in this link: <https://drive.google.com/open?id=1M33tRqcsyb-qN-tzOVmpkxvAtgnkigQJ>

Lima Adaptation Knowledge Initiative (LAKI): LAKI is a joint initiative of the UN Climate Secretariat (UNFCCC) and UN Environment Programme (UNEP). ICIMOD is leading the work LAKI in the HKH region. The HI AWARE pilots were presented at the LAKI side event held during 2nd-6th December, 2017 before the Resilient HKH Conference at ICIMOD. These were taken up by the LAKI process as adaptation solutions that help reduce the adaptation gaps in the region.

IN-COUNTRY

Science-Policy Roundtable on Climate Change Adaptation, 29th – 30th June, 2017: During a strategic engagement with stakeholders that involved interacting with government officials from **Indian Himalayan states in June 2017 at ICIMOD**, HI AWARE presented some of the solutions that have come out of the work done so far, including demonstrating the usefulness of the [touch table application](#). Following this, some of the Himalayan states expressed their interest in building capacity in the relevant nodal agencies at the state level on geospatial applications in adaptation planning.

HI-AWARE support to NAP: The Government of Nepal, being a Party to the United Nations Framework Convention on Climate Change (UNFCCC), has initiated the National Adaptation Plan (NAP) formulation process. The NAP formulation process is currently led by the Ministry of Population and Environment (MoPE) and working groups (thematic and cross-cutting) are coordinated by nine concerned ministries. The agreed overall objectives of the NAP process are to reduce vulnerability to the impacts of climate change by building adaptive capacity and resilience; and facilitate the integration of climate change adaptation, in a coherent manner, into relevant new and existing policies, programmes and activities, in particular development planning processes and strategies, within all relevant sectors and at different levels, as appropriate. The international Centre for Integrated Mountain Development (ICIMOD), through its several regional initiatives such as HI-AWARE and HIMALICA is providing technical assistance to the government

of Nepal in four major areas. The support includes technical assistance in producing climate trend and scenarios, vulnerability and risk assessment in four major sectors which includes, water and energy, forest and biodiversity, gender and social inclusion and livelihood and governance. ICIMOD is also supporting in building capacity of government of Nepal through regional learning and sharing. HI-AWARE is specifically supporting the government by feeding into knowledge and information generated through its various research components. The work on climate trend and scenarios is part of the research component 1 which looks into mapping of key climate risk and impact in major river basins. The methodology and data used for climate trend and scenarios at the river basin is further expanded to include country level assessment.

From HI-AWARE-ICIMOD, the team was involved in the modelling of future projections on temperature, precipitation and extreme events. The value addition of these projections was that it provided a reference point for concerned authorities to gauge the historical context of climate change impacts. The interaction was with hydrological and climate experts that have worked closely with representatives from the Ministry of Population and Environment, and the Department of Hydrology and Meteorology. Along with this, other members from HI-AWARE worked with members of MoPE to develop a vulnerability and risk assessment framework to better contextualize the efforts of planning towards risk adaptation. Multiple discussion meets have taken place, to ensure that HI-AWAREs contributions to the modelling process are formalized and integrated for national planning. An interaction workshop for Climate Change Scenarios for NAP formulation process in Nepal was held on 17th Jan 2018 where the main findings on research on climate scenarios, especially the change in precipitation and temperature, and 11 climate extreme indices were presented. Two publications from these interactions have also been formalized: "Vulnerability and Risk Assessment Framework and Indicators for National Adaptation Plan Formulation Process in Nepal" and "Synthesis of the Stocktaking Report for the National Adaptation Plan Formulation Process in Nepal". Learnings from this cross-collaborative effort can be taken as lessons for other member countries and lesser developed countries in the HKH.

Engagement with Nepal Administrative Staff College (NASC): Set up as a national level autonomous institution in 1982 under the Nepal Administrative Staff College (NASC) Act, 1982, the objective of NASC is to provide necessary training for the employees of the Government of Nepal and Public Enterprises; identify measures for enhancing the capability of administration of the Nepal Government and management of public enterprises to contribute towards development programme of the country; and undertake problem-oriented research, consulting and information service programmes for preparing training materials and making training more useful. HI-AWARE programme is supporting NASC faculties in **curriculum revision** and putting HI-AWARE research into the training programmes of NASC. To start with the faculties from NASC and ICIMOD are working together to update Disaster Risk Reduction course.

Climate Change Certificate Course Programme: The ICIMOD - HI-AWARE research findings and knowledge on Climate change and its impacts were packaged in the form of a **Climate change certificate course programme** and delivered to district level local government officials from Chitwan including private sector and Agriculture and Forestry University (AFU). This was a unique programme with four modules spread across five months designed to meet the needs at the local level. Subsequently, an **MOU has been signed between HI-AWARE (ICIMOD) and AFU** to strengthen its faculty in climate change as well as be a knowledge hub for dissemination of such climate related knowledge to various stakeholders (see picture below).



Dr. David Molden, DG, ICIMOD and Prof, Ishwari Prasad Dhakal, Vice Chancellor, Agriculture and Forestry University, Nepal exchanging the MOU for research capacity building collaboration



Hariyo-Ban programme: ICIMOD – HI-AWARE signed an MOU with **Hariyo-Ban programme** to support **6 villages** in two districts for collaborative research on identifying and evaluating successful adaptation measures in the Gandaki River Basin. This research will help the programme in prioritizing adaptation options for the communities in two districts of Nepal – Chitwan and Nawalparasi. Further, the programme is supporting

intervention these selected districts by: a) identifying local and national level criteria and indicators for successful adaptation strategies, b) documenting of successful adaptation interventions in the river basin, c) revisiting adaptation planning cycle and identifying the bottlenecks in terms of adaptation planning and recommendations on addressing of issues, and d) providing recommendations for designing effective adaptation interventions for Phase II of the program.

Heat Stress Management in Urban Areas (Case study of Delhi), 25th April 2017: TERI and WENR co-organised a workshop during early 2017 with an aim to disseminate research that was carried out under the Research Component 3 focussing on indoor temperatures and heat stress. This event presented snippets from HI-AWARE's research to an expert roundtable with an aim to refine and package the outputs to reach the widest audience. The event also led to developing an understanding from the experts on the various paths to manage heat stress across scales (within households and across neighborhoods and localities).

Challenges on the Path towards a Lower Carbon Construction Industry, 23rd August 2017: TERI in collaboration with the University of Edinburgh organised a daylong event that aimed at furthering the understanding on indoor heat stress patterns that was carried out during 2016. The event aimed at bringing together architects, policy-makers and community based organisations to share their experiences around the challenges and bottlenecks regarding eco-building materials that not just reduce the emissions from the construction industry but also lead to various other co-benefits, especially around co-benefits. By forging collaborative partnerships such as these, TERI had furthered the outreach and ambit of research being carried under HI-AWARE, resulting in a congruous research pathway around similar research topics.

The State of Cryosphere Conference in Gangtok, Sikkim, 19th and 20th February, 2018: TERI has co-organised the State of Cryosphere (with specific focus on Eastern Himalaya and Sikkim) Conference in close association with the Integrated Mountain Institute (IMI) and other partners including the Department of Science and Technology, Sikkim, Divecha Centre for Climate Change and Swiss Development Cooperation amongst others. The event helped identify key bottlenecks in furthering glacier research, and chalking a research roadmap to build knowledge and capacities for the Eastern Himalaya. This close partnership with regional stakeholders had helped forge "partnerships for change" and help sustain key issues of research identified by HI-AWARE beyond its timeframe. The outcomes (and roadmap) of this conference was to carry out further research on understanding the role of black carbon on glacial melt; increased understanding on water usage patterns and understand the role of glacial melt on water availability and access in respect to upstream and downstream communities.

Training/ Stakeholder Workshops

- BCAS in collaboration with C4RE Services Ltd. organized **community level training workshop** (for 30 carpenters, masons, sawmill operators from Teesta plain area) on "Climate and Flood Resilient (CFR) house construction demonstration" on 10 - 11 January, 2018, at the CFR habitat, Haibatkha of Kaunia, in Rangpur (Figure 1). The participants were drawn in from neighboring villages and Lalmonirhat, and Nilphamari districts of lower Teesta basin. Outcomes from the training workshop
 - Enhanced awareness and provided hands on training on wood preservation and sawing to suit particular needs for CFR habitats. Important, saw mills battens/timbers sized doesn't match the requirements for CFR habitat construction. Hence, BCAS and C4RE team had to work with saw mill operator to saw the timber specially for CFR habitats
 - Participants from neighboring villages and elsewhere all showed profound interest in the CFR habitats.
 - Participants from Hatibandha, Lalmonirhat, and Dimla, Neelphamari districts had been arguing to build these cluster houses at their location so that they can replicate the CFR habitat in their locality.
- **Stakeholder workshop on institutional mapping and adaptation prioritization practices:**
 - As part of stakeholder driven prioritization of adaptation measure a community consultation workshop has been conducted under different community, upazila, and regional level under the study areas and all categories within the community (landless farmers, marginal farmers, fishers, women groups etc.). The objective of the consultation was to facilitate dialogues among

- the stakeholders in identifying of and setting priorities among different sectoral and cross-sectoral adaptation options.
- During adaptation prioritization the research team found the agriculture sector got the most priority at all level. This gives very important learning for policy communication that there is synergy of thinking and practical experiences from farmers to the regional stakeholders. This creates an opportunity for partnership among the stakeholders.
 - A third phase of the stakeholder consultation process, where participatory prioritization tools were used to rank identified adaptation options and organize a feedback from stakeholders on these priorities and criteria for prioritization. Participatory assessment of climate stress, drivers and conditions leading to vulnerability process also helped to get a preliminary insight into stakeholders' perception of current vulnerabilities and impacts in different regions of the Teesta floodplain.
 - These community consultations were a **two way communication process where researchers and at the same time community leaders, stakeholders, local people shared and presented their thinking, knowledge, needs and priorities.** These fruitful consultations helped HI-AWARE researchers to verify and validate their findings with the feedbacks of the stakeholders at the three levels.
- One day training workshops were organized twice at Mountain Agricultural Research Centre (MARC) in Gilgit - Baltistan, Pakistan in April 2017. These were on topics of **“Olive and other Fruit plants cultivation in Gilgit-Baltistan”** and **“Conservation and Domestication of Medicinal Plants for livelihood improvement”**. Subsequent to this, a session on training of farmers of the pilot site (Chakri, Rawalpindi) on ‘Vegetable Nursery Entrepreneurship’ was organized in May 2017.
 - Training on **‘Spring-shed Management in HKH Region’** was held in Islamabad from 16-19th May, 2017 by PARC in collaboration with ICIMOD.
 - About 50 women from 5 different villages in Upper Hunza participated in the two-days training program on installation of walking tunnels and cultivation of offseason vegetables. Village Women organization has taken the responsibility to run and maintain the eight walk-in tunnels installed through support from HI-AWARE in Gircha and villages in its vicinity (Sost, Nazimabad, Sarteez) for improving livelihood.
 - Similarly, PARC organized two days training on installation of high tunnel, good agriculture practices and off season cultivation of vegetable production in harsh climatic conditions to improve and build farmers skills and knowledge under the micro agro climatic conditions in Hoper Village. The training was arranged in a community based high school where science students also participated. HI-AWARE installed a high tunnel (50’x100’) in this school to engage and train students who will further engage the community in these practices. Fifteen people of the locality participated in the training and demonstration of tunnel installation.
 - PARC has organized farmer field days in Chakri in November 2017 and January 2018 for training farmers on different agricultural practices and climate smart technologies installed at the pilot site including High Efficiency Irrigation Systems (HEIS) and diversification of crops and fruits to improve livelihoods.
 - Imparted trainings regarding “Alternate energy resources” in NCRD on Solar Energy and Biogas to the professionals from different provincial governments. September 2017.

Requests and Collaborations

- WENR We have received two requests from Pakistan to train people to use the water and food model.
- Recently, Ministry of National Food Security & Research (MNFSR) has designated Dr. Bashir Ahmad (PI HI-AWARE, Pakistan) as the National Climate Change Coordinator to nationally

coordinate with provincial agriculture and livestock departments on the status of implementation of Climate Change Policy Framework to Ministry of Climate Change (MoCC).

- Currently, 45 people have consulted HI-AWARE team for installation of solar pump and around 60 farmers have showed their interest in tunnel farming and consulted HI-AWARE team. The HI-AWARE pilot site is also becoming a learning site for professionals, farmers, students and practitioners. Akhtar Hameed Khan National Center for Rural Development (AHKNCRD) had organized a training course on “Climate Change-Implication & Adaptation for Rural Areas” and they requested HI-AWARE for a field visit to the site at Chakri Saroba for demonstrating adaptation practices in agriculture, energy and water sector. ([Link](#))
- National Disaster Management Authority (NDMA) of AJK has request HI-AWARE to conduct a training climate change, adaptation and disaster management for its officials and other stakeholders. Moreover, they are enthusiastic to visit the HI-AWARE pilot sites and learn about the adaptation practices which can be used for improving livelihoods of small farmers.
- HI-AWARE at 3rd Karachi International Water Conference – Future of Water. HI-AWARE team member from PARC, Mr. Zeeshan Tahir Virk was invited to present in Pakistan’s Water security session on 22nd Nov, 2017. Mr. Virk presented HI-AWARE’s research on changing scenarios of water availability, urbanization and climate change in urban settlements of western Himalayas in Pakistan. These towns rely on unique water resources such as springs or harvested rainwater, which are under serious threats due to increased demand and climate variability. Mr. Virk concluded his presentation by laying emphasis on the need of public ownership and support for development of water resources in such emerging mountain towns, so that they can play an effective contribution towards Pakistan’s economy.
- Presented HI-AWARE’s pilot solar pumping system at LAKI Satellite event in “Resilient Hindu Kush Himalaya: developing Solutions towards a sustainable future for Asia” December 2- 6, 2017 in Kathmandu, Nepal.
- **The International Fund for Agricultural Development (IFAD)** has provided a mega project of worth 12 billion PKR to Gilgit-Baltistan government in which there is a plan to convert 50,000 acres of land under irrigated agriculture. IFAD officials visited HI-AWARE pilot site on 17 March-2018 and appreciated the whole model, they were very much eager to replicate the model in GB. They have requested to provide technical support for installation of solar pumping system to uplift water from Indus River and to integrate high efficiency irrigation system for converting the barren land available at the bank of Indus river into agricultural land. This is a great success of HI-AWARE pilot and large number of farmers will get benefit from HI-AWARE pilot by putting the research into use.

7. Capacity Building

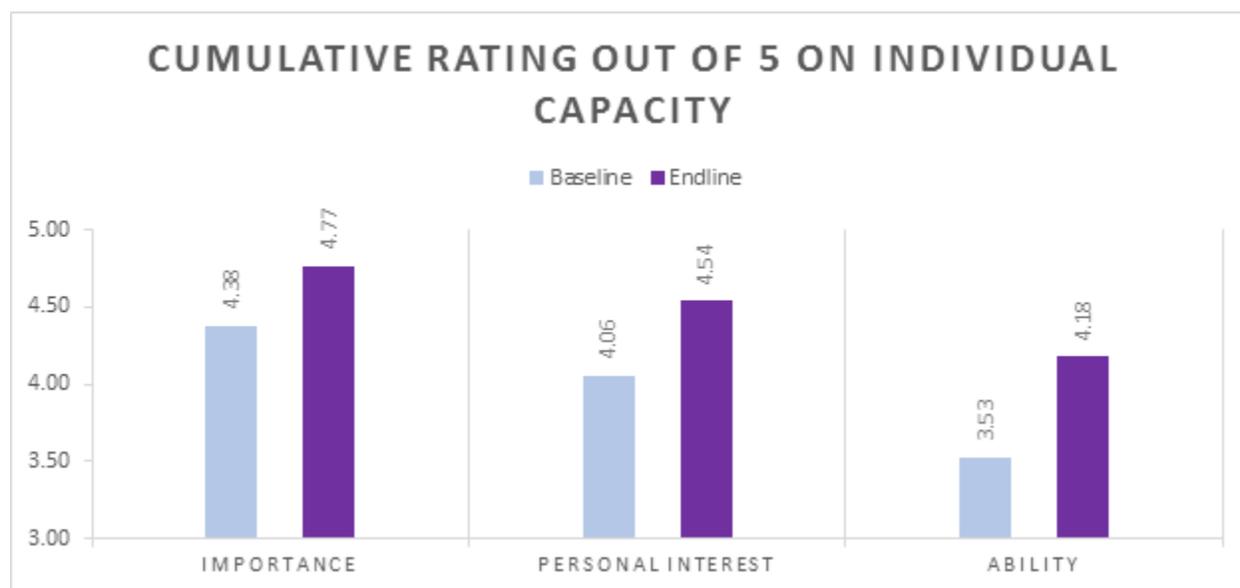
An integral part of the HI-AWARE research effort has been to contribute to the research community by engaging not just with existing researchers but also encouraging and supporting new talent and potential. This is evident in the number of Masters and PhD students that HI-AWARE supported.

To gauge this strengthening of research capacity, HI AWARE conducted a capacity building survey this year (endline) across the consortium to assess gains and losses in individual and institutional capacity through the project timeline, based on the perceptions of the researchers involved. The survey was designed on the lines of CARIAA’s capacity self-assessment that was conducted in 2015 (baseline) across CARIAA consortia and administered through Google Forms. Different dimensions to both individual and institutional capacity were identified and specific questions framed under them. These questions were considered and then rated on a 5 point scale. For the individual capacity question, these ratings were based on the degree to which the identified capacity is important to collaborative research on adaptation (Perceived Importance), the degree to which the identified capacity is interesting to an individual (Interest),

and the degree to which an individual possesses or is able to use the identified capacity (Ability to Execute) (Hammill, Anne, Blane Harvey, and Logan Cochrane. 2016. CARIAA Capacity Self-Assessment: Baseline report for IDRC. IISD)

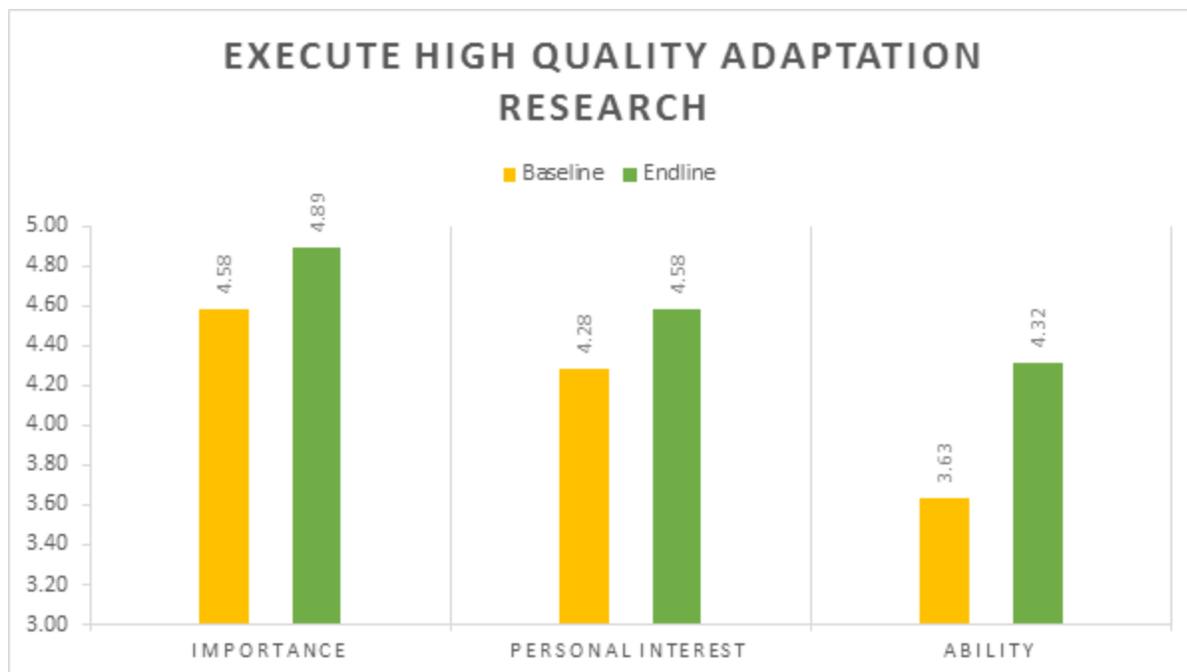
The following graphs are a representation of change in perceptions of those 19 individuals out of the total 62 respondents who had also attempted the baseline survey conducted in 2015. This would be able to show a clear transition of individual assessment of different criteria. It is evident that there is a clear increase in ratings accorded to certain indicators of individual and institutional capacity. Most importantly, individuals' perception of their own ability across criteria has improved.

Graph 1 showcases the cumulative rating out of 5 for all questions on individual capacity. Graph 2 and 3 are components of individual capacity.



Graph 1

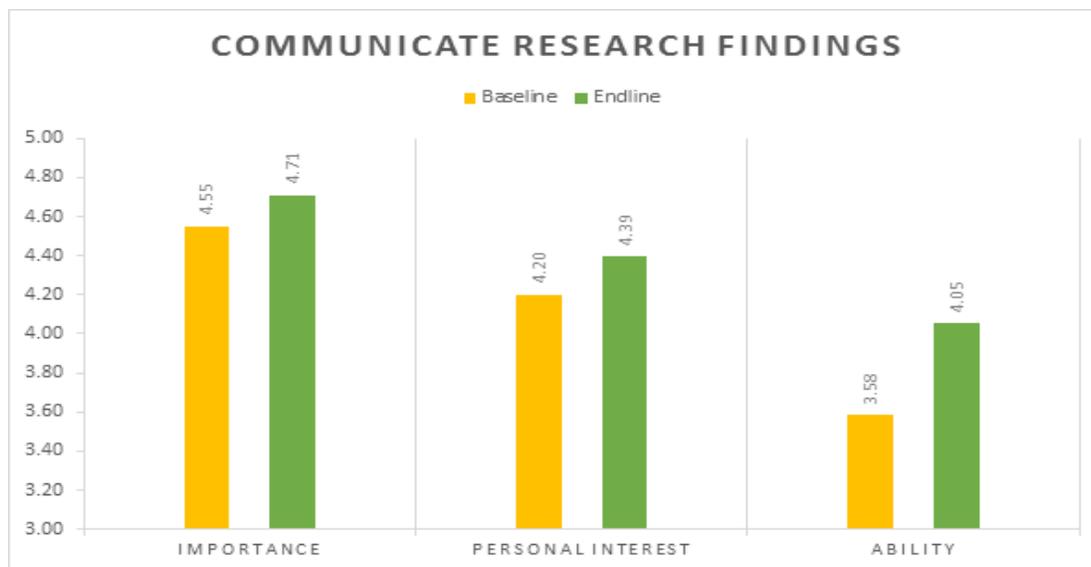
Graph 2 shows rating for questions under execution of high quality adaptation research. This criteria subsumes under it questions on generating robust evidence at international standards and identifying relevant audience for its dissemination.



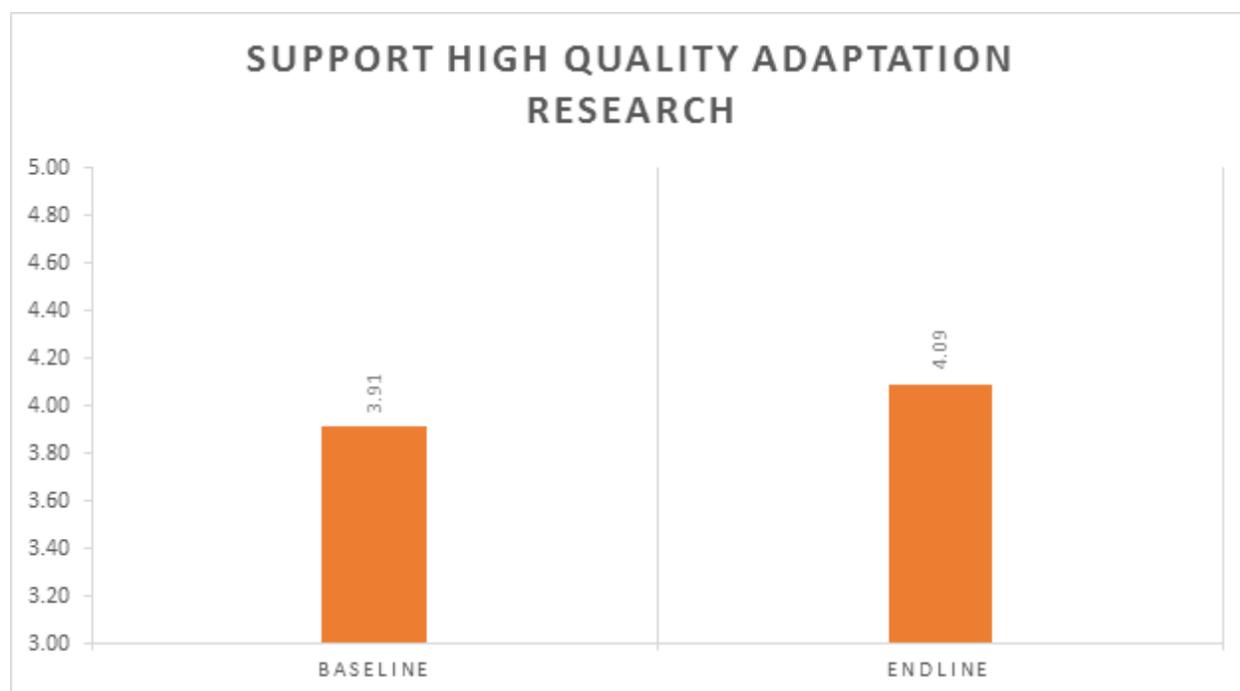
Graph

2

Graph 3 highlights the perception associated with communicating research findings effectively. This criteria includes questions on contribution to academic journals in the form of high quality peer reviewed articles and then being able to translate complex findings in a user friendly and accessible format.



Graph 4 shows an important criteria of assessing change in institutional capacity, i.e., through support of high quality adaptation research. This includes questions asked on the assurance of the organization delivering high quality research, the presence of appropriate administrative and management systems within the organization, and the presence of gender sensitive policies that effectively recruit and develop female researchers. It can be seen from the graph that the endline rating is higher than the baseline.



Therefore it can be concluded that as far as producing high quality adaptation research is concerned, respondents' perceived importance, interest and abilities in this regard have increased both as individuals as well as of the institutions to which they belong.

1. Supporting postgraduate and PhD students

- BCAS has been supporting an MPhil and an MSc student from Rajshahi University under HI-AWARE fellowship. Mr. Sk. Junnun Al – Hussain (MSc student) finished his study under the title of "Identification of drought and flood induced critical moments and coping strategies in hazard prone lower Teesta river basin" in July 2017. His MSc thesis can be accessed through [this link](#). Another MPhil student Mr Abdullah Al Mamun has converted his MPhil to PhD recently. Mr Mamun will submit his PhD thesis titled 'Climate change adaptation and socio-economic patterns in Teesta basin of Bangladesh' to Rajshahi University.
- Binod Parajuli, M.Sc. grantee with HI-AWARE - ICIMOD was selected to attend the G20: Think 20 Summit in Germany, to present on his thesis on flood risk communication. He successfully defended his master's thesis which was done under the aegis of Tribhuvan University, supported by HI-AWARE. HI-AWARE's young researchers - Sangita Dandekhya (ICIMOD) and Talha Mehmood (PARC) each received scholarships to pursue higher education. Sangita, grantee of the Erasmus Mundus scholarship, will be pursuing a PhD in Hydro informatics and water management from Brandenburg University of Technology Cottbus-Senftenberg. Talha Mehmood, will be pursuing a Ph.D. in hydrology from Universität Würzburg, Germany, under the HEC-DAAD scholarship.
- In 2017-18, the TERI team has engaged 7 female and four male Masters level students in different research components. Two PhD Students, Ms. Sudeshna Maya Sen and Ms Divya Sharma are selected by TERI School of Advanced Studies under the HI-AWARE project after a round of interview conducted by the University. Ms Maya Sen is doing her research around the context of integrated farm management under the Task 3.3 in RC3 and is also a part of the RC3 working group. Ms Sharma is building her research around Task 2.2 and 2.3 under RC2 and is a part of RC2 working group. She is interested in exploring determinants for community level decision making regarding livelihood strategies under a water scarcity context.
- WENR is supervising three PhD students under HI-AWARE (2 from Pakistan, 1 from India). Those three PhD projects will continue beyond the durations of HI-AWARE, and the candidates plan to

defend their theses in autumn 2019. They are also co-supervising two PhD students at Faisalabad University who are working on theses on heat stress and have worked with us on the measurements in Pakistan. They are engaged in regular supervision of BSc and MSc students from Wageningen University. Three PhD students are working hard on their dissertations. Sumit Vij has published his first paper, the others are finalizing for submission.

- PARC under HI-AWARE is making efforts to strengthen the expertise of a number of M.Sc. fellowships have been awarded to students of local universities to develop their expertise in the science of climate change and climate change adaptation. Two students have already completed their MScs under this component; three are involved in thesis research whereas efforts are under way to award fellowships to 10 more students in the coming year. Mr. Muhammad Saleem Pomee who has been partially supported by PARC component of HI-AWARE for PhD in Germany is about to complete his synopsis. He has already submitted review paper and working on his journal publication.

2. Research Capacity

- HI-AWARE researchers Dr. Golam Rasul and Dr. Anjal Prakash were selected as Coordinating Lead Authors (CLAs) for the IPCC special report on Oceans and Cryosphere in a Changing Climate. They attended authors meeting in Fiji in September, 2017 and Quito, Ecuador in February 2018. The report would be out early next year wherein special topics of glaciated mountains and deltas are included wherein HI-AWARE and CARIIA researches would be contributing. Apart from them, two HI-AWARE researchers, Mr. Avash Pandey and Dr. Santosh Nepal have been selected as chapter scientists in the report.
- As a network partner, TERI University faculty members Mr M V Shiju and Dr. Gopal Sarangi are closely engaged in RC2 and RC3 working groups respectively.
- Young researchers from TERI who are contributing to the study, have been submitting their work for dissemination in international/ national forums. Mr Ganesh Gorti from TERI was selected for a panel presentation at the Integrated Disaster Risk Management Conference held in Iceland in 2017. The presentation focused on the tool multi criteria analysis, and its assessment for prioritizing adaptation options in the study areas.
- A Masters degree student from TERI SAS has contributed to the publication of an article titled "Mass Balance Reconstruction Since 1963 and Mass Balance Model for East Rathong Glacier, Eastern Himalaya, Using Remote Sensing Methods" in *Geografiska Annaler*, Volume 97, Issue 4, December 2015, Pages 695–707. In this study mass balance, accumulation, ablation, runoff and temperature lapse rate for the East Rathong glacier are estimated for the time period 1963–2011 using remote sensing methods and climate data. A mass balance model is proposed for the glacier that computes mass balance as difference of volumes of consecutive years. Volume estimates of glacier are based on application of volume–area scaling law to glacier area computed from satellite images. As a follow up to the above study, the model proposed is being further refined using the primary data being collected from the glacier and instruments installed at different sites.

8. Cross-Consortia Research Themes

HI-AWARE is engaged in three cross-consortia research work which is outlined below:

Meta-Synthesis of Gender, Social Differentiation and Inclusion in Adaptation Research and Action:

This proposal comes from the Gender and Equity Sub Group (GEG) of CARIIA Under this proposal, a meta synthesis of 23 case studies selected from Africa and Asia are analysed using a method – qualitative comparative analysis (QCA). QCA is a method that bridges qualitative and quantitative analysis: During the reporting period, the cross-consortia Gender and Equity working group met in Dubai from January 29-31 in Dubai. The aim was a research workshop on meta-synthesis of gender, social differentiation and inclusion in adaptation research and action. The primary idea was to synthesize some of the case studies developed over last few years, utilizing the QCA methodology. 23 case studies were analysed, and this resulted in

four pathways identified to be pursued on how climate change affects gender equity and relations. A draft article is now being developed to showcase these pathways.

Migration in climate hot spots in South Asia: diversity in patterns and approaches

The issue of migration within climate change discourse has been under debate, particularly when attributing migration to climate change is considered. Migration can have a positive or a negative connotation considering the perspective used for framing. On one hand it can be looked upon as an adaptation strategy (as being assessed by DECCMA) but on the other it can be seen as an outcome of failure to adapt. However, there is a common understanding that migration is taken as a livelihood strategy by households in areas facing severe climate change impacts. But there is limited data and understanding on various patterns of migration (internal/international, seasonal/temporary/permanent, selected household member/whole household) in climate change “hot spots” in the South Asian region. Any additional data/information in this theme would be helpful to better understand this under-researched topic.

During the reporting period, a group of scientists from different thematic background came together for a write shop at Kathmandu on 14-17th March 2018, to unpack the migration-household adaptive capacities linkages in the climate change hotspots of South Asia. The objective of the write shop was to synthesize the findings from four CARIIA consortia working in the diverse climate change hotspots of South Asia. Adaptation at Scale in Semi-Arid Regions (ASSAR) works in the semi-arid plateau of India; Deltas, Vulnerability and Climate Change: Migration as an Adaptation (DECCMA) works in the deltas of India and Bangladesh; Himalayan Adaptation, Water and Resilience (HI-AWARE) works in the river basins in Nepal, India, Bangladesh and Pakistan; and Pathways to Resilience in Semi-arid Economies (PRISE) works in the semi-arid plains of Pakistan.

After four days of brainstorming and putting together collective evidence, the group has concluded that migration is a complex, multi-drive r, nuanced livelihood strategy, which is driven by the changing aspiration of the people and by socio-economic and environmental stressors. Similarly, adaptation to environmental stressors is a complex and location specific phenomenon. However, both migration and adaptation measures are not available for all the households in the hotspot areas due to barriers and lack of capacities, leading to trapped vulnerable population. From the findings of the four consortia, it is clear that migration is only a response strategy to environmental stressors but has the potential to be an adaptation strategy with concerted effort towards better migration outcomes and access to effective adaptation measures.

1.5 Degree Warming of World

At the COP-21 held in Paris in 2015, the world collectively committed to the to the task of “*holding the increase in the global average temperature to well below 2°C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5°C*”. To aid the facilitative dialogue to achieve this goal, the COP 21 invited the IPCC to provide a Special Report in 2018 on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways. During CARIIA’s Second Annual Learning Review (ALR2), organized 14-16 May in Wageningen, CARIIA partners have recognized that the hotspot approach to exploring impacts and adaptation has the potential to provide excellent regional inputs to the 2018 Special Report. Therefore, researchers from the CARIIA consortia agreed to prepare peer-reviewed scientific publications on the impacts of 1.5 versus 2.0 degrees global change at their respective hot spots, which provide scientific evidence for the IPCC’s Special Report. This is done by making smart use of data that is already produced under the CARIIA program, and doing additional analyses. Furthermore, a CARIIA wide synthesis publication on the impacts of 1.5 degrees global temperature increase is prepared. This effort shows that the regional hot-spot approach followed by CARIIA, offers excellent possibilities to follow-up on ongoing changes in global policy and scientific focus. During the reporting period, the draft of the paper - **Characterising climate signals in complex social-ecological systems [at 1.5 and 2°C] was finalised**. This paper aimed at reconciling results from ‘top-down’ model simulations of climate impacts with more ‘bottom-up’ qualitative descriptions based on insights from ongoing studies in four hotspot systems of the developing world. In so doing we address the absence of empirical evidence that stimulated the IPCC.

Capacity building for Adaptation Pathways in Africa and Asia

The project is designing a framework for structured synthesis and learning about adaptation pathway development across consortia. For this, a dedicated Community of Practice is assisting consortium members and strategic partners on cases of adaptation pathway development. The members of the Community of Practice is applying the learning framework to evaluate adaptation pathway development in different circumstances. The dedicated team of researchers and strategic partners from HI-AWARE, ASSAR, DECCMA and PRISE is now consolidating the lessons on the strength and weaknesses of different approaches to develop adaptation pathway for specific purposes and end-users in the context of the CARIIA hot spots, and evidence-based guiding principles for developing adaptation pathways to inform decision making for adaptation policy and practice. A special issue in environment science and policy journal has been commissioned with 12 case studies from Africa and Asia.

9. Summary of Key Lessons and Recommendations

- The distribution of tasks and responsibilities amongst consortium members could have been done in a more precise way during the planning stage in 2014. Although it was good to have almost all institutes involved in almost all tasks, this makes it more difficult to hold institutes accountable for different tasks and deliverables, because the different roles weren't described in sufficient detail. This makes the consortia management heavy which takes away time from research.
- Synthesizing a long term multi-country and multi-million research has its challenges. Through participatory process, HI-AWARE has developed internal mechanisms and used shared learning dialogue tool which were used during two workshops. Using this tool, the synthesis products were culled out in shared process. This is a great source of learning which we would try to document for dissemination.
- 'Research into Use' (RiU) in HI-AWARE has followed a strategy which was defined initially and then revisited to reflect the changing policy scenario. RiU has been a great source of learning for policy and practice oriented research. Our research outcomes have helped us better align with the present policy scenario and demands in place in the HKH region, focusing on the production of stakeholder driver platform: the Adaptation Portal. This portal is to be populated with information from institutions/practitioners/researchers working in the region on identifying of successful community level adaptation options. This platform represents the next step in research synthesis where participatory engagement in the platform allow us to refine the final product. In addition to this, a certificate program devised to educate local government officials and line managers on the changing climate change context has been devised. This program encourages such practitioners to approach day-to-day problems in their respective work areas through a holistic climate change and development lens, based on learnings accumulated during the certificate course. The demand for this course seems promising as other governments in the region such as Pakistan, have also requested for a similar course to be implemented as well.

Annexes

Annex 1: List of HI-AWARE publications – status as of April 30, 2018

Peer reviewed Journal Articles

1. Rasul, G. (2015). Water for growth and development in the Ganges, Brahmaputra, and Meghna basins: an economic perspective. *International Journal of River Basin Management*, 5124(March), 1–14. <http://doi.org/10.1080/15715124.2015.1012518>
2. Collier, E., & Immerzeel, W. W. (2015). High-resolution modeling of atmospheric dynamics in the Nepalese Himalayas. *Journal of Geophysical Research: Atmospheres*, 120(19), 9882–9896. <http://doi.org/10.1002/2015JD023266>.

3. Rasul, G., & Sharma, B. (2015). The nexus approach to water–energy–food security: an option for adaptation to climate change. *Climate Policy*, 16(6), 682–702. <http://doi.org/10.1080/14693062.2015.1029865>
4. Collier, E., Maussion, F., Nicholson, L. I., Mölg, T., Immerzeel, W. W., & Bush, A. B. G. (2015). Impact of debris cover on glacier ablation and atmosphere-glacier feedbacks in the Karakoram. *Cryosphere*, 9(4), 1617–1632. <http://doi.org/10.5194/tc-9-1617-2015>
5. Rasul, G. (2016). Managing the food, water, and energy nexus for achieving the Sustainable Development Goals in South Asia. *Environmental Development*, 18, 14–25. <http://doi.org/10.1016/j.envdev.2015.12.001>
6. Dahri, Z. H., Ludwig, F., Moors, E., Ahmad, B., Khan, A., & Kabat, P. (2016). An appraisal of precipitation distribution in the high-altitude catchments of the Indus basin. *Science of the Total Environment*, 548-549, 289–306. <http://doi.org/10.1016/j.scitotenv.2016.01.001>
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9. Lutz, A. F., ter Maat, H. W., Biemans, H., Shrestha, A. B., Wester, P., & Immerzeel, W. W. (2016). Selecting representative climate models for climate change impact studies: An advanced envelope-based selection approach. *International Journal of Climatology*. <http://doi.org/10.1002/joc.4608>
10. Thapa, B., Scott, C., Wester, P., & Varady, R. (2016). Towards characterizing the adaptive capacity of farmer-managed irrigation systems: learnings from Nepal. *Current Opinion in Environmental Sustainability*, 21(October), 37–44. <http://doi.org/10.1016/j.cosust.2016.10.005>
11. Siderius, C., Biemans, H., Van Walsum, P. E. V., Van Ierland, E. C., Kabat, P., & Hellegers, P. J. G. J. (2016). Flexible strategies for coping with rainfall variability: Seasonal adjustments in cropped area in the Ganges basin. *PLoS ONE*, 11(3), 1–23. <http://doi.org/10.1371/journal.pone.0149397>
12. Lutz, A. F., Immerzeel, W. W., Kraaijenbrink, P. D. A., & Shrestha, A. B. (2016). Climate change impacts on the upper Indus hydrology: sources, shifts and extremes. *PLOS One (under Review)*, 1–33. <http://doi.org/10.1371/journal.pone.0165630>
13. Sylvia Szabo, Robert J. Nicholls, Barbara Neumann, Fabrice G. Renaud, Zoe Matthews, Zita Sebesvari, Amir AghaKouchak, Roger Bales, Corrine Warren, Ruktanonchai, Julia Kloos, Efi Foufoula-Georgiou, Philippus Wester, Mark New, Jakob Rhyner & Craig Hutton (2016) Making SDGs Work for Climate Change Hotspots. *Environment: Science and Policy for Sustainable Development*, 58(6), 24-33 [DOI: 10.1080/00139157.2016.1209016]
14. Karpouzoglou, T.; Vij, S. (2017) Waterscape: A Perspective for Understanding the Contested Geography of water. *WIREs Water* 2017, e1210. <http://dx.doi.org/10.1002/wat2.1210>
15. Adhikari, L.; Hussain, A.; Rasul, G. (2017) Tapping the Potential of Neglected and Underutilized Food Crops for Sustainable Nutrition Security in the Mountains of Pakistan and Nepal. *Sustainability* 2017, 9, 291. <http://dx.doi.org/10.3390/su9020291>.
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18. Kraaijenbrink, P.D.A., Bierkens, M.F.P., Lutz, A.F., Immerzeel, W.W. (2017). Impact of a global temperature rise of 1.5 degrees Celsius on Asia's glaciers. *Nature* 549, 257-260. <http://sci-hub.tw/10.1038/nature23878>
19. Wijngaar, Rene.; Lutz, A.F.; Nepal, S.; Khanal, S.; Pradhananga, S.; Shrestha, A.B. et al. (2018). Climate change will result in increased hydrological extremes in the upstream domains of the Indus, Ganges, and Brahmaputra. *PLoS One* 12(12). <https://doi.org/10.1371/journal.pone.0190224>
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22. Singh, T., Siderius, C., Velde, Y. Vd., (2018), When do Indians feel hot? – internet searches indicate seasonality suppresses adaptation to heat <https://doi.org/10.1088/1748-9326/aaba82>
23. Dahri ZH, Moors E, Ludwig F, et al. Adjustment of measurement errors to reconcile precipitation distribution in the high-altitude Indus basin. *Int J Climatol.* 2018;1–19. <https://doi.org/10.1002/joc.5539>
24. Rasul, G., Hussain, A., Mahapatra, B., & Dangol, N. (2017). Food and Nutrition Security in the Hindu Kush- Himalayan Region. *Journal of the Science of Food and Agriculture.*
25. Udas, Pranita B, Anjal Prakash and Chanda G Goodrich (2018) Gendered Vulnerabilities in Diaras: Struggling with Floods in the Gandak River Basin. *Economic and Political Weekly.* Vol. 53, Issue No. 17, 28 Apr, 2018. PP- 46-54. Available online at <http://www.epw.in/journal/2018/17/review-womens-studies/gendered-vulnerabilities-diaras.html>.

HI-AWARE Working Papers

1. Lutz, A; Immerzeel, W; Biemans, H; Maat, H; Veldore, V; Shrestha, A (2016) Selection of climate models for developing representative climate projections for the Hindu Kush Himalayan region. *HI-AWARE Working Paper # 1.* Kathmandu: HI-AWARE.
2. Lutz, AF; Immerzeel, W (2016) *Reference climate dataset for the Indus, Ganges, and Brahmaputra River Basins.* HI-AWARE Working Paper # 2. Kathmandu: HI-AWARE
3. Dasgupta, P (2016) Assessing costs and benefits of climate change adaptation, *HI-AWARE Working Paper #3.* Kathmandu: HI-AWARE
4. Maharjan, A; Prakash, A; Gurung, CG (2016) *Migration and the 2015 Gorkha earthquake in Nepal: Effect on rescue and relief processes and lessons for the future,* HI-AWARE Working Paper #4. Kathmandu: HI-AWARE
5. Acharya, A; Poddar, P (2016) *The river itself warns us: Local knowledge of flood forecasting in the Gandaki River Basin, West Champaran, India,* HI-AWARE Working Paper #5. Kathmandu: HI-AWARE
6. Bimal Raj Regmi (2016) Classification of adaptation measures and Criteria for evaluation Case Studies in the Gandaki River-Basin. *HI-AWARE Working Paper #6.* Kathmandu: HI-AWARE.
7. Ankita Shrestha and Rucha Ghate (2017) Transboundary Water Governance in the Hindu Kush Himalayan Region: Beyond the dialectics of conflict and cooperation. *HI-AWARE Working Paper #7.* Kathmandu: HI-AWARE.
8. Suruchi Bhadwal, Sambita Ghosh, Ganesh Gorti, Mini Govindan, Divya Mohan, Prasoon Singh, Sresohi Singh, Yamini Yogya (2017). The Upper Ganga Basin: Will Drying Springs and Rising Floods Affect Agriculture? *HI-AWARE Working Paper #8.* Kathmandu: HI-AWARE.
9. Sangita Dandekhya, Matthew England, Rucha Ghate, Chanda Gurung Goodrich, Santosh Nepal, Anjal Prakash, Ankita Shrestha, Sreoshi Singh, Mandira Singh Shrestha, Pranita Bhushan Udas (2017). The Gandaki Basin-Maintaining Livelihoods in the Face of Landslides, Floods, and Drought. *HI-AWARE Working Paper #9.* Kathmandu HI-AWARE
10. Annemarie E. Groot, Saskia E. Werners, Bimal Regmi, Hester Biemans, Giovanna Gioli, Tanvir Hassan, Nabir Mamnun, Hassnain Shah, Bashir Ahmad, Christian Siderius, Tanya Singh and Philippus Wester (2017). Critical climate stress moments: Conceptualisation and assessment methods. *HI-AWARE Working Paper #10.* Kathmandu: HI-AWARE.
11. Saqib Shakeel Abbasi, Bashir Ahmad, Murad Ali, Muhammad Zubair Anwar, Zakir Hussain Dahri, Nusrat Habib, Abid Hussain, Bilal Iqbal, Sultan Ishaq, Naveed Mustafa, Rozina Naz, Zeeshan Tahir Virk, Philippus Wester. The Indus Basin – A glacier-fed lifeline for Pakistan. *HI-AWARE Working Paper #11.* Kathmandu: HI-AWARE.
12. Abu Syed, Afroza Haq, Arfan Uzzaman, Chanda Gurung Goodrich, Dwijen Mallick, G Mini, Ghanashyam Sharma, Klasang Nyima, Nabir Mamnun, Navarun Varma, Prasoon Singh, Rucha

- Ghate, Shreya Triwedi, Sudeshna Sen, Suruchi Bhadwal, Tanvir Hassan, Tanzina Dilshad, Vishakha Gulati, Zakia Naznin (2017). The Teesta Basin- Enough water for power and agriculture for all? HI-AWARE Working Paper #12. Kathmandu: HI-AWARE
13. Sultan Ishaq, Bashir Ahmad, Ali Kamran, Nelufar Raza, Muneeb Ahmed Khan, Zeeshan Tahir Virk, Salar Saeed Dogar, Muhammad Khalid Jamil, Naveed Mustafa, Talha Mahmood, Masooma Hassan (2017). Classification of Adaptation Measures and Criteria for Evaluation: Case Studies in the Indus River Basin. HI-AWARE Working Paper # 13. Kathmandu: HI-AWARE.
 14. Devjit Roy Chowdhury, Sugat B. Bajracharya (2018) Water Management Technologies for Climate Smart Agriculture in South Asia. HI-AWARE Working Paper # 14. Kathmandu: HI-AWARE
 15. Flügel, W.A., Nepal, S., Shrestha, A.B. (2018) Framework for Upstream-downstream Linkages of Land and Water Management in the Hindu Kush Himalayan (HKH) Region. HI-AWARE Working Paper 15/2018. Kathmandu: HI-AWARE
 16. Regmi, B.R., Shrestha, K. (2018) Policy gaps and institutional arrangements for water resources management in Nepal. HI-AWARE Working Paper 16/2018. Kathmandu: HI-AWARE
 17. Regmi, B.R., Shrestha, K., Sapkota, R., Pathak, K. (2018) Water constitutes successful adaptation measures? Reflections from the national and local contexts of Nepal. HI-AWARE Working Paper 17/2018. Kathmandu: HI-AWARE

Annex 2: Special Journal Issue - Conceptualizing and Contextualizing Gendered Vulnerabilities in the Hindu Kush Himalayan Region – Accepted by Journal Environmental Development (forthcoming in August-September 2018 issue) Edited by Chanda Gurung Goodrich, Anjal Prakash and Pranita Bhushan Udas

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1. Editorial: **Gendered Vulnerability in HKH: What do we know, what do we want to know?** Chanda G Goodrich, Anjal Prakash and Pranita B Udas (ICIMOD)
2. **Conceptualizing gendered vulnerability to climate Change: Contextual conditions and drivers of Change** - Chanda Gurung Goodrich (ICIMOD), Pranita Bhushan Udas (ICIMOD) and Harriet Larrington-Spencer (EX-ICIMOD)
3. **Comparative assessment of gender sensitivities to climate extremes in the high and mid hills of Sikkim** - Ghanashyam Sharma (The Mountain Institute) , Suruchi Bhadwal (TER), Ganesh Gorti (TERI), Sudeshna Sen (PHD candidate TERI University), Bibhuti Bhatt (TERI University)
4. **Identities, affiliations and vulnerabilities in the Mid-hills and floodplains of West Bengal**- Chanda Gurung Goodrich (ICIMOD) and Chhaya Vani Namchu (ICIMOD).
5. **Norms, practices and gendered Vulnerabilities in Lower Teesta Basin, Bangladesh** - Jannatul Ferdous, Zakia Naznin & Dwijen Mallick; Bangladesh Centre for Advanced Studies (BCAS), Dhaka
6. **Basin perspective of gendered vulnerabilities and adaptation: a case of Gandaki River Basin** - Pranita Bhushan Udas (ICIMOD), Deepak Tamang Search Nepal), Anju Pandit (CIMOD), Krity Shrestha (Practical Action), Aparna Unni (Megh Payne Abhiyan, NGO based in Bihar)
7. **Perceptions of climate shocks and gender vulnerabilities in the Upper Ganga Basin** - Suruchi Bhadwal (The Energy Resources Institute (TERI), G Mini (TERI), Vani Rijhwani (TERI), Neha Khandekar (TERI), Ganesh Gorti (TERI), Ishani Sachdeva (CEDAR – NGO Based in Dehradun, India)
8. **Identifying gender vulnerabilities in context of climate change in Indus basin** - Saqib Shakeel Abbasi, Muhammad Zubair, Nusrat Habib, Saira Batool, Qaiser Khan (Pakistan Agriculture Research Center, Pakistan)
9. Synthesis paper – **Echoes of Inter-sectionality: Gender Spaces, and Vulnerabilities in the HKH** – Chanda Gurung Goodrich, Anjal Prakash and Pranita Bhushan Udas (ICIMOD)

Annex 3: Special issue in Water Policy Journal: Water in Himalayan Towns: Lessons for Adaptive Water Governance – Edited by David Molden and Anjal Prakash

Sr No	Name of the paper	Contributors
1	<i>Editorial</i> Mapping Challenges of Adaptive Water Management in Himalayan Towns	David Molden and Anjal Prakash
2	Review paper : Urbanization and Water Insecurity in the Hindu Kush Himalayas: Insights from Bangladesh, India, Nepal, and Pakistan	Sreoshi Singh, Aditi Mukherji, Tanvir Hassan, Masooma Hassan and Neha Bharti
3	Water management in Himalayan towns: what do we know and what did we learn?	David Molden, Anjal Prakash, Philippus Wester and Eszter Krasznai Kovacs
4	The Demand – Supply Paradox: A case of two Himalayan towns in Pakistan	Zeeshan Tahir Virk, Bashir Ahmad, Bilal Khalid, Salar Saeed, Nelufar Raza, Ali Kamran
5	The Falling Water Towers: Water supply, demand and use under rising urbanization in western Himalayas	Neha Bharti, Neha Khandekar, Prateek Sengupta, Suruchi Bhadwal
6	Perform or Wither? Role of Water Users' Groups in two Municipalities of Nepal	Anjal Prakash, Kriti Shrestha, Sreoshi Singh, Menaka Hamal
7	Local Political structure and the future of water management: A case of two towns in Eastern Himalayas	Chhaya Vani Namchu, Kalsang Nyima, Sreoshi Singh, Ghanashyam Sharma, Chanda Gurung Goodrich.
8	The Temporal and Spatial Dimensions of Household Water Scarcity in the Kathmandu Valley	Olivia Molden
9	Gendered and caste differentiated vulnerability in a peri urban village in Kathmandu, Nepal	Sangita Dandekhya and Anjal Prakash
10	Deconstructing Domestic Water Paradox through Political Economic Lens in the Darjeeling Region	Rinan Shah and Shrinivas Badiger
11	Examining options for adaptations to urban flooding using hydraulic models: A case of two cities in South Asia	I. A. Pervin, S M Mahbubur Rahman, Humayun Kari, A K Enamul Haque, Ganesh Dhakal, and Mani Nepal

Annex 4: Research Component Wise Output Table

HI-AWARE Outcome Level Indicators and Progress 2017-18

Outputs	Indicators	Cumulative Target for 2018	Status as of April 15, 2018
Output 1 High quality and policy and practice relevant research on (i) climate change impacts; (ii) the drivers and conditions leading to vulnerability; and (iii) innovative climate change	Indicator 1 Number and quality knowledge on (i) (ii) climate change impacts on water supply/demand in the IGB basins and significant shifts in flow regimes based on cryosphere-	1. Two scientific papers (2) (monitoring of high mountain, upstream-downstream linkages) Cumulative targets: - Datasets: 10 + as per demand - Scientific papers: 9	We prepared the data set as per demand. There are nine data sets of which one is for reference period and remaining eight are the future downs-called GCM for HKH Basins. Data sets available at: http://rds.icimod.org/Home/DataDetail?metadataId=29332&searchlist=True http://rds.icimod.org/Home/DataDetail?metadataId=29245&searchlist=True

<p>adaptation approaches and practices conducted and knowledge generated, disseminated and strategically communicated</p>	<p>hydrological modeling; and (iii) hydro-meteorological extremes and hazard mapping generated, disseminated and strategically communicated</p>	<ul style="list-style-type: none"> - Touch table application: 1 - Reports: 2 - Data sharing platform: 1 - Documented public-domain models: 2 - Equipment procured and installed: 4 	<p>http://rds.icimod.org/Home/DataDetail?metadataId=29246&searchlist=True http://rds.icimod.org/Home/DataDetail?metadataId=29331&searchlist=True</p> <p>Scientific Papers 10 peer reviewed journal articles published <u>Touch table application done</u> – see report for <u>Gandaki River Basin</u></p> <p>Documented public-domain models: 2 (SPHY and LPJML Model) Reports (3) – Working paper (3) no 1, 2 and 15 4 Equipment procured and installed: 1 in East Rathong Glacier (India), 1 in Upper Ganga in Pindar (India), 1 Shimshal (Pakistan), 1 Lantang (Nepal)</p> <p>Cumulative - 10 peer reviewed journal articles, 3 working papers; 9 data sets published</p>
	<p>Indicator 2 Number and quality knowledge on socio-economic, governance and gender drivers and conditions leading to vulnerability of the poor in the mountains and plains of the HKH region, in the context of climate change, generated, disseminated and strategically communicated</p>	<ol style="list-style-type: none"> 1. One synthesis journal article on river basin specific differential vulnerabilities. 2. One synthesis journal article on interrelations and interplay of socio-economic and bio-physical drivers of vulnerability (linking RC2 and 1). 3. One dialogue process in one of the Study Basins to facilitate regional cooperation. 4. One journal article on gender and climate change vulnerabilities. 	<ol style="list-style-type: none"> 1. 2 Draft Journal Articles ready for discussion in CRMT 2. This is part of triangulation paper in Synthesis document 3. <u>Two flood dialogues happened</u> – final dialogue is planned in June 2018 4. 9 journal articles under preparation for special issue in Environment and Development and 5 papers are ready for cross consortia Routledge book on Gender and Climate Change (Annex no 3 and 4); 6 working papers already published (HI-AWARE working paper no 4, 7, 8, 9,11 and12) 5. Regional workshop is planned as CCAPS in August 16-17, 2018 at Kathmandu. <p>(Cumulative: 9 peer reviewed journal article (forthcoming), 5 book chapters (forthcoming) and 6 working papers published + 1 working</p>

		<p>5. Regional workshop on adaptive strategies for gender inclusive climate resilient development organized and report produced.</p> <p>6. Cumulative: 4 peer reviewed journal articles</p> <p>7. Cumulative: 7 Working Papers</p>	<p>paper on socio-economic drivers is in editing process</p>
	<p>Indicator 3 Number and quality of knowledge on (i) existing climate change adaptation practices relevant for the region; (ii) which adaptation practices work and why, through both science and stakeholder driven monitoring and piloting; and (iii) new approaches to inclusive socio-economic analysis of adaptation practices generated, disseminated and strategically communicated</p>	<p>1. Review of CC policies of 4 partner countries.</p> <p>2. Piloting of three climate adaptation practices successful.</p> <p>3. Four CISCAs established and up and running.</p> <p>4. Six peer reviewed outputs accepted</p> <p>5. Four policy briefs published.</p> <p>6. Two book chapters published.</p> <p>7. Field monitoring database published (based on CISCAs and springs research).</p>	<p>1. Eddy moor's article</p> <p>2. 3 pilots successfully done</p> <p>3. 4 CISCAs installed in India (1 each in east and west Sikkim , 1 in Delhi, 1 in Rudraprayag, 1 in Chakri (Pak) and 1 in Juglot (Pak) – documentation is in process)</p> <p>4. 8 journal articles published</p> <p>5. Policy briefs are under preparation</p> <p>6. Book chapters are merged with special issue</p> <p>7. Field monitoring data on Sprig is to be uploaded on Himalayan Spring Initiative Portal – CISCAs data will go to RDS of ICIMOD</p> <p>4. Cumulative: Working papers (7) no 3, 5,6,13, 14, 16, 17 Peer reviewed Journal articles - 8 (11 peer reviewed journal articles on urban water is forthcoming in Water Policy)</p>
	<p>Indicator 4 Number and quality of knowledge on (i) how climate change will affect critical adaptation moments for different sectors and events; and (ii) the determination of adaptation turning</p>	<p>1. Methodologies for assessment of critical moments developed and tested.</p> <p>2. 12 surveys / workshops conducted to identify critical moments and ATPs.</p> <p>3. Sector specific and spatially explicit quantification tool for ATPs and</p>	<p>1. Methodology for assessment developed and published – Annemarie E. Groot, Saskia E. Werners, Bimal Regmi, Hester Biemans, Giovanna Gioli, Tanvir Hassan, Nabir Mamnun, Hassnain Shah, Bashir Ahmad, Christian Siderius, Tanya Singh and Philippus Wester (2017). Critical climate stress moments: Conceptualisation and assessment methods. HI-AWARE Working Paper #10. Kathmandu: HI-AWARE.</p>

	points for different sectors and locations generated, disseminated and strategically communicated	identification of hot spots in each basin developed. 4. Two peer reviewed papers on CMs, ATPs, methods, tools and field realities. 5. Mapping of ATPs in the four Study Basins and validation by stakeholders.	2. 12 survey workshop conducted and sector specific tools developed and reports are ready. Please see reports here . 3. Quantitative tool has been developed (LPJML) and application is under development as HI-AWARE brief. 4. 4 working papers on CM are in the pipeline – will be ready by July 2018; Three journal articles is being drafted (RC 4 – Anjal, ATP wheat – Saskia; RC1, 2 4 triangulation – Flip) 5. Mapping of ATPs – Mapped for food security in Indus and GLOF in upper Teesta in Sikkim. Documentation in process. Cumulative 5 working paper (1 published, 4 in pipeline), 3 journal articles
	Indicator 5 Number and quality of knowledge on (i) the design of sustainable adaptation pathways that enable the improvement of policies and practices to help vulnerable populations adapt to climate change; and (ii) the barriers and bridges for the implementation of adaptation pathways generated, disseminated and strategically communicated	1. Synthesis report on stakeholder driven and gender inclusive adaptation pathways. 2. Eight stakeholder meetings on APs 3. 3 reports 4. 2 journal articles	1. Synthesis report is coming out as issue brief 2. 4 stakeholders meeting happened (one per basin due to currency exchange loss) 3. 3 peer reviewed journal article published; 4 peer reviewed journal articles is forthcoming in environmental science and policy and 2 working papers on ATPs and APs Cumulative 3 peer reviewed journal articles published 4 peer reviewed journal article and 2 working papers in pipeline
Output 2	Indicator 1.	1. Web analytics	Web analytics report is enclosed in the annual report

<p>Evidence-based and tested innovative adaptation approaches and practices effectively promoted with relevant communities and institutions at various levels, in order to improve policies and practices that help vulnerable populations adapt to climate change</p>	<p>Number and type of evidence-based and tested innovative adaptation approaches and good practices made widely and proactively available in the public domain:</p> <ol style="list-style-type: none"> 1. Number of Documents available in HI-AWARE Website and Website visits 2. Number of Document downloads in the HKH region and outside 3. Number of Media coverage and social media presence 	<p>3. Media/social media tracking, with a baseline mapping against the selected indicators in 2014. Monitoring of geographical distribution.</p>	<p>Target Achieved</p>
	<p>Indicator 2. Number of stakeholder engagement events involving HI-AWARE researchers in HI-AWARE Study Basins, including targeted events to promote adaptation innovations.</p> <ol style="list-style-type: none"> 1. Frequency 2. Extent (appropriateness of stakeholders) 3. Effectiveness- feedback received from the stakeholders 	<p>Frequency and extent (in terms of types/number of stakeholder engaged) collected through ongoing reporting by consortia members. Disaggregated by researchers, policy-makers, practitioners and media/media intermediaries and M/F.</p> <p>Perceived effectiveness measured through survey administered to sub-set of engagement activities (Question: information useful, timely, relevant= Scale of 1-</p>	<p>75 stakeholders event</p> <p>Target Achieved</p>

		5) and in 2018 through follow-up with participants in earlier events on whether/how engagement activities informed and/or influenced their actions.	
<p>Output 3 Strengthened capacity of the HI-AWARE research community (HI-AWARE Consortium members, supported PhDs and MScs and HI-AWARE partners) for conducting high quality research on adaptation issues and communicating and using research results strategically</p>	<p>Indicator 1: Individual Numbers of individuals in the HI-AWARE research community who report strengthened capacities (disaggregated by gender). Women and men supported for PhD, MSc, Post docs, internship</p>	<p>1. 16 individuals from each consortium member (50% female); 12 individuals from partners 2. 6 PhDs and 20 MScs supported (50% female)</p>	<p>1. Completed – reported in the consortium report under capacity building (report is in designed process) 2. 6 PhDs (3 male and 3 female) and 26 MSc (12 male and 14 female candidates) Target Achieved</p>
	<p>Indicator 2: Institutional Reported changes in capacity of consortium members and HI-AWARE partners to: (i) design, implement, communicate and use research and evidence with attention to gender and inclusion (against self-assessment at baseline); (ii) collaborate within consortia in terms of design and implementation; and</p>	<p>Inside CARIAA partnership: Capacity assessment baseline and follow-up surveys (mid-term and final). Outside of consortia: Survey of partners (mid-term and final). All documented with gender indicated</p>	<p>This is reported in 2018 annual report. The report is getting prepared. Target Achieved</p>

	(iii) secure new funding and partnerships		
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Impact of HI-AWARE

Outcome	Indicator	Target	Status as on April 15 2018
Key stakeholders in planning, policy, practice and research use a range of evidence-based and tested climate change adaptation innovations to support livelihoods in the HI-AWARE study basins (Teesta, Gandaki, Upper Ganga and Indus) in ways that benefit vulnerable women and men	Number of relevant institutions and key stakeholders (planning, policy, practice and research) that have used policy and practice relevant knowledge generated by HI-AWARE in promoting adaptation policies and practices that are gender sensitive and inclusive	Stakeholder engagement and dialogue processes for results uptake successful, with 75 events completed. At least 8 institutions, two in each Study Basin, have used HI-AWARE knowledge products	Achieved 1. NASC, Nepal Curriculum development for DRR 2. Tribhuvan University Curriculum Development 3. JEEVIKA (Govt of Bihar) recognizes eco-san toilet as flood resilient technology and same is considered for ODF plus villages 4. Notredame University Bangladesh using HI-AWARE knowledge products 5. Interview by Bangladesh TV – Abu Syed on Teesta 6. National Public Radio of USA picked up HI-AWARE Rudraprayag Experiment for radio broadcast 7. TERI University using CISCAS for supporting Student’s research 8. Christian’s talk on Dutch Radio on heat stress 9. HI-AWARE inputs in implanting Provincial level development scheme on solar water pumping in Pakistan 10. Technical support provided to Police

			College Sihala, Pakistan for solar water pumping 11. NCRD, Pakistan using HI-AWARE pilot site for demonstration of climate smart agriculture
	Number of evidences showing HI-AWARE research results have been referred to in documents (reports, briefs, video, news paper), policy dialogues and decision-making forums relevant for policies and practices in the region and globally	At least four policy documents refer to HI-AWARE research results. HI-AWARE referred to in four policy dialogues	<ol style="list-style-type: none"> 1. GB- Climate Change policy inputs 2. Punjab (Pak) – Solar Pump Policy (inputs sent by PARC) 3. NAP, Nepal using HI-AWARE data on Climate Scenario 4. Sustainable Development Bill of Government of Sikkim, India refers to HI-AWARE work 5. HI-AWARE researchers advised to Bangladesh Climate Change Strategy and Action Plan based on HI-AWARE research 6. CEDAR inputs to state action plan on climate change of UK, India <p>Policy dialogue</p> <ol style="list-style-type: none"> 1. Sustainable mountain development Summit in Mizoram 2017 mentions HI-AWARE – legislators meet 2. SDPI called on PARC for conference on Sustainable Development Conference 2017 3. Pakistan CC Parliamentarian Standing Committee

			<p>meets HI-AWARE and PRISE researchers, Feb 2018</p> <p>4. JEEVIKA invited MPA to present about Eco-San at a meeting of all DDCs of Bihar</p>
	<p>Number and types of requests received from relevant stakeholders to HI-AWARE to brief on, produce, partner in or provide advice for applying generated knowledge</p>	<p>Eight requests to brief on HI-AWARE knowledge.</p> <p>Six requests to partner.</p> <p>Eight requests to provide advice.</p>	<p>1. Flip Wester gave briefing to South Asian Commission of the European Parliament, Nov 2014</p> <p>2. HI-AWARE BCAS briefed MPs in Dhaka, Feb 2017</p> <p>3. MP Sikkim invites TERI for Legislators Meet on Himalayan Glaciers March 2018</p> <p>4. Ministry of Agriculture invites TERI for mission 2022 to doubling farmer's income</p>