Water, Sanitation and Hygiene – Gender Equality Measure (WASH-GEM) Climate Modules: Pilot Report

Institute for Sustainable Futures

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1 Introduction

Developed by the Institute for Sustainable Futures at the University of Technology Sydney and partners[1], the WASH-GEM is a quantitative measurement tool that explores the diverse experiences of gender equality by both women and men. Through structured interviews, the WASH-GEM quantifies gendered experiences and changes across five conceptual domains. Across the five domains, the WASH-GEM has 16 themes - reported on scales of zero-to-one. Four themes are WASH-related and 12 focus on gender equality in society more broadly, as seen in

Figure 1. Ultimately, the WASH-GEM seeks to explore how changes in WASH can lead to changes in gender equality in society more broadly – aiding in the monitoring and evaluation of gender-transformative WASH programs, projects, and policies (MacArthur et al. 2023).

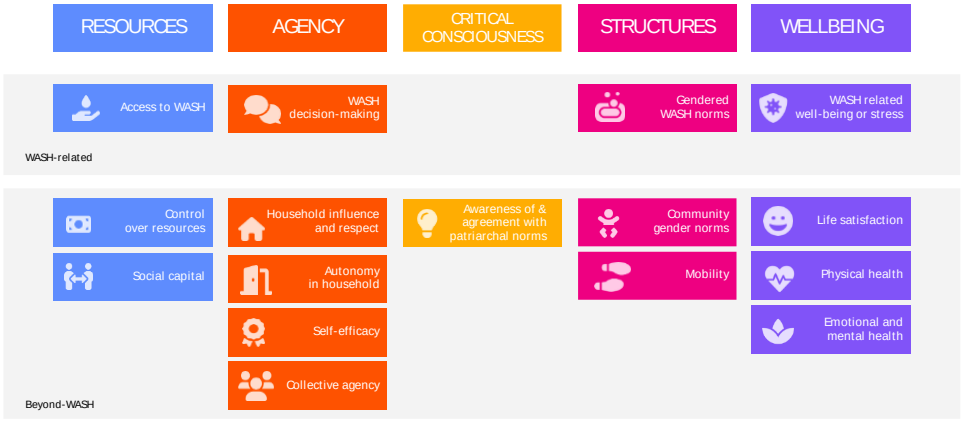


Figure 1. WASH-GEM Themes and Domains (v3.0)

The WASH-GEM is grounded in critical concepts in gender and development theory (Carrard et al. 2022), and has been piloted in five countries with gender-focused WASH programming of iDE (Cambodia, Ghana) and SNV Development Organisation (Nepal, Lao PDR, and Bhutan), with a baseline-endline analysis conducted in Nepal (MacArthur, Basnet, et al. in preparation). The WASH-GEM was developed through a partnership approach, and in doing so, has aided these programs in creating strategic programming decisions to support transformative gender equality (Gonzalez et al. 2022).The WASH-GEM has also recently undergone a detailed validation analysis and version 3.0 of the tool is forthcoming (MacArthur et al. in preparation).

In the context of the broader Water for Women Fund's transition to embed a focus on climate change, we have adapted and expanded the WASH-GEM to explore the connections between climate change and gender equality in gender-transformative WASH programming. This pilot was conducted in collaboration with SNV in Nepal, Lao PDR and Bhutan in 2022 and included a review of relevant literature and testing of climate modules that can be used alongside the WASH-GEM: 1) a bespoke module to compare the perceptions of women and men related to climate change, and 2) a set of 12 adapted items which directly align with existing WASH-GEM items.

This report summarizes the findings and learnings from piloting the WASH-GEM's climate modules. The report beginnings with an overview of the approach taken to adapt the WASH-GEM to climate and details the two tested modules. Section 3 then introduces the results from the two modules. We end with a brief discussion and reflections on the strengths and limitations of the two modules before offering brief conclusions.

[1] Partners included: iDE, SNV, CMB, IWDA and Edge Effect

2 Approach

To pilot the climate adaptions to the WASH-GEM, the ISF adopted a four-step process which included a literature review, peer review, piloting and sensemaking. This report focuses on the piloting and sensemaking phases.

The WASH-GEM climate modules were piloted in Nepal, Bhutan and Laos PDR countries between August and October 2022. The modules were added to a previously planned use of the WASH-GEM amongst three SNV programs, all part of the Water for Women Fund.

Data was collected using the existing WASH-GEM protocols which included survey implementation training, enumerator training and ethical considerations. Further details on these protocols can be found on the WASH-GEM site: https://sites.google.com/uts.edu.au/washgem).

Data was collected using Android tablets and Kobo Toolbox and cleaned by the SNV country program teams in Excel. Analysis was conducted by ISF using R-Studio.

Table 1. Pilot countries - Nepal, Bhutan and Laos highlighted in green

2.1 Module 1: Gendered Climate Resilience

Module 1 tested seven items focused on the gendered experiences of four climatic events (floods, droughts, landslides, and severe storms). The types of events asked about was determined by the enumeration team, as such many respondents answered these questions multiple times for different climate events. The questions were adapted from set of subjective measures developed to explore climate resilience in Tanzania (Jones, Samman, and Vinck 2018)

Figure 2. Gendered experiences of climate resilience – seven tested items

To analyse these results, for each of the four climate events (floods, droughts, landslides, and severe storms), validation procedures were conducted in broad alignment with a selection of practices in scale development (Boateng et al. 2018). Details on the results of the scale development can be found in Annex A, and the results using the scales for analysis can be found in Section 3.

- **Item Reduction:** Exploratory factor analysis to identify if any items should be dropped and to understand the underlying factors.
- **Reliability**: Calculation of Cronbach Alpha and Omega Total to test for the internal consistency as unidimensional or multidimensional measures. This also included the development of bi-factoral models.
- **Dimensionality:** Confirmatory factor analysis to check the underlying factors and test the fit of models.
- **Measure Invariance:** Calculation of invariance across gender and country for each scale.
- **Scoring:** Calculation of climate-event resilience scores to compare by gender and country and to compare between dyad-pairs.

2.2 Module 2: Adapted WASH-GEM Items

Module 2 includes 12 items (questions) that are directly adapted from the existing WASH-GEM tool. These 12 items are framed to ask about experiences of gender equality both in 'normal times' and during 'climate events'.

Difference in responses were compared by gender to better understand the different impacts of climate events on gender equality aspects between women and men. Pairwise t-tests were conducted to calculate the statistical significance of the differences between women and men's scores.

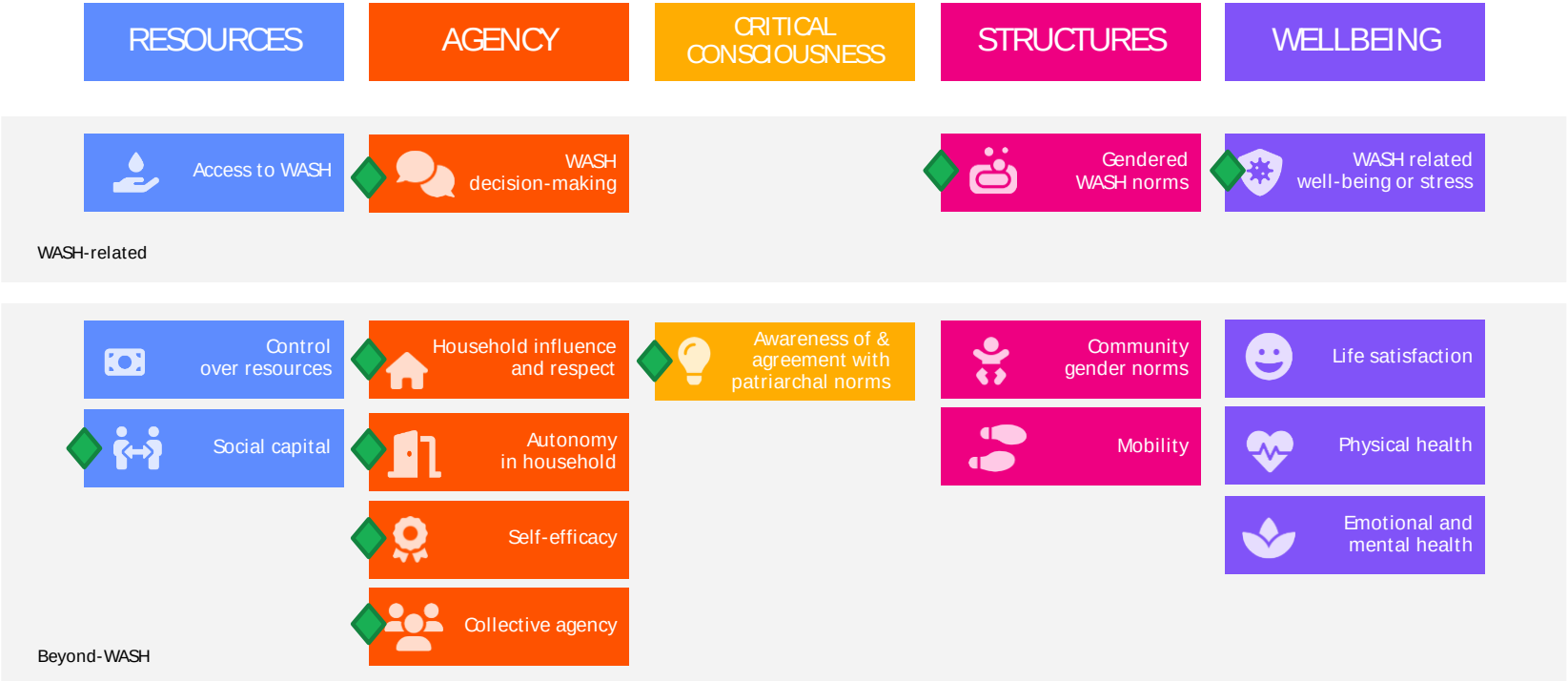


Figure 3. WASH-GEM climate questions

3 Results

Overall, 2406 respondents participated in the pilot study from the three countries: Bhutan, Laos and Nepal. The districts in Nepal were separated into two locations as they represent very different climatic, geographic and socio-economic conditions.

Most respondents had preschool or lower education and the mean age was 47.4 years across all respondents.

Table 2. Respondents by locale

	Women (N=1218)	Men (N=1188)	Overall (N=2406)
Bhutan	209 (17.2%)	178 (15.0%)	387 (16.1%)
Laos	198 (16.3%)	198 (16.7%)	396 (16.5%)
Nepal - Dailekh	315 (25.9%)	317 (26.7%)	632 (26.3%)
Nepal - Sarlahi	496 (40.7%)	495 (41.7%)	991 (41.2%)

Table 3. Age and education level of respondents

	Women (N=1218)	Men (N=1188)	Overall (N=2406)
Age			
Mean (SD)	45.2 (28.0)	49.5 (28.2)	47.4 (28.2)
Median [Min, Max]	43.0 [19.0, 822]	48.0 [19.0, 714]	45.0 [19.0, 822]
Education groups			
Preschool-	906 (74.4%)	579 (48.7%)	1485 (61.7%)
Primary	153 (12.6%)	308 (25.9%)	461 (19.2%)
Secondary+	156 (12.8%)	297 (25.0%)	453 (18.8%)
No Response	3 (0.2%)	4 (0.3%)	7 (0.3%)

3.1 Module 1: Resilience Scales

3.1.1 Resilience Scale Development

Drawing on the responses for each of the seven items in Module 1, we crafted a five-item using both exploratory and confirmatory factor analyses. Two items were dropped across all the scales based on the exploratory factor analysis. Once the scales were finalized, all scales showed high internal consistency (see Table 4) and correlated well with one another (Persons r = 0.65 – 0.76).

Table 4. Resilience scale reliability

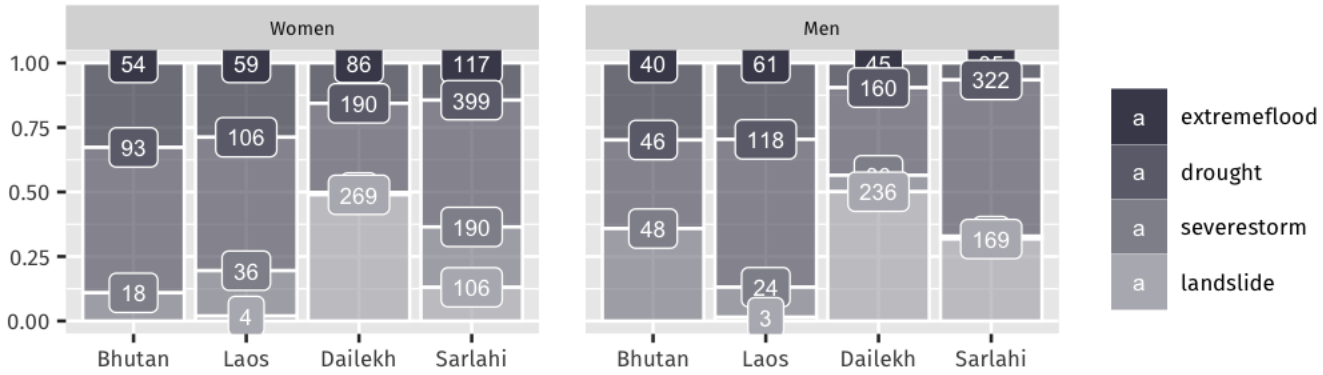
	Number of Observations (n=)	5-item Scale Internal Consistency	
		Cronbach Alpha	Omega Total
Flood	878	0.76	0.95
Drought	1385	0.76	0.89
Landslide	737	0.77	0.96
Severe Storm	841	0.77	0.94

The scale scores represent the perceived resilience of individuals with 0 equating with no resilience and 1 equating with high resilience. Multiple choice responses are coded in a similar fashion to the WASH-GEM and averaged to create the scale value.

The high correlation between the four scale results at dyad, gender, country and overall levels indicates that asking respondents to respond to a single climate event (rather than multiple) would be sufficient.

3.1.2 Enumerator selected climate events

Enumerators were asked to select the most relevant climate events based on local context from extreme flood, drought, severe storm and landslide. They were able to select more than one option.

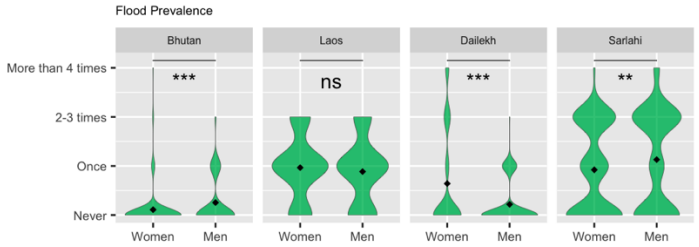


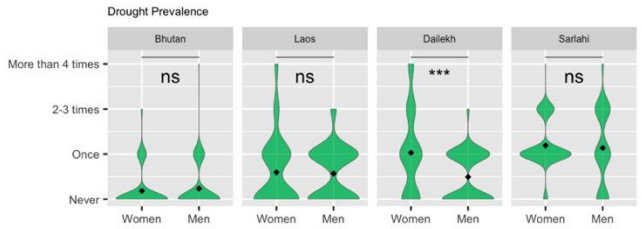
Event	Women	Men	Total	Percentage of Respondents
Flood	316	181	497	21%
Drought	788	646	1434	60%
Severe Storm	249	108	357	15%
Landslide	279	408	687	29%

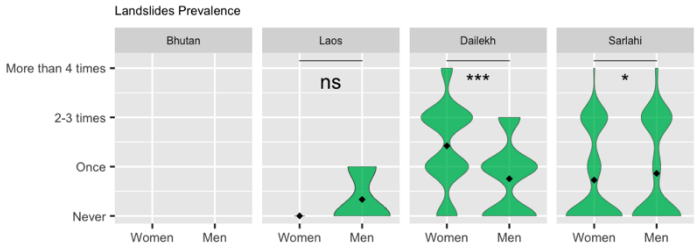
- Overall the three rounds of data collection had 3841 responses related to the four types of climate events within the 2406 respondents.
- The types of climate events were determined by enumerators based on local context.
- Across all three countries, the most common type of climate event was drought with 60% of respondents sharing the perceptions of resilience to drought. The lowest response was to severe storms at 15%.
- The Bhutan data was collected differently, and enumerators could only select one option. In Nepal and Laos, enumerators could select multiple options.
- The landslide option was not used in Bhutan, and had low numbers of responses in Laos.

3.1.3 In the last two years, how often have you experienced a {}?

These violin plots[2] indicate the perceived prevalence or frequency of selected climatic events. This item was not included in the final resilience scale as it was not shown to be associated with the other items during validation, but does show the prevalence of perceived climate events and as such as still a worthwhile item. The plots also indicate the statistical significance between for pair-wise t-tests between women and men's responses (p-values ***=0.001, **=0.01, *=0.05), and the diamond shape indicates the mean value.





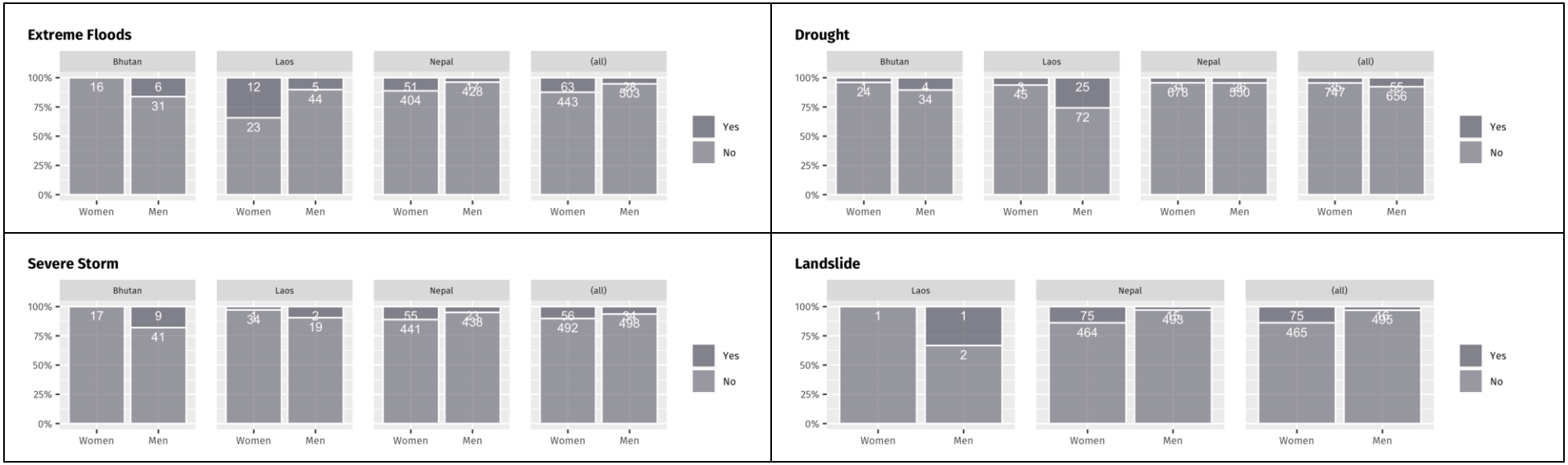


- Frequency of climate events can be objectively assessed using secondary climate sources, however human perceptions represent an important dimension of climate resilience. As can be seen by our data, there are differences between how women and men perceive climate events – and most significantly with relation to severe storms.
- In Bhutan, women perceived more floods, but men perceived more drought and storms.
- In Laos, there was not a difference in perceived number of floods, droughts and landslides between women and men. However, men perceived more severe storms than women.
- In Dailekh, women perceived more climate events than men across all four climate categories.
- In Sarlahi, the trends flipped back and forth between who perceived more events, however there was a statistically significant difference between responses for floods, landslides and severe storms.

[2] Learn about how to understand violin plots here: https://chartio.com/learn/charts/violin-plot-complete-guide/

3.1.4 Please think about the last {} that affected your household. Did you know about it in advance?

This item was not included in the final resilience scale, but does show that overall early warning systems are not working for all four climatic events.



3.1.5 Scale Scores

Violin plots of each resilience scale (flood, drought, storm, and landslide) based on preparedness, recovery, adaptation, and seriousness (community and household, are shown in the following summary with analysis based on the region (country or district - Nepal). The plots also indicate the statistical significance between for pair-wise t-tests between women and men's responses (p-values ***=0.001, **=0.01, *=0.05).

Overall, there were statistically significant differences between women and men scores for all four scales. However, the trends were not the same in all locales. In Bhutan, men had higher self-reported resilience across all four scales. In Sarlahi (southern Nepal), women had higher self-reported resilience than men, which aligns with other studies of empowerment in the district (MacArthur, Chase, et al. in preparation). In Dailekh (hilly Nepal) and Laos, the trends changed with the different climate events.

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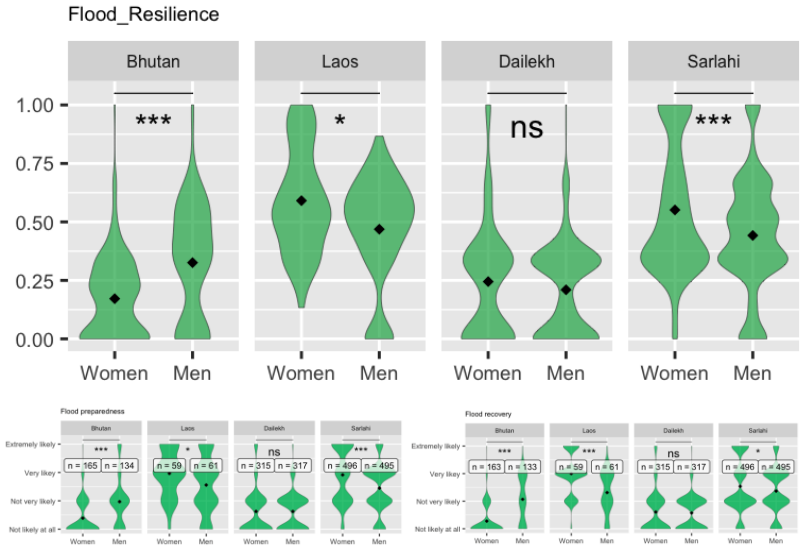
<td> 
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Self-reported flood resilience was statistically different between women and men in three of the four locales.
In Bhutan, men reported significantly higher resilience than women. However, in Laos and Sarlahi (southern Nepal), women reported higher resilience than men. In Dailekh (hilly Nepal), women and men had similar flood resilience scores.
When this is explored at the item level, there were also gender differences for the same three areas related to floods; with women much less likely to feel prepared or to recover than men in Bhutan and Laos, but more likely in Sarlahi.

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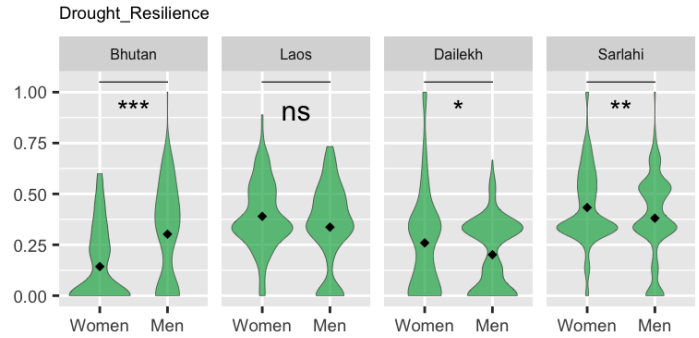
<td> 
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Self-reported drought resilience was statistically different between women and men in three of the four locales.
In Bhutan, men reported significantly higher resilience than women. In both Nepali districts, women reported higher resilience than men. In Laos, women and men had similar flood resilience scores.

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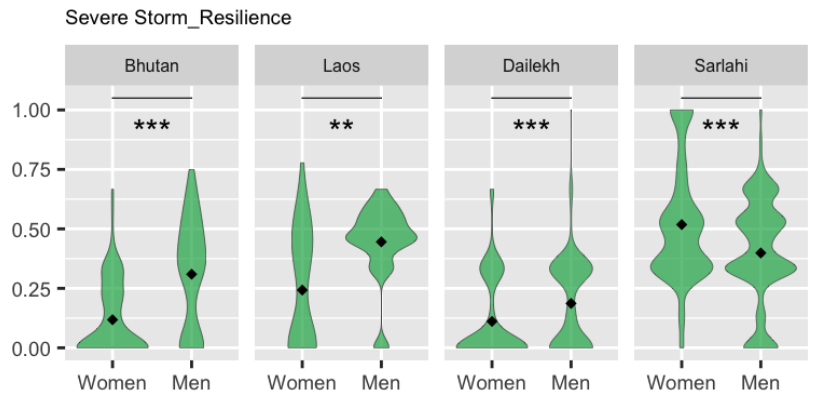
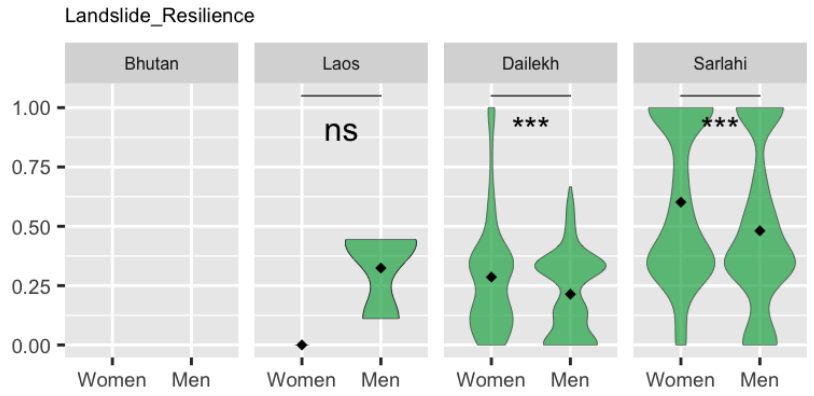
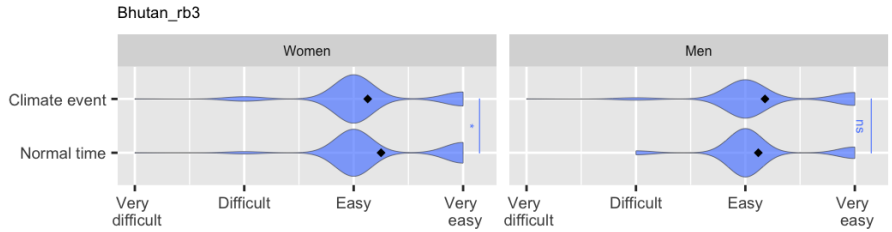
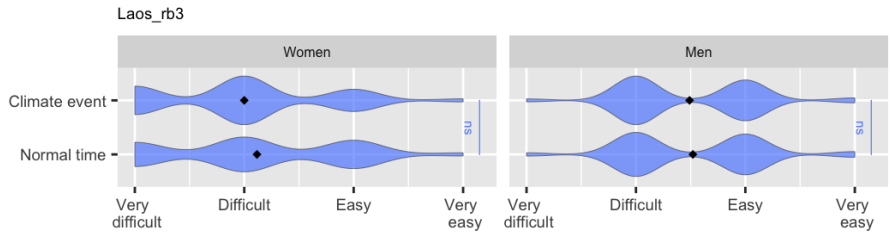
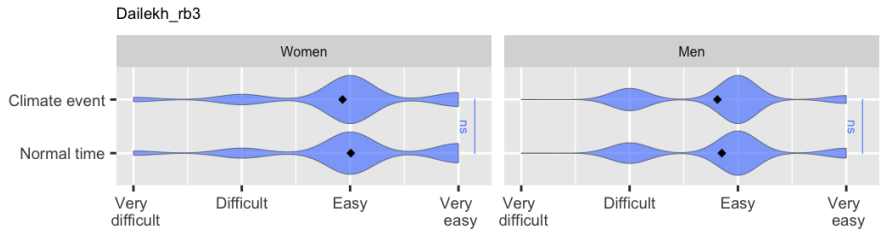
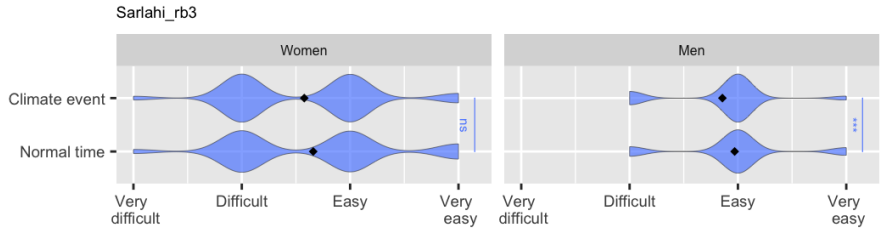
	• Self-reported drought resilience was statistically different between women and men in all four locales. • In Bhutan, Laos and Dailekh, men reported significantly higher resilience than women. However, in Sarlahi women reported higher resilience than men.
	• Landslides were not included in Bhutan and had limited responses in Laos. • In Nepal (Dailekh and Sarlahi) women had significantly higher self-reported resilience scores to landslides than men.

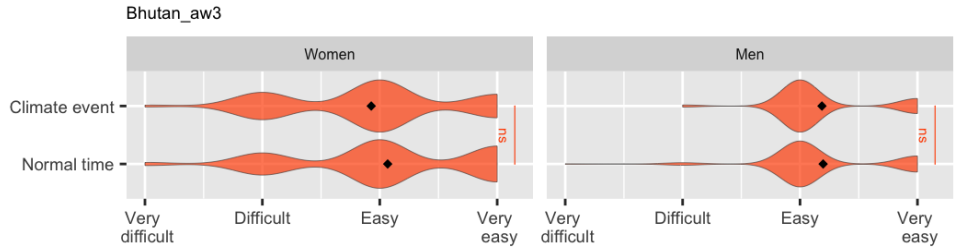
3.2 Module 2: WASH-GEM Climate Questions

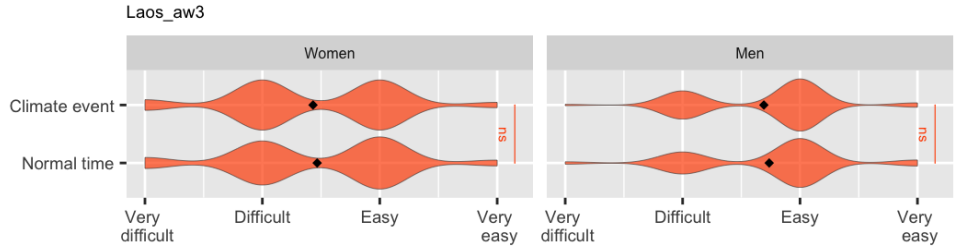
These questions are adaptations of 12 WASH-GEM questions/items. Most are asked for both 'normal' time and during a climate event.

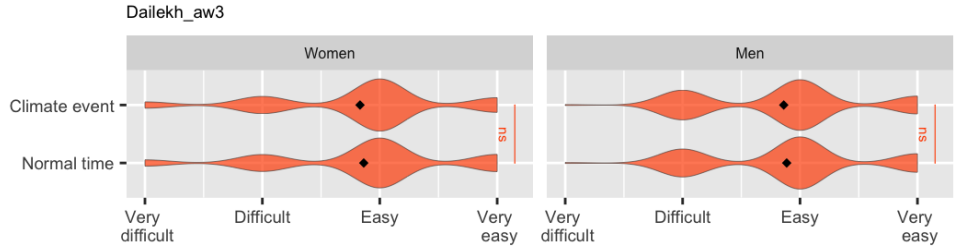
3.2.1 How easy or difficult is it for you to ask for non-financial help from people outside your household {during normal times and during severe weather events or disasters}?

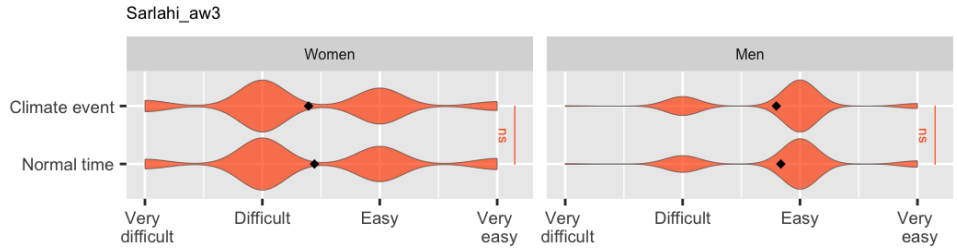
	No differences between climate events and 'normal' time for both men in Bhutan. Small differences seen in women's responses with more women saying it was easier during 'normal' time than during climate events.
	No differences between climate events and 'normal' time for both women and men in Laos and Dailekh.
	
	No differences between climate events and 'normal' time for both women in Sarlahi Nepal. However, there were differences between men's perceptions of social capital in normal times versus climatic times. It should be noted that this aligns with the trends seen in other WASH-GEM studies in Sarlahi.

3.2.2 aw3_climate. How easy or difficult is it for you to raise concerns about water, sanitation and hygiene in the community with influential people {during severe weather events or disasters}?



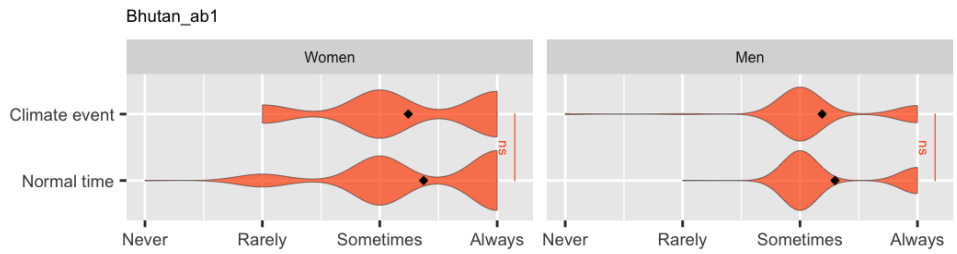
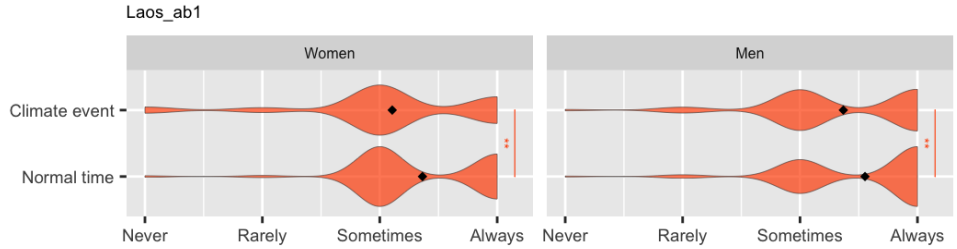
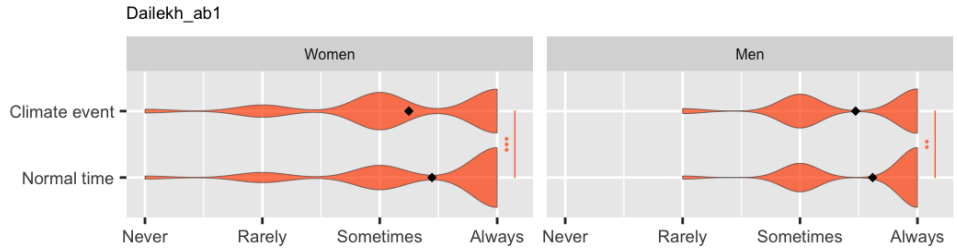
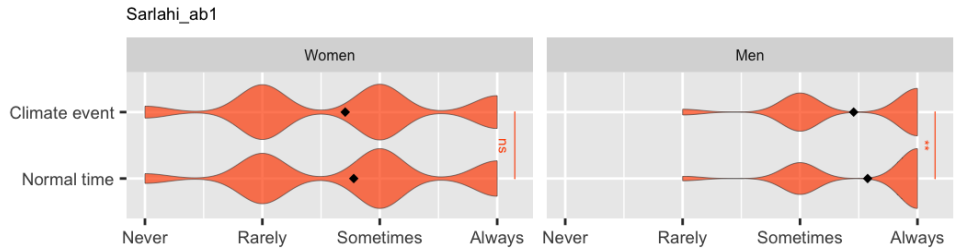




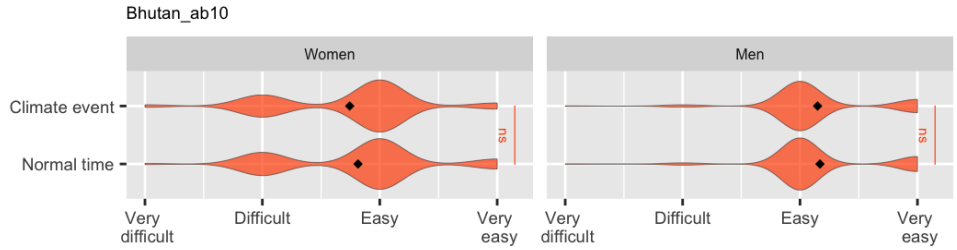


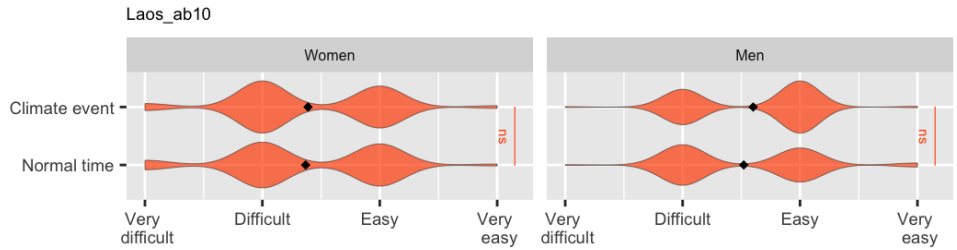
No differences between climate events and ‘normal’ time for both women and men across all four locales.

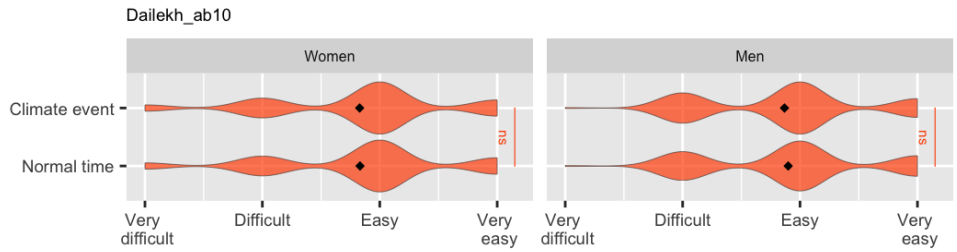
3.2.3 How often do your family members listen to your opinions when making big decisions {during normal times and during severe weather events or disasters }?

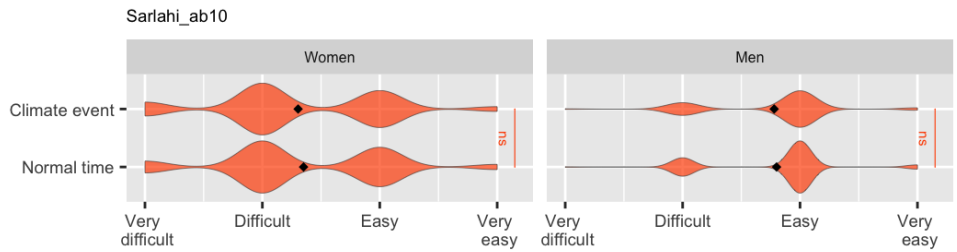
	No differences between climate events and 'normal' time for both women and men in Bhutan.
	Both women and men in Laos identified that they have less family influence during severe weather events than during 'normal' time.
	Both women and men in Dailekh identified that they have less family influence during severe weather events than during 'normal' time.
	Men in Sarlahi identified that they have less family influence during severe weather events than during 'normal' time.

3.2.4 How easy or difficult is it for you to raise concerns with influential people {during normal times and during severe weather events or disasters during severe weather events or disasters}?



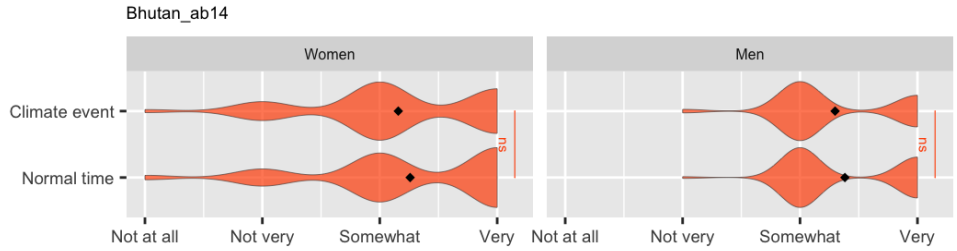




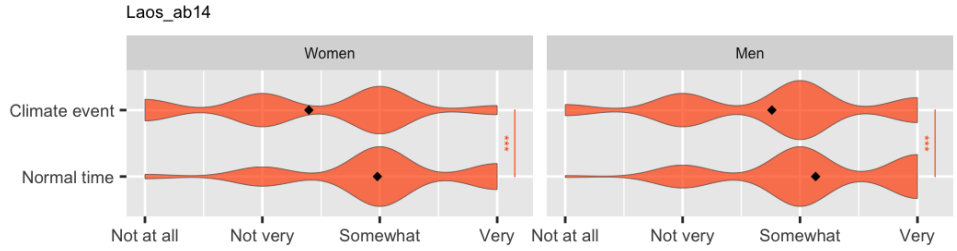


No differences between climate events and ‘normal’ time for both women and men in all four locales.

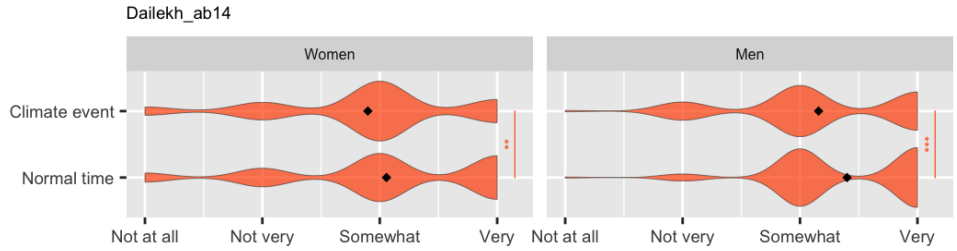
3.2.5 How confident are you in your ability to solve problems faced in your household {during normal times and during severe weather events or disasters during severe weather events or disasters}?

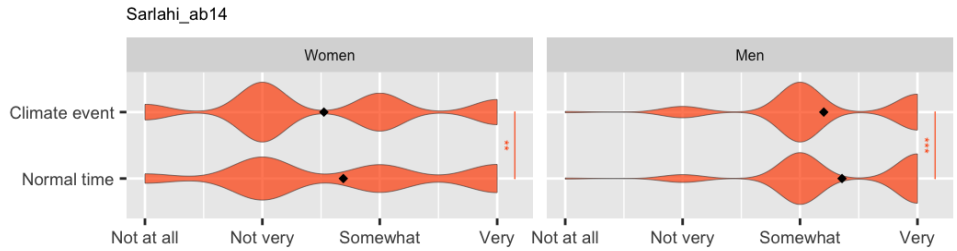


No differences between climate events and 'normal' time for both women and men in Bhutan.

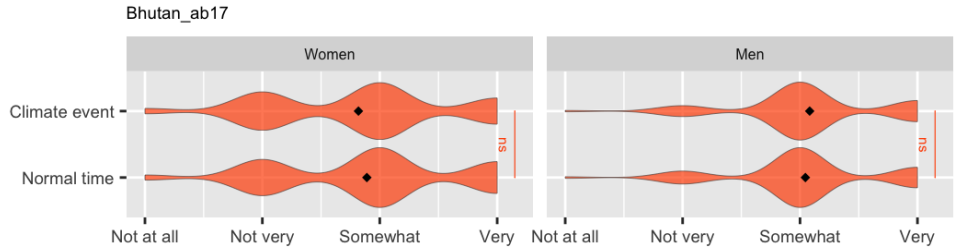


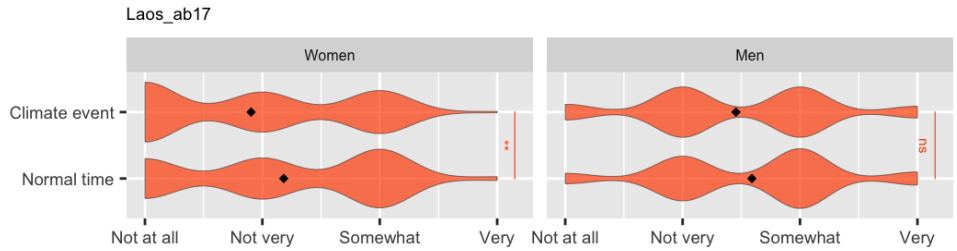
Women and men in Laos, Dailekh and Sarlahi all described feeling less confident to solve household problems during severe weather events.

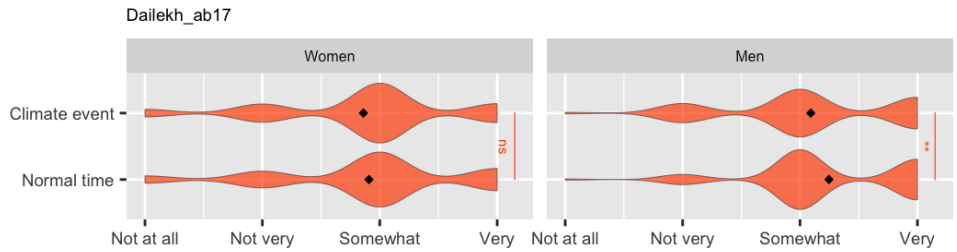


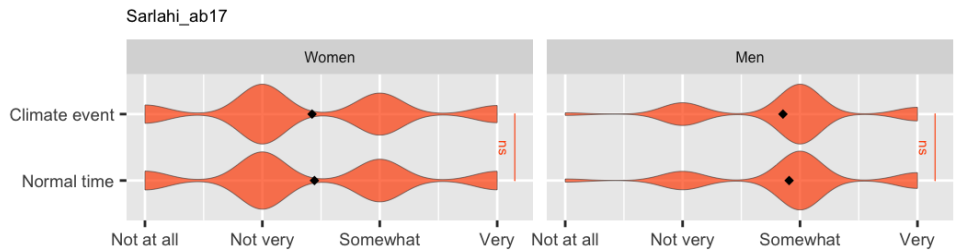


3.2.6 How confident are you in your ability to help solve problems faced in your village or community {during normal times and during severe weather events or disasters during severe weather events or disasters?}?



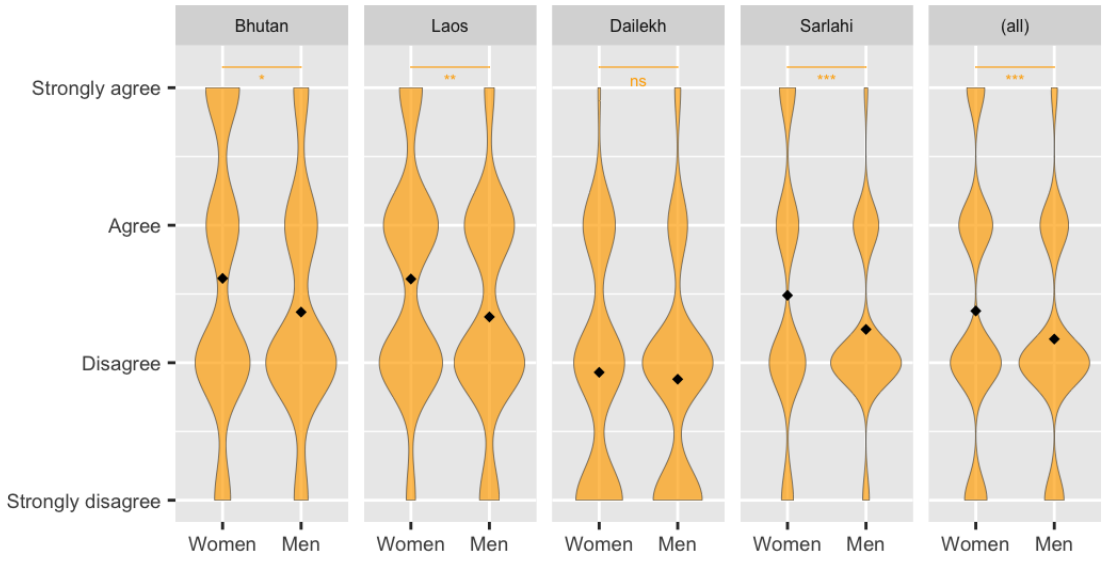


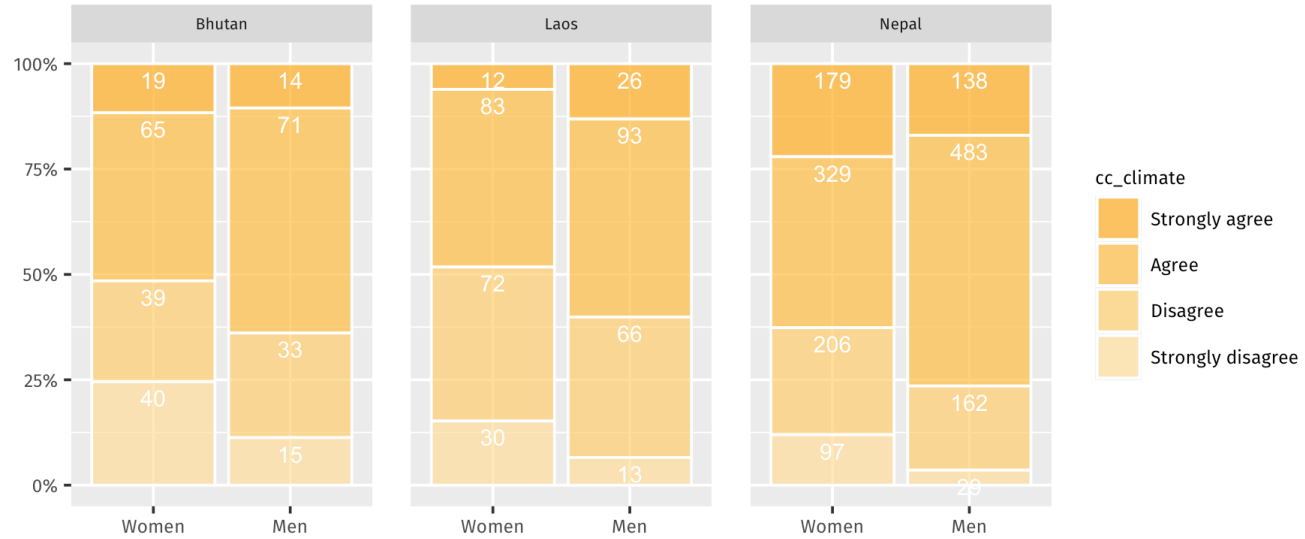




No differences between climate events and 'normal' time for both women and men in Bhutan, Laos and Sarlahi. However, men in Dailekh did feel less confident to solve problems in their communities during severe weather.

3.2.7 cc1_climate. Disasters affect everyone in our community equally.

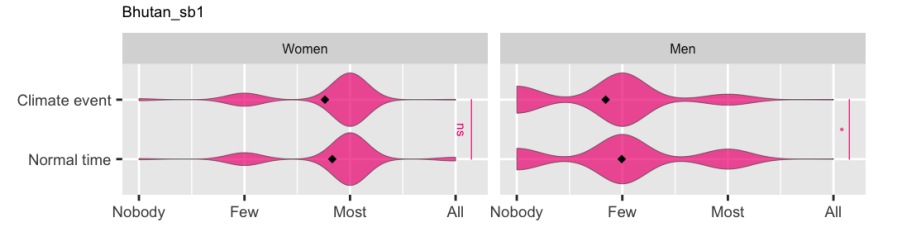


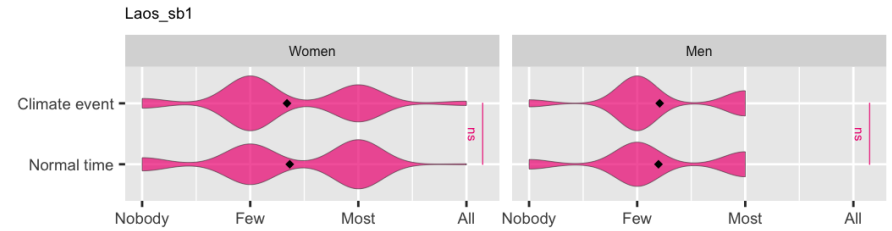


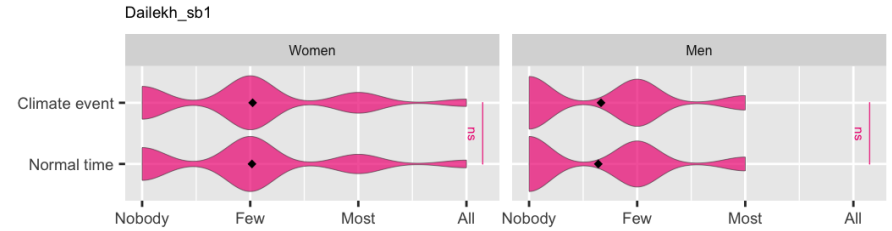
This item is not comparable between severe weather times and 'normal' times.

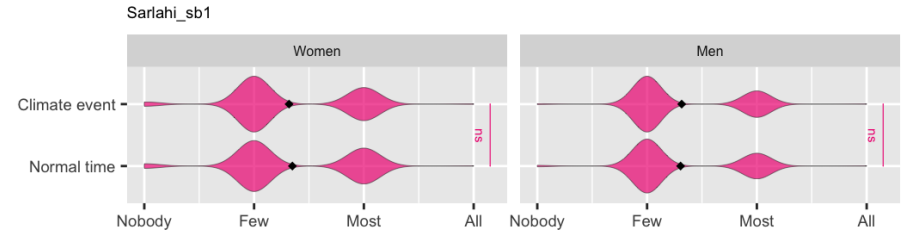
Women in Bhutan, Laos and Sarlahi agreed more that disasters affect everyone in the community equality. In Dailekh responses did not differ between women and men.

3.2.8 Among men you know, how many regularly care for children, the sick or elders in the household {during normal times during severe weather events or disasters}?



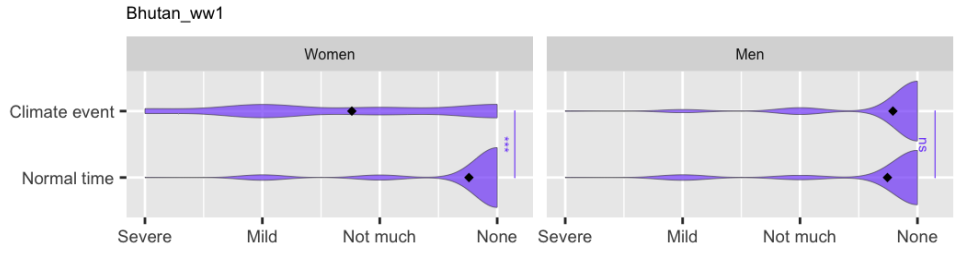


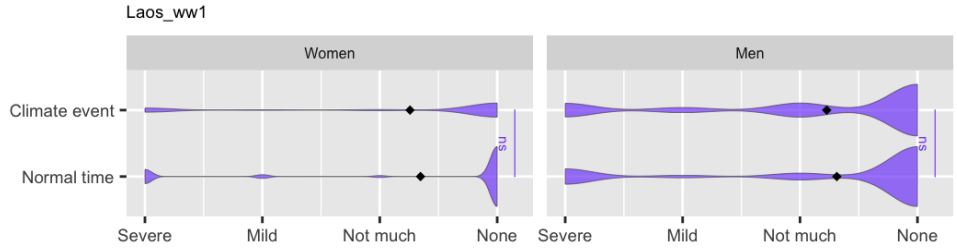


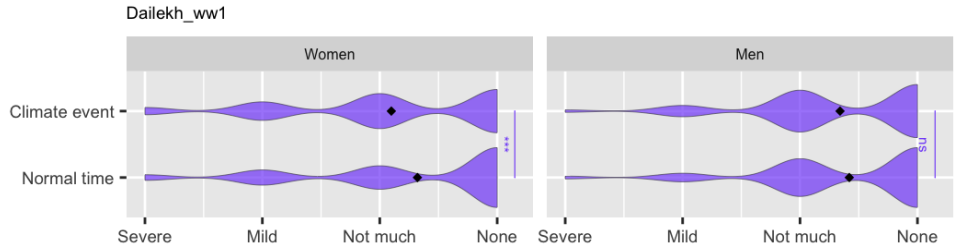


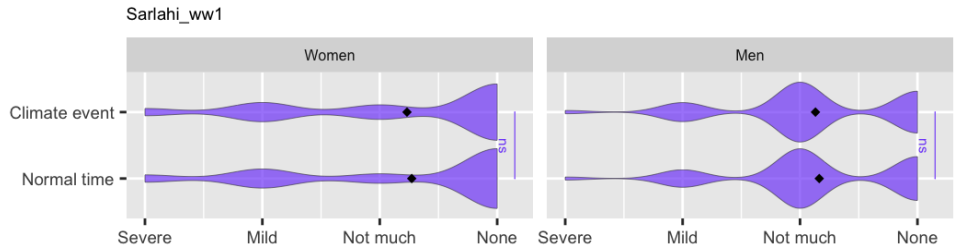
No differences between climate events and 'normal' time for both women and men in all four locales except for men in Bhutan. Men in Bhutan noted that men are less likely to take on care roles during climate events than during 'normal' time.

3.2.9 To what extent does dealing with your daily defecation cause you stress {during normal times and during severe weather events or disasters}?



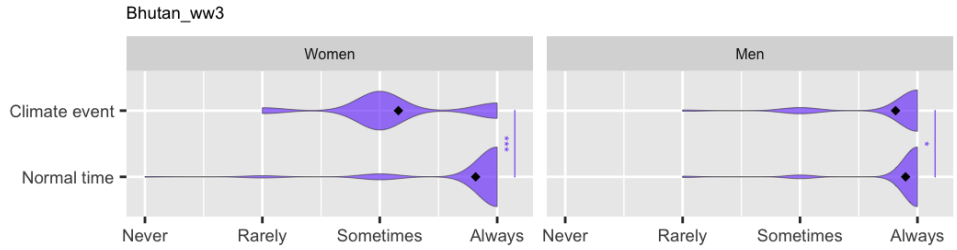


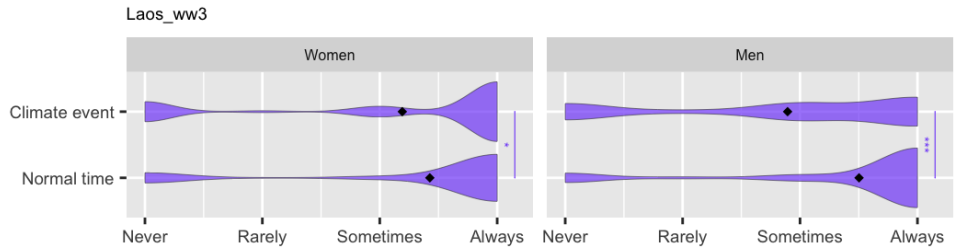


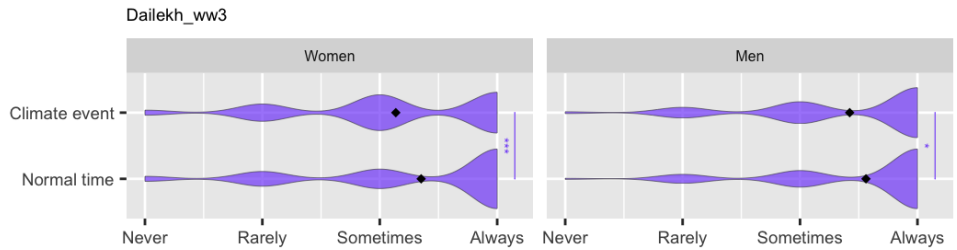


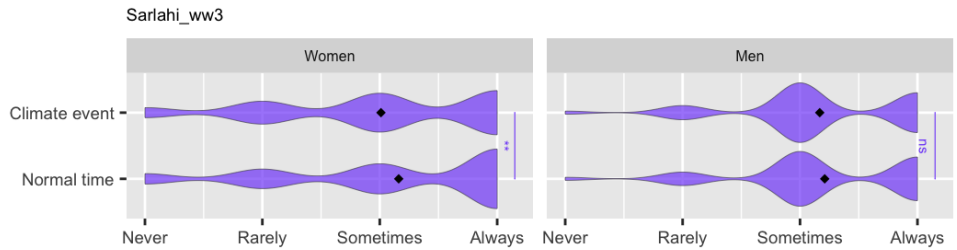
No differences between climate events and ‘normal’ time for both women and men in all four locales except for women in Bhutan and in Dailekh. These women noted that they are more likely to experience stress during climate events than during ‘normal’ time.

3.2.10 How often do you feel safe when accessing the toilet or other defecation arrangements, {during normal times and during severe weather events or disasters}?



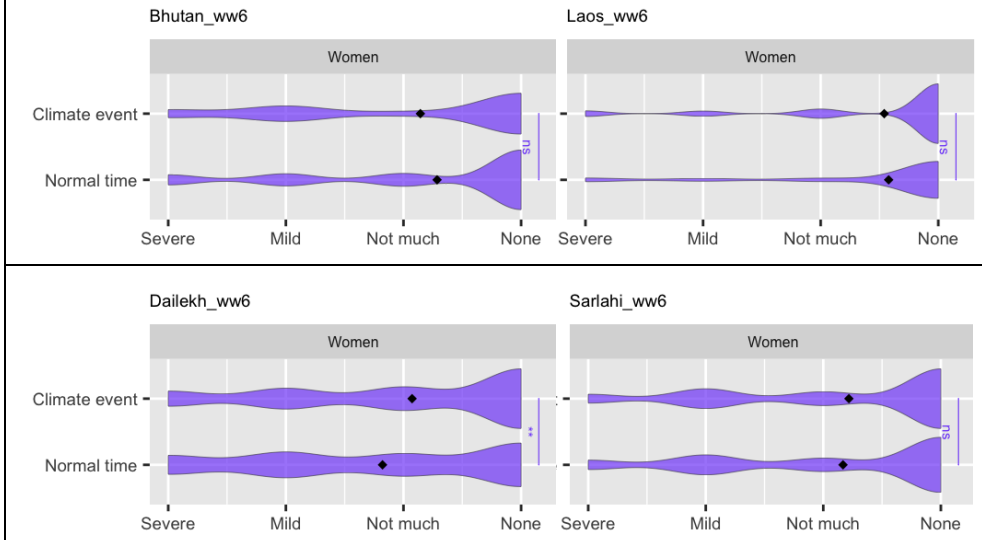






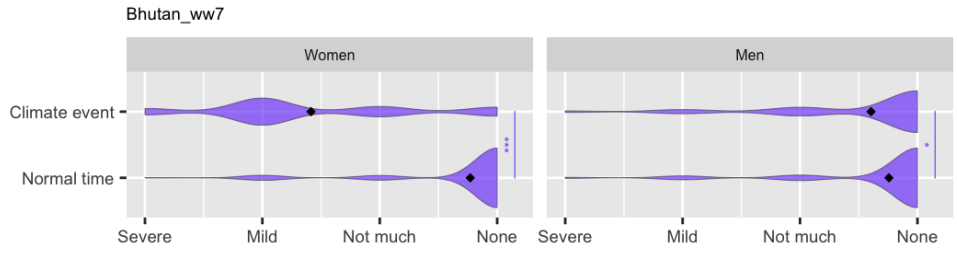
Women and men in Bhutan, Laos and Dailekh – alongside women in Sarlahi all agreed that they felt less safe using the toilet or other defecation arrangements during server weather than in regular times.

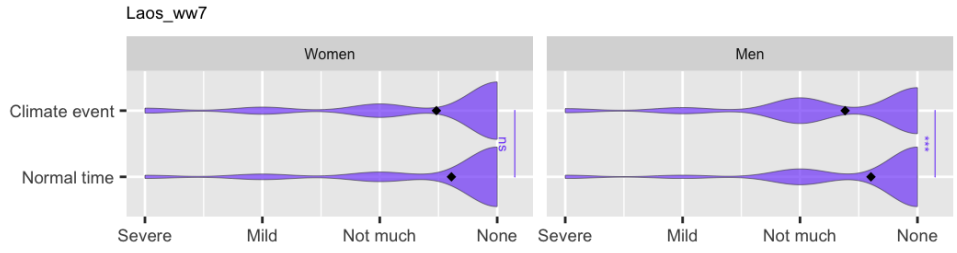
3.2.11 To what extent does dealing with your menstrual hygiene needs cause you stress {during normal times and during severe weather events or disasters}?

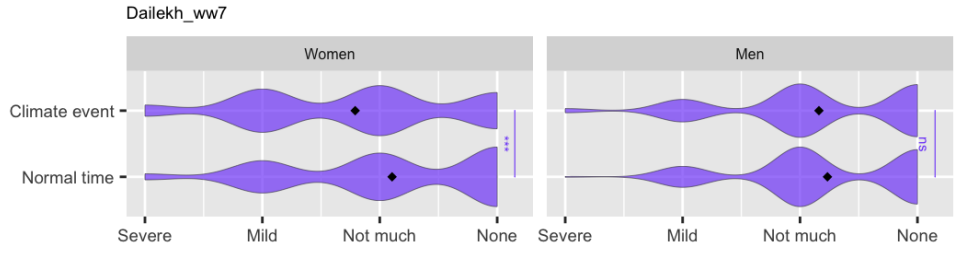


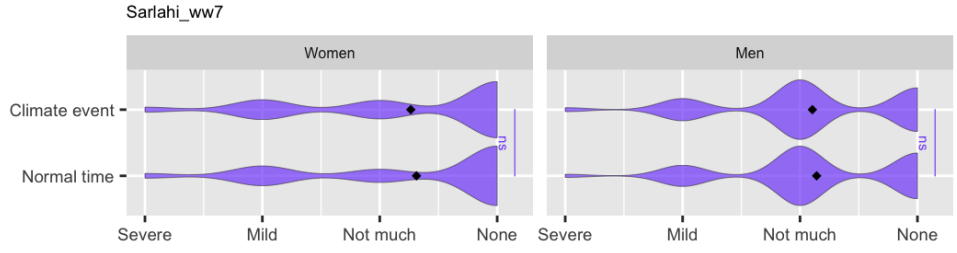
Women in Bhutan, Laos and Sarlahi did not have significantly different experiences in managing their menstruation during severe weather events. However, women in Dailekh noted that it was less stressful during climate events than normal time. This result is counter-intuitive and could represent that the item was misunderstood.

3.2.12 **ww7_climate. To what extent does obtaining drinking water cause you stress {during severe weather events or disasters}?**





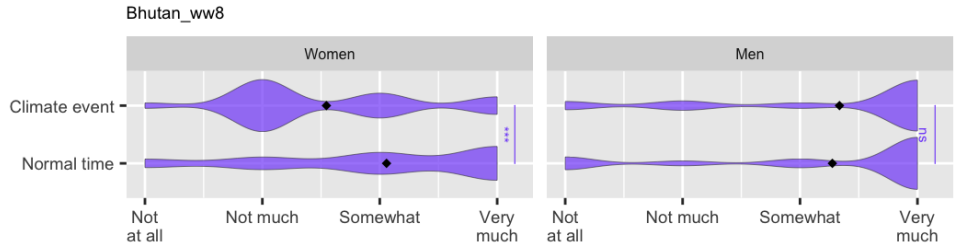


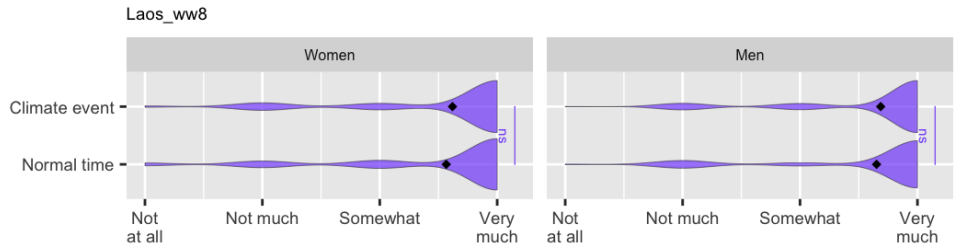


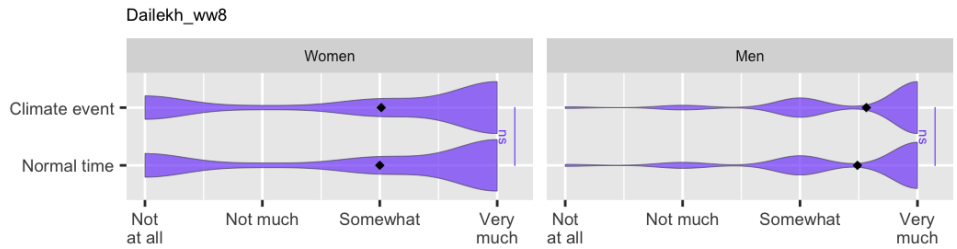
Women in Bhutan and Dailekh, alongside men in Laos agreed that obtaining drinking water causes more stress during severe weather events.

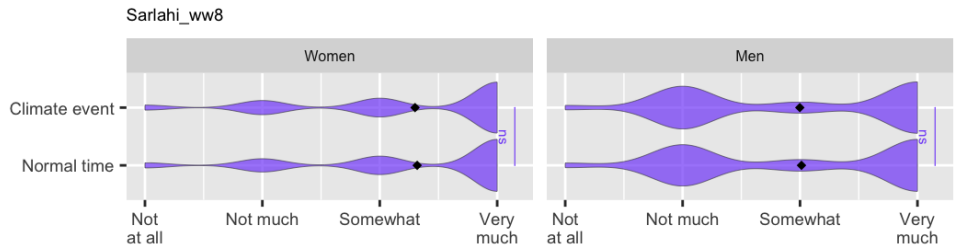
No differences between climate events and ‘normal’ time for both women and men in Sarlahi.

3.2.13 ww8_climate. To what extent is managing water, sanitation or hygiene a cause of conflict in your household {during severe weather events or disasters?}









No differences between climate events and 'normal' time for both women and men in all four locales except for women in Bhutan. Bhutanese women noted that they are more likely to experience water related conflict during climate events than during 'normal' time.

4 Reflections and Recommendations

This report has outlined the results of piloting of the WASH-GEM Climate Modules in collaboration with SNV in Bhutan, Nepal, and Laos. The first module tested a set of 7-items representing the resilience to severe climatic events. The second module tested 12-matched items with existing WASH-GEM items to clarify differences between 'normal' times and during climate events. The two modules were designed to help adapt the WASH-GEM for use in climate resilient and gender-transformative WASH programming.

The results indicate that there are significant differences between how women and men perceive and experienced climate-change related severe weather events. Most notably, women and men had significant differences in the types and frequency of events labelled extreme. These results are like findings of other subjective water related scales such as the Household and Individual Water Insecurity scales (Young et al. 2021).

In addition, we noted key areas in which there were no differences between women and men's experience during normal times and during disasters, including: asking for non-financial help; raising concerns with influential leaders, more generally or about WASH and; helping solve problems in the village/community.

Equally, there were key areas in which either men or women, reported worse experiences during disasters as compared with normal times. Within households, men and women in Laos and Dailekh and men in Sarlahi were less listened to in big decisions. In addition, men and women in Laos, Dailekh and Sarlahi had less confidence in their ability to solve household problems during disasters. In Bhutan, defecation cased greater stress for women during climate events but remained the same for men. In Bhutan, Laos and Dailekh women and men felt less safe attending to their defecation needs during events. For household water supply, women in Bhutan and Dailekh, and men in Laos found it more stressful to obtain drinking water during times of disaster. Lastly, women in Bhutan noted that during events, WASH caused more household conflict than during normal times.

The experiences of piloting the modules have led to two recommendations:

- First, we recommend **including Module 1 in relevant future uses of the WASH-GEM which are interested in climate issues**. The scales display internal reliability, pass confirmatory factor analysis and could be tested for construct validity against other tools used in climate change studies.

- Second, we recommend **piloting a new version of Module 2 that includes all items from a select number of WASH-GEM themes**. This approach would align with the iteration of the WASH-GEM which aggregates results across themes rather than domains. Recommended themes could include social capital (rb3-rb4), household influences (ab1-ab2) and wash-wellbeing (ww1-ww7). The climate addition to critical consciousness could also be included in future iterations but provides similar insights to the existing critical consciousness module. From the 12 tested items, only eight showed statistically different results between men and women's responses. These results were even less clear cut when broken down by other variables such as country, district, and education.

5 Conclusions

Climate change events are known to impact people differently, based on their sensitivity and ability adapt, and as such, it would be expected that women and men may have different experiences of climate events. Understanding such differences can support more nuanced practice in efforts to prepared communities for climate events and to minimise their negative impact. By extending the WASH-GEM, a measure designed to reveal differences in gendered experiences across five domains, to include climate aspects, it is possible to obtain insight into differential experiences. Application of the current climate models as well as further development of the climate modules can support improved climate resilient WASH policy and programming.

6 References

Boateng, Godfred O., Torsten B. Neilands, Edward A. Frongillo, Hugo R. Melgar-Quiñonez, and Sera L. Young. 2018. “Best Practices for Developing and Validating Scales for Health, Social, and Behavioral Research: A Primer.” *Frontiers in Public Health* 6(June):1–18. doi: 10.3389/fpubh.2018.00149.

Carrard, Naomi, Jess MacArthur, Caitlin Leahy, Simone Soeters, and Juliet Willetts. 2022. “The Water, Sanitation and Hygiene Gender Equality Measure (WASH-GEM): Conceptual Foundations and Domains of Change.” *Women’s Studies International Forum* 91(2022):102563. doi: 10.1016/j.wsif.2022.102563.

Gonzalez, Diana, Rana Abdel Sattar, Ratan Budhathoki, Naomi Carrard, Rachel P. Chase, Joanne Crawford, Gabrielle Halcrow, Tyler Kozole, Jess MacArthur, Christopher Nicoletti, Veasna Toeur, Min Prasad Basnet, Aastha Chhetri, Harishova Gurung, Ambika Yadav, Pa Vourchnea, and Juliet Willetts. 2022. “A Partnership Approach to the Design and Use of a Quantitative Measure: Co-Producing and Piloting the WASH Gender Equality Measure in Cambodia and Nepal.” *Development Studies Research* 9(1):142–58. doi: 10.1080/21665095.2022.2073248.

Jones, Lindsey, Emma Samman, and Patrick Vinck. 2018. “Subjective Measures of Household Resilience to Climate Variability and Change: Insights from a Nationally Representative Survey of Tanzania.” *Ecology and Society* 23(1). doi: 10.5751/ES-09840-230109.

MacArthur, Jess, Min Prasad Basnet, Ratan Budhathoki, Aastha Chhetri, Ambika Yadav, and Juliet Willetts. n.d. “Evaluating Changes in Gender Equality Related to Water, Sanitation and Hygiene Interventions in Rural Nepal: Findings from a Quasi-Experimental Evaluation.”

MacArthur, Jess, Naomi Carrard, Jose Mott, Stuart Raetz, Mia Siscawati, and Juliet Willetts. 2023. “Gender Equality Approaches in Water, Sanitation, and Hygiene Programs: Towards Gender-Transformative Practice.” *Frontiers in Water* 5:1090002. doi: 10.3389/FRWA.2023.1090002/BIBTEX.

MacArthur, Jess, Rachel P. Chase, Diana Gonzalez, Tyler Kozole, Chris Nicoletti, Juliet Willetts, Phnom Penh, Min Prasad Basnet, Ratan Budhathoki, Aastha Chhetri, Harishova Gurung, and Gabrielle Halcrow. n.d. “Investigating Impacts of Gender-Transformative Interventions in Water, Sanitation, and Hygiene: The Water, Sanitation, and Hygiene – Gender Equality Measure (WASH-GEM).”

Young, Sera L., Hilary J. Bethancourt, Zacchary R. Ritter, and Edward A. Frongillo. 2021. “The Individual Water Insecurity Experiences (IWISE) Scale: Reliability, Equivalence and Validity of an Individual-Level Measure of Water Security.” *BMJ Global Health* 6(10):1–14. doi: 10.1136/bmjgh-2021-006460.

Annex A: Resilience Scale Development

Item Difficulty Index + Item Discrimination

Item difficulty and discrimination together aim to understand what percentage of respondents answered similarly. We seek Item Discrimination values over 0.40 and Item Difficulty values over 0.30. Values at or under this threshold have been highlighted in blue and align with _4 and _7 items from each set of questions.

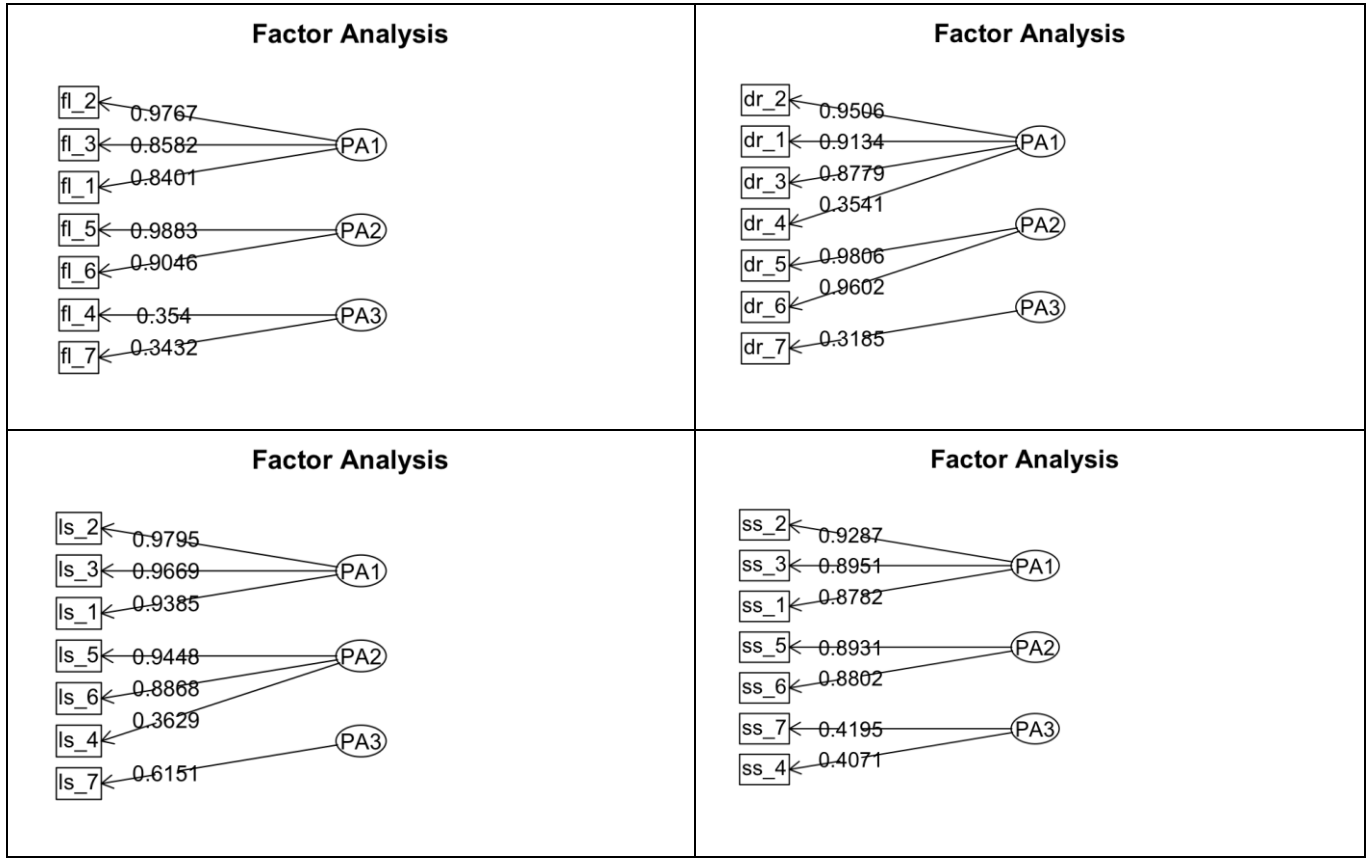
Row	Missings	Mean	SD	Skew	Item Difficulty	Item Discrimination
fl_1	15.13 %	0.4	0.34	0.39	0.40	0.68
fl_2	15.25 %	0.36	0.32	0.52	0.36	0.58
fl_3	15.13 %	0.38	0.31	0.43	0.38	0.72
fl_4	15.13 %	0.24	0.3	0.83	0.24	0.38
fl_5	63.26 %	0.42	0.2	2.06	0.42	0.40
fl_6	61.89 %	0.43	0.21	1.9	0.43	0.43
fl_7	56.90 %	0.09	0.28	2.92	0.09	0.22
dr_1	10.89 %	0.34	0.3	0.58	0.34	0.72
dr_2	10.93 %	0.31	0.28	0.51	0.31	0.65
dr_3	10.89 %	0.33	0.27	0.44	0.33	0.74
dr_4	10.85 %	0.28	0.26	0.59	0.28	0.33
dr_5	41.98 %	0.4	0.17	2.57	0.40	0.44
dr_6	40.98 %	0.4	0.17	2.43	0.40	0.43
dr_7	37.95 %	0.06	0.24	3.7	0.06	0.31
ls_1	32.29 %	0.43	0.38	0.37	0.43	0.73
ls_2	32.29 %	0.4	0.37	0.54	0.40	0.63
ls_3	32.29 %	0.41	0.36	0.48	0.41	0.68
ls_4	32.29 %	0.3	0.31	0.41	0.30	0.36
ls_5	68.74 %	0.41	0.2	2.27	0.41	0.45
ls_6	60.22 %	0.43	0.2	1.97	0.43	0.43
ls_7	56.32 %	0.09	0.28	2.94	0.09	0.27
ss_1	17.79 %	0.34	0.32	0.56	0.34	0.69
ss_2	17.79 %	0.32	0.3	0.56	0.32	0.67
ss_3	17.75 %	0.33	0.3	0.46	0.33	0.76
ss_4	17.71 %	0.23	0.29	0.75	0.23	0.38
ss_5	64.59 %	0.37	0.12	3.48	0.37	0.47
ss_6	63.92 %	0.37	0.12	3.32	0.37	0.46
ss_7	55.11 %	0.08	0.28	3.02	0.08	0.26

Item Reduction

Exploratory factor analysis for each of the four scales using all seven of the tested items. For all four climate events, two items did not align and had lower loadings and/or switched factors: _4 and _7. As such these two items were dropped to create a five-item scale.

- #4 In the last two years, how often have you experienced a {}?

- #7 Please think about the last {} that affected your household. Did you know about it in advance?



Reliability

	Number of Observations	7-items		5-items	
		Cronbach Alpha	Omega Total	Cronbach Alpha	Omega Total
Flood	878	0.72	0.88	0.76	0.95
Drought	1385	0.76	0.95	0.76	0.89
Landslide	737	0.66	0.74	0.77	0.96
Severe Storm	841	0.75	0.89	0.77	0.94

Reliability was calculated using both Alpha – best for unidimensional, and Omega – best for multidimensional measures. As can be seen the five-item measure performed better and is above the thresholds for internal consistency.

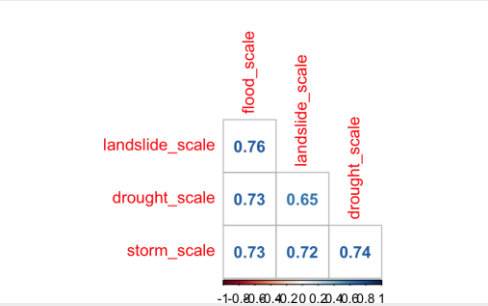
Dimensionality and Invariance (Gender)

The following table summarises the test of dimensionality through confirmatory factor analysis of the different scales. This is then tested for configural, metric and scalar invariance across gender. Within the table, blue background shading indicates invariance has been met. Each cell contains four numbers, which represent:

- Comparative Fit Index (CFI)
- Tucker-Lewis Index (TLI)
- Root Mean Square Error of Approximation
- Standardized Root Mean Square Residual

	Model (CFA)	Configural	Metric	Scalar
Flood **(standard results)**	0.993 0.984 0.078 0.031	0.997 0.992 0.034 0.032	0.998 0.997 0.022 0.034	0.990 0.985 0.047 0.045
Drought **(scaled results)**	0.999 0.996 0.040	0.994 0.985 0.033	0.987 0.977 0.041	0.971 0.959 0.054

	0.015	0.017	0.021	0.033
Landslide	0.991	0.976	0.936	0.890
	0.979	0.953	0.896	0.846
(robust results)	0.087	0.099	0.097	0.127
	0.033	0.075	0.077	0.088
Severe Storm	0.998	0.976	0.936	0.890
	0.994	0.953	0.896	0.846
(robust results)	0.042	0.075	0.099	0.118
	0.020	0.047	0.077	0.088



Persons R correlations between the different scale results indicating strong correlations between all the scales.

The weakest correlation is between drought and landslide.