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RECEIVED 06 April 2024

ACCEPTED 09 July 2024

PUBLISHED 11 September 2024

## CITATION

Iyer R and Kohlitz J (2024) Climate impacts on rural sanitation: evidence from Burkina Faso, Bangladesh and Lao PDR. *Front. Water* 6:1413225. doi: 10.3389/frwa.2024.1413225

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# Climate impacts on rural sanitation: evidence from Burkina Faso, Bangladesh and Lao PDR

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Climate change is a real, emerging issue in the rural sanitation sector. In an already stressed context, they threaten sustained sanitation progress and outcomes. Yet, evidence gaps continue to exist on how climate impacts affect rural sanitation and hygiene practices and the narratives of people and households at the forefront, experiencing climate impacts on sanitation in rural areas are largely absent. The sector also needs more thinking on how programming can adapt to consider climate hazards. This paper builds evidence on climate impacts on rural sanitation practices through case studies in Burkina Faso, Bangladesh and Lao PDR. Studies were undertaken through various participatory methodologies to understand and respond to lived experience, differentially experienced impacts and tacit knowledge of climate impacts on rural sanitation. Climate hazards affect sanitation via numerous, dynamic interlinking pathways. The social context and local anthropogenic activities shape how these hazards impact physical access to sanitation infrastructure, access to local resources and markets, and livelihoods needed to support safe sanitation. These impacts include behaviours and practices, infrastructure, and people's capacity to invest in sanitation. Strong implications have emerged for how sanitation practice, research and policy must evolve to account for climate hazards to ensure sustained sanitation outcomes, systemic resilience and programme delivery. The rural sanitation sector must recognize the various interlinkages and distinct experiences of climate across people's daily lives as they have cascading impacts on sanitation practice. Climate considerations must be integrated at every stage of sanitation project delivery, and more holistic pathways must be explored, to ensure root causes of systemic issues such as poverty and vulnerability are considered for sustained and transformative outcomes.

## KEYWORDS

climate hazards, climate adaptation, sanitation & hygiene (WaSH), participation, rural sanitation, participatory research, sanitation

## Introduction

Climate change is a serious emerging concern in the sanitation sector. Evidence on current progress is stark—the joint monitoring programme estimates that 3.5 billion people lack safely managed sanitation, including 1.9 billion people with insufficient access to basic services and 419 million who continue to practice open defecation (WHO and UNICEF, 2023). Climate

hazards (adverse climate events and trends such as floods and droughts) are an additional concern in an already stressed context, threatening sustained progress and lasting sanitation outcomes. Climate impacts, understood as the outcome of climate-related events and trends, are also not equal. They disproportionately affect vulnerable groups and have major implications for their capacity to adapt and respond.

Discussions across the rural sanitation sector indicate the need for more explicit evidence on how climate impacts affect different people, how they respond or cope, and their diverse experiences of grappling with additional burdens (Kohlitz and Iyer, 2021). More insight is also needed in the broader water, sanitation and hygiene (WASH) sector to effectively situate sanitation issues within the myriad of pressures that climate change enforces on people's livelihood opportunities, health, and household priorities. These have major implications for programming and progress in the sector to achieve more systemic resilience and resource allocation and ensure climate-sensitive programme delivery for sustained and safely managed outcomes.

With this rationale, the Sanitation Learning Hub at the Institute of Development Studies (SLH IDS) and University of Technology Sydney's Institute for Sustainable Futures, (UTS-ISF), and a range of partners<sup>1</sup> have undertaken three research case studies in Burkina Faso, Bangladesh and Lao PDR from 2021–23. This paper presents the findings from these studies. It aims to build and contribute to the evidence base on how climate hazards impact rural sanitation and hygiene services in different ways; to highlight the use of grounded and participatory research methodologies to explore and capture varied local realities and experiences; and explore how climate-sensitive responses can be feasibly integrated within ongoing participatory rural sanitation programmatic interventions.

## Emerging evidence and thinking on climate and sanitation

Climate change is an emerging focus in the sanitation sector. Despite numerous empirical links between climate and sanitation, water and its links to climate continue to dominate the narrative, with sanitation comparatively behind. Current scholarship in this area speaks to both climate mitigation and adaptation, with climate hazards having major implications for the future of broader WASH responses (Howard, 2021). While it has been comparatively easier to ascertain climate impacts on water services and needs (Oates et al., 2014), its direct impacts on sanitation services and links to climate action, have not been explored until more recently. This can be attributed to both a reduced focus from national governments on sanitation within their nationally determined contributions (NDCs), as well as the need to strengthen evidence between sanitation and climate adaptation and mitigation (Dickin et al., 2020).

We know that climate change is a threat to sanitation systems (Howard et al., 2010), with implications for disease spread. Diarrhoeal disease prevalence rises with increasing temperatures and after heavy rainfall and flooding occurrences (Levy et al., 2016). The risk of the

spread of cholera significantly increases during heavy rains and floods where people share sanitation facilities or practice open defecation (Howard et al., 2010; Righetto et al., 2013; Jones et al., 2020). Evidence also shows that improved sanitation services can ameliorate some of these effects (Jones et al., 2020).

Within this discourse, climate hazards and their impacts on urban sanitation have still received more attention than rural sanitation. Damage to urban sanitation infrastructure and technology is already well documented (Hyde-Smith et al., 2022), particularly during heavy rainfall and flooding (Hughes et al., 2021), along with preliminary assessments of flood impact on different types of sanitation infrastructure (Sherpa et al., 2014) and urban informality (Heath et al., 2012). Researchers have also produced ways to measure and manage the durability and resilience of infrastructure during and after hazards (Luh et al., 2017; Lebu et al., 2024) and indicated a range of technological solutions available during heavy rain and flooding (ISF-UTS and SNV, 2019; Borges Pedro et al., 2020). However, infrastructural and technical perspectives dominate these discussions, with relatively less focus on social and institutional mechanisms (ISF-UTS and SNV, 2019). This is despite evidence now indicating that urban governments need to engage with several social and institutional mechanisms, such as planning and financing, user awareness, and monitoring and evaluation for more resilient cities (Willettts et al., 2022).

Yet, climate hazards also impact rural sanitation services and facilities. Evidence indicates that many people in rural areas do not rebuild or repair latrines when they are damaged during and after heavy rainfall or flooding (Mosler et al., 2018; Chambers et al., 2022). In cases where toilets need water for use, scarce water conditions can cause changes in behaviour, where people revert to open defecation or use failing infrastructure (McGill et al., 2019; UTS-ISF and SNV, 2022). In Burkina Faso, toilets were built following community-led total sanitation interventions with local materials often collapsing following heavy rains and people had to resort to using their neighbour's sanitation facilities (Kouassi et al., 2023).

The resilience of WASH systems has therefore emerged as a significant recent focus of academic thinking within the climate and sanitation sector (Tshuma et al., 2024). Researchers have sought to quantify resilience and suggested several indicators to monitor and evaluate climate resilience within WASH (GWP and UNICEF, 2017). Howard et al. (2021) have also compiled an index to measure resilient water and sanitation systems through comprehensive metrics in lower- and middle-income countries. This was tested by measuring community-managed water supply systems in Ethiopia and Nepal with results indicating the need for more investment in resilient systems (Nijhawan et al., 2022). Measuring sustainable access in the context of resilient sanitation systems, however, continues to be unclear with a lack of consistent framework, holistic considerations and clear metrics across sustainability, resilience and technical aspects (Chambers et al., 2022).

However, these metrics are primarily driven towards quantitative perspectives and miss out on more qualitative and "soft" evidence around experiences, and tacit knowledge. The narratives of people and households at the forefront, experiencing climate impacts on sanitation in rural areas are largely absent. Diverse climate impacts stemming from contextually and culturally driven vulnerabilities have been extensively recorded within broader climate adaptation literature (Birkmann et al., 2022; Cissé

<sup>1</sup> Partners have been detailed in each Case Studies – Rationale, Methodologies and Findings section.

TABLE 1 Summary of exploratory case studies relating to rural sanitation.

Country	Focus of case study	Key climate hazards discussed	Research and implementer partners
Burkina Faso	Climate impacts and coping mechanisms at the village level	Heavy rainfall and flooding Dry spells and slow onset desertification	Institut de Recherche en Sciences de la Santé UNICEF
Bangladesh	Climate impacts and coping mechanisms at the village level	Flooding Cyclones Storm surges Salinity	WaterAid Rupantar
Lao PDR	Programmatic experiences supporting households to prepare for flooding	Flooding	SNV

et al., 2022; Taylor et al., 2022; Jerin et al., 2023). Considering rural sanitation-related vulnerabilities are also guided by several social-cultural factors (House et al., 2017; WHO and UNICEF, 2023), more evidence is needed on how its interactions with climate impacts produce distinct experiences and challenges.

Gaps exist in terms of how impacts vary across age, gender, geographical conditions and more, as well as how they intersect and coalesce in distinct personal experiences, with consequent effects on rural sanitation practices. Gaps also exist on how local anthropogenic activities can compound the experience of climate impacts and their subsequent effects on sanitation practices. This has significant implications for how the sanitation and hygiene sector considers and responds to these varied realities through systemic changes in programming. For instance, in the informal settlement of Murray in Cape Town South Africa, acknowledging the significance of lived experience and local realities by the local government, was a crucial enabler for upgrading sanitation services towards climate-sensitive infrastructure (Peirson and Ziervogel, 2021). Similar approaches are needed in the rural sanitation sector.

## Case studies—rationale, methodologies and findings

### Rationale

This paper presents three exploratory case studies (Yin, 2009) across diverse settings—Burkina Faso, Bangladesh and Lao People's Democratic Republic (PDR)—that collectively examine climate impacts and responses related to sanitation. Each case study aims to shed light on the lived experiences of households and how they cope with climate impacts on their sanitation access (Burkina Faso and Bangladesh) or how practitioners support households to anticipate and prepare for impacts (Lao PDR). The purpose of presenting these three case studies side-by-side is to illustrate, beyond numbers and technology, the varied climate impacts on sanitation that people are confronted with and how practitioners can address this in the near term. They also provide an evidence base of how climate hazards interact with sanitation behaviours and infrastructure, to discuss how sanitation practice, research and policy must evolve to account for climate change. It is not a comparative analysis, but rather a more wide-ranging exploration to highlight the various ways in which climate and sanitation-related challenges intersect and manifest in practice and programming.

The country locations were purposively chosen to present development contexts across Southeast Asia, South Asia, and Africa. Specific sites within the countries were chosen based on existing professional relationships between the authors and development actors working on climate and sanitation issues in those countries. We specifically sought out development actors addressing climate change in their sanitation work to facilitate the gathering of experiences on climate impacts on sanitation and responses being undertaken. The case studies are summarised in Table 1.

Across all three studies, research approaches drew on participatory research and learning methods, to understand and capture tacit knowledge and lived realities, co-produce evidence with those experiencing these issues and ensure that research findings could contribute to building research scholarship on the various links between climate and rural sanitation. Co-production, whereby diverse stakeholders (researchers, practitioners and community members in our case) interact to discuss context-based issues and solutions (Norström et al., 2020), is particularly suitable for climate change research because climate impacts are multi-faceted and contextual (Vincent et al., 2020). Hence, diverse inputs into the problematisation and solution-building for climate risks (i.e., potential adverse outcomes related to climate hazards) help to enable a more holistic perspective on a case that is less likely to neglect key issues that are important to some people. A risk with the co-production approach is that one stakeholder group can dominate the problem and solution framing (Vincent et al., 2020). We sought to mitigate this risk through our facilitation of participatory methods (explained elsewhere in this section) and critical analysis of the results.

Our case studies were designed to address the climate-specific rural sanitation gaps that were prioritised by the in-country partners. In Burkina Faso, SLH IDS and UTS-ISF partnered with colleagues at Institut de Recherche en Sciences de la Santé (IRSS) and UNICEF in Burkina Faso. Acknowledging the lack of discussion around climate and sanitation, and the need for explicit evidence to highlight linkages between climate hazards and sanitation, the case study aimed to establish and document these impacts to begin a discussion locally and nationally. In Bangladesh, SLH IDS and UTS-ISF partnered with WaterAid Bangladesh and Rupantar. Bangladesh has a history of recognising and tackling climate issues on WASH due to its vulnerability to severe cyclones and flooding (Barua et al., 2023). There is also extensive experience with documenting local knowledge through participatory ways separately within sanitation and disaster response. Therefore, the Bangladesh case study documents how existing WaterAid approaches were strengthened to capture, explore

and respond to climate hazards on sanitation-related issues through existing programming. Finally, in Lao PDR, UTS-ISF, SLH IDS, and SNV Laos developed a case study to document experiences with piloting methods for integrating messages about flood risks into a community-led Total Sanitation (CLTS) triggering process. This case study was developed in response to research that identified that local government officials in Lao PDR often feel poorly equipped to address climate impacts on rural sanitation (UTS-ISF and SNV, 2022).

## Limitations

All case study contexts and partners were selected through the authors' existing knowledge and prior networks and relationships. Hence, while these provide rich examples of work undertaken on climate and sanitation, other programmatic examples exist. It is important to note that diverse people experience climate impacts differently, so the experiences presented in this paper may not represent the most important issues for all people. Further contextualised case studies are needed to reveal the specific problems and opportunities different people face.

## Participatory methodologies

Using qualitative and participatory methods was intentional for several reasons. Participatory methodologies have a documented history of contributing towards capturing lived and local experiences (Merriam and Grenier, 2019; Logie et al., 2023), particularly with sanitation (Sorcher et al., 2023) and menstrual health (Dongre et al., 2007; Scorgie et al., 2016; Schmitt et al., 2017). These methods were used in all three case studies to access daily, underexamined experiences and tacit knowledge, to build a complex, diverse and dynamic picture of people's actions and responses to climate and sanitation-related challenges. Participatory methods aim to "hand over the stick" (Chambers, 1994), prioritising and situating the voices and experiences of their participants centrally to guide the narrative, and generate knowledge, in this case on sanitation and hygiene.

This paper also demonstrates how participatory methods were used in different ways and in different contexts to highlight and showcase their contribution towards research engagement and building evidence. Local partnerships were undertaken for all three studies. In Burkina Faso, these methods were used within formative research to establish a preliminary but significant link between climate hazards and rural sanitation and hygiene behaviours and practices, beyond water issues. In Bangladesh, existing participatory programmatic consultation methods were built on to include climate and sanitation-related participatory prompts and exercises to better understand and respond to sanitation-related vulnerabilities. In Laos, the study pilot adapted CLTS triggering activities to integrate consideration of climate risk into its *Sustainable Sanitation and Hygiene for All* rural sanitation program. CLTS triggering is a process whereby community members are motivated to take collective action to end open defecation in their community through participatory activities (e.g., mapping sites of open defecation, transect walk to sites of open defecation) that change their perceptions and behaviours relating to sanitation and hygiene.

Specific methods for all three studies are provided below.

## Case study 1 in Fada Gourma, Burkina Faso

### Context

Burkina Faso is challenged by significant climate and sanitation issues. By 2080–99 critical temperature increases of 3–4 per cent are estimated, higher than the global average of 1.7 per cent (World Bank Climate Change Knowledge Portal, 2024). The mean annual temperature in Burkina Faso has been steadily rising since 1950 and the number of intense storms in the Sahel region where Burkina Faso is located has risen threefold since 1982 (Taylor et al., 2021). The joint monitoring programme estimates that 54.7 per cent of people still practise open defecation and 13.5 per cent of rural Burkina Faso has access to a basic facility (WHO and UNICEF, 2020).

SLH IDS partnered with colleagues from the Institut de Recherche en Sciences de la Santé (Institute of Social Science Research or IRSS) and UNICEF Burkina Faso to undertake this study. In the province of Fada Gourma in the East Region, four villages in Diabo and Tibga municipalities were selected during discussions with UNICEF, based on their ongoing Community-led total sanitation programme areas. Villages chosen were deliberately contexts that were not directly affected by conflict and insecurity. All four villages were at different stages of progression along their open-defecation-free (ODF) journeys. Two had been triggered (the first stage of a CLTS process), one was declared ODF, and with no engagement in the fourth village. Chambers and Kar (2008) understand triggering as a process "based on stimulating a collective sense of disgust and shame among community members as they confront the crude facts about mass open defecation and its negative impacts on the entire community". It is undertaken to encourage people to take action to improve their sanitation conditions (Chambers and Kar, 2008).

### Methods

Eighteen participatory group discussions were undertaken with an average of 10 people in each discussion across four villages. This consisted of seven participatory group discussions each with men and women and another four with young people in mixed-gender groups. People were requested to self-select and participate in these groups based on availability and interest. These discussions used impact diagrams and climate hazard mapping in each discussion and undertook group discussions separately with men, women and young people to understand varied and specific climate impacts on individual, household, and village-level sanitation throughout the year. This helped capture differentiated effects on people and understand the scope of sanitation prioritisation during and after climate-related hazards, along with ongoing mechanisms to cope and adapt.

Impact diagrams (Kohlitz et al., 2020a) involved people collectively identifying and quantifying the different climate impact pathways in their daily lives and activities. This captured the consequences of hazards on local features and people's health, household infrastructure, and livelihoods. This highlighted linkages between climate hazards and sanitation and was followed by a discussion on where sanitation ranks within a list of priorities. This activity was undertaken separately with groups of men and women to understand and explore gendered roles and activities.

For climate hazard mapping (Kohlitz et al., 2020b), people drew maps of where they lived and identified where climate hazards affect

their village or settlement (including where it floods, where water remains standing, which water bodies dried up and more). This was followed by a discussion of how these affect sanitation service levels for people in different ways.

These discussions captured tacit knowledge and lived realities and unpacked the complex experiences of climate impacts on sanitation and hygiene practices. Furthermore, it ensured people were involved in the assessment and knowledge creation of their own sanitation and hygiene situation. The findings were presented back to participants from both activities for transparency, validation and data quality assurance.

In addition, researchers also conducted 35 semi-structured qualitative interviews to understand historical changes in climate and the various ways people feel challenged and respond. 21 interviews were undertaken with village leadership and community health personnel in the focus villages, and 14 interviews with WASH stakeholders in local government and WASH agencies (UNICEF, SNV, PLAN Burkina Faso and ACF). UNICEF contributed towards identifying relevant WASH stakeholders and staff and community-level leadership in the four villages.

All participatory groups and interviews were administered in French. Research partners from IRSS lead the facilitation of participatory group discussions and the undertaking of qualitative interviews. The research was undertaken between July and November 2021. The Institute of Development Studies in the UK and IRSS in Burkina Faso both granted ethical approval. COVID-19 precautions were followed and all activities were undertaken with government guidance. Data analysis was undertaken both within participatory groups by participants and respondents during data validation, and later by researchers using thematic analysis methods (Braun and Clarke, 2012).

## Findings

Across all four villages, residents reported heavy and unpredictable rainfall leading to floods, and alternately very dry conditions and increasing desertification. These impacts cut across various daily aspects such as livelihoods, accessibility, health and infrastructure. Along with climate hazards, human activities such as deforestation, reduced vegetation cover, and synthetic chemical-based pesticides and fertilisers in agricultural practices in the region are worsening the impact of climate hazards. Groundwater and soil nutrient quality are also consequently affected.

One interviewee stated *“Many trees have disappeared nowadays. We can say that seven years ago they still existed. There is a tree called ‘TITORE’ that we found a lot here but they have all disappeared. The scarcity of rain is the cause. We no longer have a forest and that is why the trees have disappeared. With the conflicts, people moved and cut down the trees in the forest to make fields. The rains are also rare.”*

During heavy rainfall and flooding, all four villages experienced damage to both household and toilet infrastructure. Most toilet infrastructure is made with local materials such as wood, mud and straw. They collapse under heavy rains and are also challenged by wood rot and termite damage. One respondent from a triggered village stated *“We use local materials to build our latrines which are not resistant to heavy rains. They cannot even resist since it’s dry wood and terra cotta... The latrines collapse every rainy season to the extent that they cannot resist. We redo them ourselves. We are doing our best. Unfortunately, we lack the money to build them with cement.”*

Participants shared in focus groups that containments for existing pit latrines overflowed and collapsed under heavy rains. Often toilets

are partially damaged, where the wooden slab may remain but supporting mud is washed away. However, anxiety and worry about these structures collapsing completely stop people from use. Many also reverted to open defecation. Participants also expressed overwhelming fatigue over the costs and time in reconstructing frequently. In an ODF village, a participant stated *“There is an old woman next door. Her wooden latrine has collapsed twice. She got tired of it and gave up.”* Collapsing facilities also led to unsafe hygiene conditions, where stormwater mixes with solid waste and leads to waterlogging and mosquito breeding grounds. Overflow sludge then contaminates local water sources. Women across all four villages shared they faced increased time pressures to fetch water for household use from further away because of contaminated water sources and other additional time burdens to undertake usual household activities. One woman shared *“periods of heavy rains [means] the backwaters are full and the crossing becomes difficult and busier. To go and tie the goats, you have to go around the backwater and that takes enough time. By the time you get back, you are already late for other activities and it is no longer possible to sweep the yard or clean the latrine.”*

During dry conditions, reduced water availability to clean and maintain latrines and handwashing was a significant concern. Women in one ODF village stated: *“During the dry season the lack of water is a real problem that makes us suffer. It is very complicated to clean the latrines and ensure their maintenance.”* This has also led to changing toilet habits and investments in using paper. *“We reduce the number of baths per person. We no longer use water when we enter the latrine, but we use paper. We really limit the waste of water”*, reported a woman from an ODF village, while a woman from a triggered village shared *“Other solutions are adopted in the dry seasons to overcome the water problem (lack) and people use paper or pieces of wood to go to the latrines.”* Additionally, in one triggered village, practitioners shared that reduced bush cover at usual open defecation sites helped galvanise demand for toilets *“There has been a decline in vegetation cover, which makes the population aware of the need to build latrines and adopt positive behaviours because there are no longer any bushes nearby to hide in. This is something that has been a trigger for the population.”*

People reported a range of impacts from rains and floods that had subsequent impacts on sanitation and hygiene practices. Almost all participants across all villages shared concerns around failing livelihoods, with cattle either getting washed away, falling ill after sudden rain and reduced availability for grazing land. This, along with crop failures, and limited land available for cultivation led to reduced household income during rains and floods. Floods also led to blocked or difficult access to roads and markets for supplies and support. These impacts affected sanitation prioritisation in different intersecting ways—reduced access to markets meant people had less scope to repair sanitation infrastructure, addressing damage to home structures was prioritised over latrines during rebuilding efforts, and also prioritised investing and financial resources restoring livelihood opportunities over sanitation.

## Coping mechanisms

While participants shared that many had to slip to open defecation, some also found other responses. People who can afford it, have started opting for building cement-based toilets. People have also selected sites on higher ground with readily available material after

rains for better protection. “When my latrine fell, I rebuilt it, but in a different space than where the old one was”, shared a respondent from a triggered village. However, not all can afford more robust materials.

In the same village, households with damaged toilets either resorted to using neighbours’ facilities or open defecation—a combination of the two was commonly shared. “When that happens (latrine fails), with the solidarity between neighbours, the latrines are shared so that these people do not resume with old habits”, shared another respondent from the same village. However, they also added, “It gets complicated when the latrine of the immediate neighbour has also fallen. Then there is no more choice to make, we have to go and do it in the open air.” In another triggered village, some households reported barricading their yard so it is not inundated with stormwater, reducing the risk of mosquito breeding in standing water or collapsing pits.

In the ODF village, some people reported using toilets to wash, so bath water could be reused to clean the toilets—“Personally, because of the lack of water I often go to wash in the toilet so that my toilet water cleans the toilet at the same time.” In the same village, when several households are affected by infrastructure damage, friends and neighbours support each other to repair affected toilets after the rains.

## Case study 2 in Sathkhira, Bangladesh

### Context

Bangladesh is ranked the seventh most impacted country by climate hazards by the Global Climate Risk Index (CRI) because of its vulnerability to a wide variety of climate-related events including salinity, drought, rainfall variability, tropical cyclones, and more that happen year-round (German Watch, 2021; Ministry of Environment, Forest and Climate Change, 2022). Over the past 50 years, average annual rainfall has declined in the eastern divisions of Bangladesh and increased in the western division (The World Bank Group, 2024). Intense precipitation events are expected to increase and sea level rise threatens the deltaic coastal zones where one-third of the country’s population lives (Climate Risk Profile: Bangladesh 2024: The World Bank Group).

SLH IDS partnered with WaterAid Bangladesh and Rupantor to undertake research in the southwestern coastal belt of Bangladesh at Krishnanagar Union, Sathkhira district. The study was conducted across all nine wards in the Union. The area is close to the Bay of Bengal and Sundarbans. The Sundarbans are a large mangrove forest and are considered significantly vulnerable to sea level rise and other climate impacts (Hazra et al., 2002). 83 per cent of the Union’s population has access to a basic sanitation facility (Nuzhat et al., 2023).

### Methods

WaterAid Bangladesh’s participatory WASH assessment methods were originally developed and compiled in 2013 (Al Rasheed, 2013). Drawing on participatory rural appraisal methods (Chambers, 1994), they enable research engagement at the “ward” level (which is below the lowest tier of administration in Bangladesh) to understand the vulnerability of WASH infrastructure, behaviour and practices. In 2022, WaterAid and SLH IDS developed this process further, adding sanitation-related considerations around safely managed sanitation and

a climate lens to assess local challenges at Krishnanagar Union. This Union was chosen for WaterAid’s interest towards further understanding this region, and Rupantor staff’s in-depth knowledge of increasing salinity and increasingly frequent storm surges in the region.

A total of 30–40 participants (with a nearly equal number of male and female participants) joined in the participatory consultation process on each day in each ward. Group sizes were determined through self-selection of interested participants and additional special attempts to ensure representation of people from different social, ethnic and economic groups across the ward for diverse participation. All consultations were administered in Bangla.

Participatory community consultations were aimed at understanding the persisting problems associated with WASH and climate hazards in the Union. This involved a series of building participatory drawing and analysis activities across a two-day consultation in each ward. The first day was dedicated towards the identification of persisting WASH problems through a transect walk with additional probing questions about climate (major hazards, the various implications for local geography, and differential impacts). It was followed by a climate and WASH risk assessment group discussion that further probed these issues across age, mobility and gender. It also included a participatory prioritisation exercise to rank these issues in order of urgency. The second day of consultation started with the consolidation of a seasonal risk calendar to identify when during the year these problems occurred. It was followed by the preparation of an institutional map where participants identified the various organisations and institutional mechanisms available for grievance redressal. These problems were then collectively addressed through a comprehensive planning document with potential solutions for these climate-induced impacts on WASH practices and services.

Additionally, three participatory group discussions were conducted (with eight women per group). Group sizes were kept small to offer a safe space for women to share their experiences and realities around WASH and climate hazards. They were conducted in areas in the Union that reported particular climate-induced challenges for women during the participatory consultation process. Finally, participatory data validation workshops were convened at three different administrative tiers—Ward, Union and Sub-district (Upazila), for data quality assurance. The ethical approval for this study was awarded by IDS. The research process was undertaken from August to November 2022.

Similar to the previous case study, data analysis was first led by participants within participatory groups, wherein key themes were identified during data validation processes. Researchers then used these themes as a starting point for further thematic analysis (Braun and Clarke, 2012) to identify commonalities and learning across different wards.

### Findings

The Union experiences climate hazards in the form of floods, storm surges and increasing encroaching salinity. These produce direct impacts on sanitation and hygiene facilities and practices that add to ongoing WASH-related challenges. Research activities found a reduced awareness of the potential benefits of sanitation and hygiene practices that have led to a lack of prioritisation of investment in sanitation facilities.

Cyclones and floods destroy household infrastructure built with weaker materials such as mud, while several participants reported more

durable materials such as brick and cement also seeing damage. They inundate toilets and pits, weaken latrine superstructures, and in extreme cases submerge latrines. In many cases, this is further damage to fragile infrastructure that has not been repaired after the previous cyclone. Some participants reported neighbours and friends using sanitation facilities with broken pits or unstable slabs for months and issues with smell as frequent fixing and rebuilding of facilities frequently, several times a year was not affordable. When sanitation facilities remain inaccessible, open defecation increases. Several others continue to use unimproved or damaged toilets despite their issues. In these scenarios, participants shared that waterborne diseases and skin conditions were a frequent problem, with an increased prevalence of diarrheal cases during monsoon when toilets remain challenging to access.

During monsoons, flooding and cyclones also cause waterlogging in certain areas around their village, disrupting access to toilets. Waterlogging and inundation of facilities lead to unsafe greywater management and local drainage systems overflow and collapse in severe cases. In two wards, despite respondents having households with more robust and well-designed brick-built latrines, sludge from dysfunctional toilets accumulates around their households and gets washed into farms and agricultural sites.

Krishnanagar has limited access to public transportation facilities and big markets and is significantly remote. This makes it difficult in terms of availability, affordability and transportation of sanitation resources and hygiene materials to the Union. Roads and communication channels like mobile networks experience significant disruptions during these storms, which adds additional difficulties.

One elderly man commented *“Open defecation was very common in the area one decade ago. Now, the affluent people have made their own improved toilets. The poorer ones are suffering since they can neither defecate in open space due to hesitation nor make a good quality latrine. In my opinion, defecating in a poorly constructed latrine is much more dangerous than defecating in an open space.”*

Another elderly man adds *“One of my relative’s four-year-old child recently died of diarrhoea right after the last flood.” “Because of the poor roadway network, the doctors cannot often provide healthcare facilities near our households”* another man added.

An elderly man said *“The amount of loss our ward’s economy faced due to climate change is immense. Most of our earning sources have been devastated due to climate change. Now we can only construct poorly maintained latrines with locally available light materials. This is a matter of huge discomfort for women since such latrines are not good enough to maintain privacy and female hygiene. This type of poorly constructed toilet makes the total household surroundings unhygienic and there is always a bad smell. Frequent occurrence of illness also affects people’s earnings.”*

A young man said, *“How many times can low-income people like us fix our toilets devastated by flood? Last year, our household fixed it twice. (It) still got damaged during the next flood.”*

Women and girls also experience these climate and sanitation impacts routinely and more acutely. Poor sanitation conditions and cascading increases in household work combine with more direct impacts on menstrual health, with severe consequences.

Women and girls experience significant discomfort with toilet access during floods—toilets are flooded or dark or both for comfort and safety. With the intrusion of saline water in drinking water sources, or increasing waterlogging women need to walk further away for water collection, travelling three hours every day on foot. Some

women shared time pressures causing them to drink and use saline water for household chores. Young children also often fetch water, disrupting their school attendance.

A young woman said *“Women in the area are very shy and do not want to speak up about their problems. As a result, they are not availing the existing healthcare and WASH facilities offered by different agencies. Men are also unaware of this situation.”*

Another farmer said *“Sometimes I help my wife to collect water. But there is always a long queue at the Pond Sand Filter (PSF). I lose at least two-three hours a day for water collection. For farmers like us, time is very valuable and so despite my interest in supporting my wife, I have no way but imposing the responsibility of water collection upon my wife.”*

Shops selling hygiene materials shut during cyclones, necessitating some women and girls using sanitary napkins to shift to cotton cloths. Several women shared their struggle with the lack of space to change, clean and dry their menstrual health products. Their issues are magnified when they travel to cyclone shelters with very reduced or unavailable sanitation and hygiene facilities. During water-scarce conditions, women and girls are compelled to use saline water to manage their menstrual health and share intimate problems and discomfort with rashes, blisters and recurring urinary tract infections. They also expressed their reluctance and visible discomfort with discussing these issues openly, choosing instead to keep their challenges silent and to themselves.

A young woman said, *“We do not know where to claim the solution to all the WASH-borne problems. Girls and women suffer the most due to the situation since they are taught to accept any problem and remain silent.”*

An old woman said *“Cotton cloths are the most common menstrual hygiene product used by the women during menstruation. When it is washed with saline water, it results in a lot of health problems and huge discomfort.”*

There are also indirect impacts that affect sanitation prioritisation. Salinity is reducing land fertility, leading to a reduced variety of crop production and reductions in household agricultural income. Flooding of water bodies where fishes are bred and increasing saline water intrusion impacts the reproduction of fishes. While some households have adapted to shrimp farming in the saline water, this is still not very lucrative. These reduced livelihood options lead to decreasing prioritisation and investments in re-construction and maintenance of sanitation infrastructure.

Two young men mention *“The suitable timeline for cultivation cannot be estimated nowadays, since the rainfall pattern is very uncertain, and it affects our income from agriculture... The saline water also reduced land fertility. We need training on how to cope with our agricultural practices with the changing climate.”*

## Coping mechanisms

Amidst ongoing climate and sanitation-related challenges, people continue to respond and cope with their emerging realities with several infrastructural adaptations. Where affordable, households have begun to construct toilets with concrete and brick and raise the height of plinths for better resilience to salinity and floods. As a more affordable option, people have begun a switch to using ceramic/porcelain tiles around concrete infrastructure, for more a durable solution to withstand saline water. These assure more functionality

during floods and cyclones. More considered site selection or changing sites for the construction of sanitation infrastructure also contributes to robust latrines during storm surges.

## Case study 3 in Savannakhet province, Lao PDR

### Context

The University of Technology Sydney—Institute for Sustainable Futures, (UTS-ISF) and the Sanitation Learning Hub partnered with SNV to pilot a CLTS process that addresses the risks of flooding to sanitation. Lao PDR was chosen due to its high exposure to flooding which is predicted to worsen with future climate change. While there is substantial uncertainty surrounding projections of future rainfall in Lao PDR due to climate change, the number of extreme rainfall events appears to be increasing and most models indicate an increase in annual average rainfall ([The World Bank Group and the Asian Development Bank, 2021a, b](#)). Hence, increasingly extreme weather poses a significant risk of slowing down or even reversing progress made in eliminating open defecation in Lao PDR. Communities in Savannakhet province were chosen as pilot sites because of their past experiences with flooding, and because they were sites where SNV was already targeting their CLTS programming.

### Methods

SNV and UTS-ISF co-designed three activities, following a brainstorm of ways to integrate flood risk considerations into CLTS activities. The activities were chosen on the basis that they aligned with SNV's ongoing CLTS triggering programme in the area and could be easily piloted at low cost by the community facilitators (government staff who work with SNV field staff at the district level to facilitate CLTS activities). SNV trained the community facilitators, who implemented the activities in the village. The three activities were as follows.

- A transect walk of flood-risk areas.

- Community mapping of flood hazards.

- Power walk.

The transect walk activity involved facilitating community members to visit areas of the village that are frequently or most easily flooded, point out the extent of the flooding and discuss the implications for sanitation access and the spread of faecal matter. The community mapping activity involved asking community members to draw out the commonly flooded areas of their village on a map and discuss possible solutions for siting or adapting latrines. Finally, the power walk activity involved asking community members to role-play diverse members of the community (e.g., young people, elderly people, people with disabilities) and consider whether they were at a relative advantage or disadvantage compared to the rest of the community when impacts related to flooding and sanitation occurred.

Within Savannakhet, SNV field staff selected three villages to pilot the activities. These villages were chosen because they were already being engaged by SNV as part of their rural sanitation programme, were still in the triggering phase of the CLTS process, and were known by the SNV team to be annually exposed to flooding. Therefore, all three activities were designed to sensitise and respond explicitly to flood-related impacts.

The villages were visited twice between November 2021 and February 2022. After an initial pilot phase, SNV and UTS-ISF revised the activities based on the initial experiences of the local facilitators and then piloted the revised activities with other villages in the districts.

The pilot activities were implemented by local facilitators, who had first participated in a training session organised by SNV. The facilitators had previous experience implementing CLTS triggering and were enthusiastic about integrating consideration of climate risks into the CLTS process. Most of the local facilitators had some understanding of the impacts of climate change as a result of their participation in previous joint workshops organised by SNV and UTS-ISF. During these previous workshops, participants learned about the causes and effects of climate change, the relevance of climate for sanitation and gender and social inclusion, and ways to address climate impacts.

During the training for the pilot activities, SNV walked the community facilitators through each activity and the group role-played the activities together, helping to pre-empt potential challenges in the community and collectively coming up with solutions. The facilitators asked questions and made suggestions on how the activities could be improved. Once the community facilitators felt confident about the activities, they went to their respective districts to pilot them. The research design was approved in line with the University of Technology Sydney Human Research Ethics Committee requirements (UTS HREC REF NO. ETH18-2599).

Experiences and lessons learned were documented during subsequent reflection meetings between SNV and UTS-ISF staff. UTS-ISF staff facilitated qualitative collaborative analysis ([Cornish et al., 2014](#)) in which UTS-ISF interviewed SNV about which parts of the activities worked well and which were challenging. UTS-ISF and SNV staff then deliberated on how to manage the challenges and risks and leverage the stronger aspects of the activities. UTS-ISF documented these discussions in notes to form the findings presented here.

### Findings

As the activities were piloted in each village, revisions to how the activities were run were made to troubleshoot issues and take advantage of what was working well. Afterwards, the facilitators reflected on their key lessons learned: grounding discussions in the local context and based on past experiences with flooding, care planning and preparation, and proactively supporting the inclusion of diverse people in the activities.

Discussions about the implications of flooding for sanitation and possible solutions were richest when they were described in the context of people's lived experiences. For example, during the transect walk, participants could point out areas that became waterlogged and difficult to walk through during heavy rain and how this caused a long journey circumnavigating difficult terrain to reach the toilet. One participant admitted this led to her choosing to relieve herself directly underneath her house rather than making the arduous trip to the toilet. Facilitators did not use climate jargon and mentioned climate change little at all. Instead, conversations focused on local terms related to flooding to ground discussions in past experiences. During the power walk activity, facilitators told relatable stories of how diverse people can have their sanitation access affected during flooding events and elicited the community members to help in the story-building. Overall, participants were able to engage well in discussing flood risks and possible solutions for sanitation when they were related to events and people they were familiar with.



Integrating the consideration of flood risks into CLTS programming requires attention towards human resources and logistics. Initially, local facilitators felt intimidated by the topic of climate change and were worried they would not be able to answer questions from the participants about the climate. The climate change workshops that preceded the training on the new activities were critical for giving the facilitators confidence and building foundational knowledge on how flood risks were related to climate change. Thoughtful planning of the CLTS-triggering intervention was also needed because the intervention was already intensive and required a significant amount of community time. Adding new activities to address flooding risked making the intervention too long for participants. With support from SNV and UTS-ISF, the facilitators learned how to streamline the new activities related to flood risks into existing activities as much as possible to avoid adding too much to the overall intervention duration. Finally, facilitators noted that the activities worked best when they were sequenced so that the transect walk was held first, followed by community mapping, and lastly by the power walk. The power walk activity requires the most critical thought and the facilitators noticed that holding the transect walk and community mapping first helped ground the scenarios in which participants were role playing.

Talking about the different impacts of flooding for diverse people in the community is a critical component of communicating flood risks to communities. Understanding how different segments of the community experience flooding impacts differently is best done through the participation of people representing those segments. In this pilot, it was sometimes challenging to gain the participation of people who were not used to being invited to speak at bigger events. Reasonable accommodations should be made to enable people, like people with disabilities, to attend and have their perspectives heard during the activities with comfort. The power walk activity was designed to facilitate community members to empathise with diverse people in their community and consider sanitation access challenges that others might face during flooding. Many participants demonstrated an understanding of these differential challenges. For example, people noted that people with disabilities and elderly people in particular struggle with accessing latrines that are located far away from homes during heavy rainfall.

## Implications for the sector and programming

The findings from all case studies demonstrate significant implications for how we understand and link climate thinking around adaptation and resilience to ongoing discussions in the rural sanitation sector.

Firstly, the studies demonstrate how **climate change impacts sanitation via numerous, interlinking pathways**. Climate change creates or worsens climate hazards. The social context and local activities shape how these hazards impact physical access to sanitation infrastructure, access to local resources and markets, and livelihoods needed to support safe sanitation. These impacts, and the burden of responding to them, are felt differently depending on the social context and specific social factors like gender, location, age, mobility, type of toilet and livelihood options. Together, they produce personalised experiences, with climate hazards exacerbating existing inequalities within rural sanitation service levels and practices, as seen in all three case studies.

**Local activities also significantly shape how impacts are experienced and responded to**, as seen in Bangladesh and

Burkina Faso. In Satkhira, Bangladesh, anthropogenic activities multiply these impacts, evidenced by the rise in salinity because of shrimp farming through a reinforcing cycle. Local activities also accelerate climate-induced riverbank erosion lowering the depth of riverbeds, ultimately leading to frequent flooding. In the East region of Burkina Faso, deforestation and reducing bush cover also had cascading impacts on sanitation behaviour and demand for toilets. Climate hazards therefore intersect with these varied ecological and social vulnerabilities to have multiple impacts on WASH behaviour in terms of accessibility, availability and quality of facilities.

Secondly, **climate impacts are increasing and escalating public health risks, and climate hazards are hindering rural sanitation coverage and are likely to reverse it**. The sustainability of coverage is being challenged and reversed by climate hazards. Even those with improved toilets are adversely affected by sludge from neighbouring broken containments in their farms and around their homes. Safe WASH behaviours are lost or reset, increasing the risk of disease. In both Bangladesh and Burkina Faso case studies, participants shared an increase in diarrhoea (especially for children under 5) after flooding and heavy rains. This has the potential to challenge hard-achieved “open defecation free” (ODF) statuses and declarations—especially when countries, states and districts are being encouraged to plan and invest in higher service levels beyond ODF, towards safely managed sanitation (SMS) outcomes instead (Berendes et al., 2017; Mara and Evans, 2017).

**There is definite scope to address climate responses within ongoing sanitation programming**. Testing and trialling different methodologies of integrating climate thinking within sanitation programming can help to ascertain some ways forward. This is consistent with recent scholarship also advocating for climate considerations to be integrated at every stage of sanitation project delivery, along with being recognised in organisational planning and decision-making processes in the sector (Gordon and Hueso, 2021). At a project level, for instance, Community Led Sanitation processes could be modified to (1) encourage people to build more robust latrines that are more likely to withstand at least low-level flooding events or (2) help people set expectations that a simple superstructure will not last and will need to be repaired each year following damaging weather. In the former case, more robust latrines may come at a higher financial cost. Households could be suggested to consider that they provide value for money (because they are less likely to collapse). A phased approach to rural sanitation development, whereby households incrementally improve their latrines initially through their own investment and then later through subsidies or other targeted support, could make acquiring more robust latrines more achievable (Robinson and Gnilo, 2016). The Lao PDR case study demonstrates how climate risk messaging can be integrated into CLTS-triggering activities, but further research is needed to determine if this changes behaviours during and after extreme weather.

We need to **expand the idea of “resilience” and start using it in the rural sanitation sector**. Resilience should consider behaviours, financing and sanitation prioritisation, beyond just durable infrastructure and technology. Scholarship in the sector indicates that existing barriers to sustained sanitation outcomes, such as poverty and social marginalisation (Thuita et al., 2017) and its various intersections, are also clear barriers to climate-related resilience (Abrams et al., 2021). This is highlighted in both Bangladesh and Burkina Faso case studies, where climate hazards disrupt and reset

sanitation behaviours, following heavy rain and floods, and water-scarce conditions. However, in both contexts, contextually driven coping mechanisms emerged. Resilience therefore needs to be framed along broader considerations of safely managed practices, and strengths-based responses that help retain safe sanitation behaviours.

The sector also needs to acknowledge that sanitation behaviours and prioritisation are guided by both climate impacts on sanitation facilities, and associated loss and damage to health and livelihoods. More research is needed to explore how climate resilience interacts with the different components of safely managed rural sanitation to produce an approach that considers “softer” factors like behaviours and attitudes to measure resilience more holistically and effectively.

Recognising these complex factors, **the burden of progressive, adaptive responses cannot fall entirely on households**. Inherent injustices and systemic inequalities deeply affect and disrupt both responding and adapting to climate hazards (Sultana, 2022; Teebken, 2024) and the progress towards sustained sanitation outcomes (Dickin and Gabrielsson, 2023; MacArthur et al., 2023). Addressing the root causes of these issues is crucial for more transformative outcomes. While there is increasing recognition in the sanitation sector about the need for a variety of support mechanisms (Odagiri et al., 2017; Kozole et al., 2023), they may not be feasible in the onslaught of repeated climate impacts that cause fatigue and reduce people’s capacity to respond and adapt appropriately. More research is needed on how climate justice frameworks can be applied to rural sanitation. This would enable the sector to address the root causes of systemic inequities for moving towards and sustaining transformative outcomes, and how support mechanisms can contribute to this process.

To achieve these outcomes, **people-centric adaptation pathways are crucial**. Participants raised several other non-sanitation concerns in each of the three countries, and this is consistent with other scholarship in the sector indicating how climate and sanitation-related issues have strong links to livelihood concerns and other local activities (Kohlitz and Iyer, 2021). Sanitation and adaptation concerns must be situated amongst people’s broader contexts. Evidence already indicates the importance of ensuring that people are supported and encouraged to identify their own adaptation needs (Pisor et al., 2022). This can ensure that existing adaptation efforts are strengths-based; that they work in tandem with their sanitation and hygiene-related priorities and are not seen in competition with building and restoring livelihoods; and they enable more equitable and just climate adaptive transitions.

## Conclusion

Climate impacts have serious implications for the rural sanitation sector. They challenge the progress made so far and have disproportionate impacts on people who are poor, marginalised and already living in challenging conditions.

Yet, to date scholarship in the WASH sector has focussed on the linkages between climate and water, and climate and urban sanitation to a certain extent but rural sanitation remains understudied. This paper establishes the clear links between climate hazards and rural sanitation practices across infrastructure, behaviours, and priorities. It situates the experience and knowledge of living with these issues and responding to them at the heart of these linkages and enables the participants’ co-production of research evidence within the WASH sector.

The findings suggest that climate impacts affect sanitation practices and behaviours in different ways, and these are guided by

several factors relating to climate hazards themselves, ongoing human activities and livelihoods, their distinct social conditions, and existing sanitation service levels. While sanitation programming can adopt these findings and should consider climate-sensitive programmatic responses, discussion and thinking in the sector need to move towards climate justice framings of addressing root causes of existing vulnerabilities to achieve more holistic outcomes. Additionally, while several resilience measures exist, our case studies demonstrate the significant nuance that still needs to be accounted for within these metrics. More research is therefore needed on what this means for existing programmatic approaches, exploring resilience perspectives within rural sanitation, and ensuring that climate and sanitation-related progress is undertaken in tandem with livelihoods recovery and ongoing local activities, rather than seen as a trade-off.

## Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

## Ethics statement

The studies involving humans were approved by Institute of Development Studies and Institute for Sustainable Futures, University Technology Sydney. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

## Author contributions

RI: Conceptualization, Formal analysis, Methodology, Project administration, Validation, Writing – original draft, Writing – review & editing. JK: Conceptualization, Methodology, Writing – original draft, Writing – review & editing.

## Funding

The author(s) declare that financial support was received for the research, authorship, and/or publication of this article. Time for the research team and select research activities in Bangladesh and Burkina Faso were funded by Sida. The Sida grant is titled Accelerating The Momentum Towards Safely Managed Sanitation By 2030: Timely, Relevant And Actionable Learning. The grant number is Sida contribution No. 12616. funded research activities in Bangladesh. Staff time in Burkina Faso was funded by UNICEF. WaterAid Bangladesh also co-funded research activity costs.

## Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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