

## RESEARCH BRIEF

# Linking Climate Vulnerability, Latrine Functionality, and Fecal Sludge Management (FSM) in Rural Cambodia



*Photo Caption: Heavy rainfall flooded the household's twin pit latrine system for three consecutive days impacting the latrine's functionality. To use their toilet, the household opens the lid of the pit latrine (covered by sheet metal in picture) releasing unsafe fecal sludge into the open environment. Oct 26, 2020. Ang Snoul, Kandal, Cambodia.*

## How does living in climate-vulnerable areas affect latrine functionality, and households' sanitation behaviors?

### Context

Climate change drastically impacts the lives of the most vulnerable people, multiplying risks they are already struggling with and jeopardizing decades of development efforts.<sup>1</sup> The sector predicts water to be the main channel through which climate change impacts will be felt by people, ecosystems and economies.<sup>2</sup>

<sup>1</sup> Short-changed on climate change: Money, water and the people on the frontline. WaterAid, 2020.

<sup>2</sup> Adaptation to Climate Change in Water, Sanitation and Hygiene: Assessing risks and appraising options in Africa. Oates et. al., 2014.



In Cambodia, it is estimated that over 25% of its population is affected by challenging environments that experience floods, high ground water, and other barriers to effective sanitation and fecal sludge management (FSM). Of that population, the majority (62.5%) live in seasonally affected flood prone areas.<sup>3</sup> Rural households living in challenging environments, particularly flood-prone areas, are some of the most climate vulnerable with respect to WASH and have limited capacity to resist, cope with and recover from climate shocks.<sup>4</sup>

## Project Background

Having achieved a marked expansion of basic sanitation coverage over the past decade, rural Cambodia is now faced with the urgent challenge of safe FSM. In partnership with the University of Colorado Boulder, iDE designed and conducted a FSM survey to better understand household-level FSM decision-making and practices across five provinces in Cambodia (Kampong Thom, Kandal, Prey Veng, Siem Reap, Svay Rieng). The survey was conducted among 1,472 rural households that owned a pour-flush latrine for more than two years. Using data from the FSM Survey, iDE explored the link between climate vulnerability, latrine functionality, and FSM intentions and practices of rural households. The goal of this research is to provide iDE with a better understanding of the impacts of living in climate vulnerable areas on latrine functionality and FSM. iDE intends to use these insights to target sanitation-challenging areas and increase households' WASH resilience against increasingly extreme seasonal climate change shocks.

## Intervention

We focused on survey questions that would allow us to analyze the complex effects of seasonal variability and living in challenging environments on latrine functionality, FSM intentions, and household practices. The data collected included frequency of latrine overflow/dysfunction during the rainy season, frequency of latrine pits filling up, and unsafe FSM intentions and practices. Unsafe practices included releasing fecal sludge into the open environment through opening the pit lid during a flood or putting a hole in the pit wall (i.e. piercing the pit, see photo above right). Using GIS mapping, the FSM Survey data was compared against major and average flood events from 2011<sup>5</sup> and 2013<sup>6</sup> respectively, as well as a number of buffer regions from 0.5 km to 1 km from observed flood incidence. A spatial representation of this analysis is shown in **Figure 1** below. Additionally, to better understand the isolated effect of being in a flood-prone area, controlling for other confounding factors, a logistic



<sup>3</sup> Small-Scale Wastewater Treatment Technologies for Challenging Environments. Bukauskas et. al., 2017.

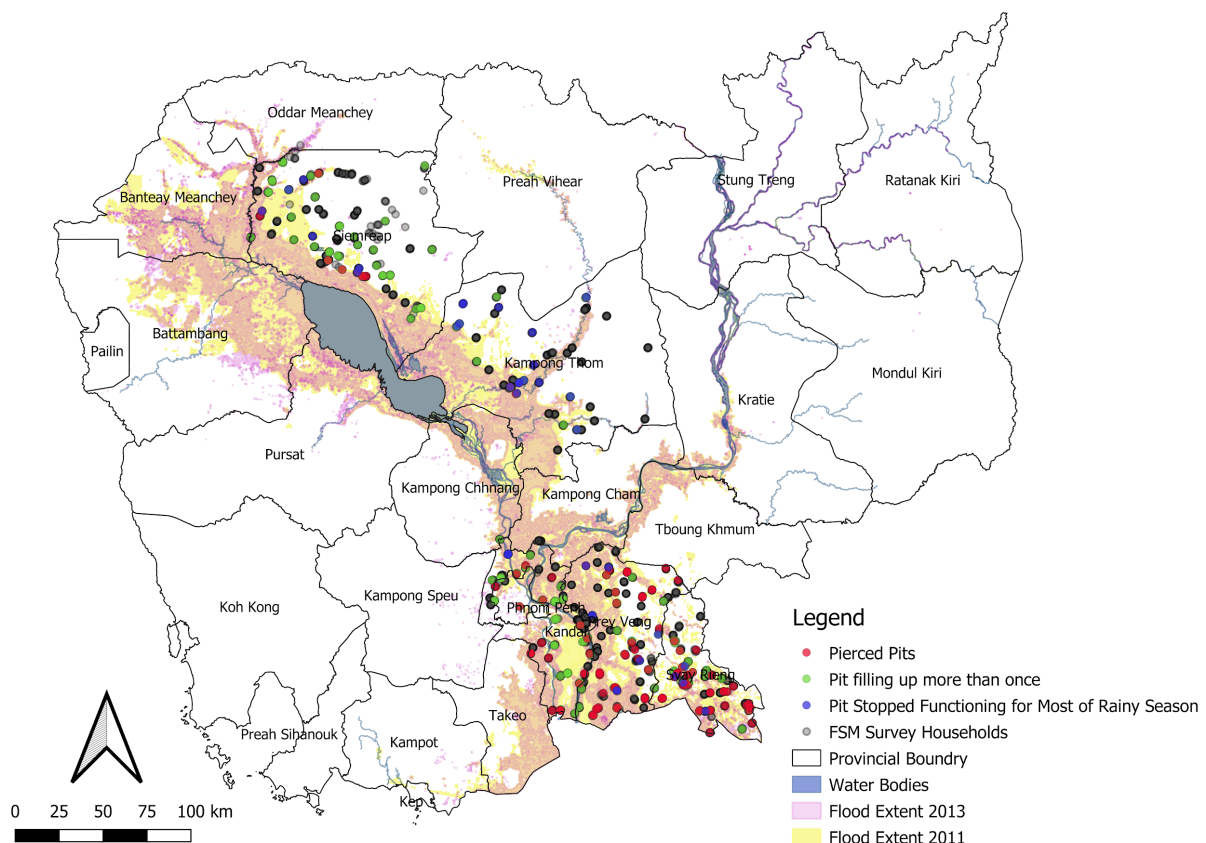
<sup>4</sup> WASH Climate Resilient Development - Strategic Framework. UNICEF/GWP, 2017.

<sup>5</sup> Cambodia Flood Extent in 2011. [https://geonode.wfp.org/layers/geonode%3Akhm\\_nhr\\_floods\\_unosat\\_2011](https://geonode.wfp.org/layers/geonode%3Akhm_nhr_floods_unosat_2011)

<sup>6</sup> Cambodia Flood Extent in 2013. <https://data.humdata.org/dataset/cambodia-other-0-0-0>

regression model was used to explain latrine functionality as a function of household size, number of pits, depth of pits, IDPoor status<sup>7</sup>, province and whether or not the household was in a flood prone area.

FIGURE 1: RURAL HOUSEHOLDS FACED WITH LATRINE FUNCTIONALITY CHALLENGES AND EXHIBITING UNSAFE FSM BEHAVIORS AGAINST 2011 AND 2013 FLOOD EVENTS IN CAMBODIA



## Key Research Findings

- Rural households living in climate vulnerable flood prone areas are more likely to face challenges with latrine functionality and more frequent occurrences of pit fillings. Climate vulnerable households, as indicated by those households within the 2011 flood zone, were more likely to have had a non-functional latrine during most of the rainy season [ $r(1,472) = .07, p < .01$ ] and were more likely to have a pit fill up [ $r(1,472) = .05, p < .05$ ].
- Living in climate vulnerable flood prone areas can exacerbate households' unsafe FSM intentions and behaviors such as pit piercing or opening pit lids during floods. A general lack of access to safe FSM solutions, combined with regular challenges with latrine functionality during the rainy season as a result of living in flood prone areas, can cause

<sup>7</sup> The IDPoor System is an initiative administered by the Cambodian government that identifies poor households, assesses their level of poverty (IDPoor 2 is poor, IDPoor 1 is poorest), and distributes identification cards for these households.

households to employ unsafe FSM practices. We found statistically significant differences in unsafe FSM intentions between households living within 1km of the 2011 flood extent and those that do not [ $t(1,472) = .03$ ,  $p < .10$ ]. We also see significantly more households with pierced pits [ $t(1,472) = .04$ ,  $p < .05$ ].

- **We do not see a greater proportion of IDPoor households in flood-prone areas but we found that households have more members.** 13% of the sample population is IDPoor in both flood and non-flood prone areas with no statistically significant difference. The average size of households in non-flood prone areas is 4.96, compared to 5.44 in flood prone areas [ $t(1,472) = .48$ ,  $p < 0.01$ ]<sup>8</sup>.
- **Pit functionality is affected by household size and living in a flood prone area.** Of all the factors considered in the logistic regression model to affect pit functionality, household size and being in a flood prone area were both positive and significant at 1% and 5%, respectively, but these results were sensitive to how we define the model<sup>9</sup>.



*Photo Caption: Latrine shelter in Kampong Thom province with visible flood high water mark about 1.3 meters from ground level.*

## Conclusion & Wider Implications

Initial results suggest that climate vulnerability is related to the functionality of latrines, with additional effects on FSM intentions and practices. With increased flooding across iDE's operational areas, we can expect to see increased challenges with dysfunctional latrines. This will further amplify the potential for unsafe FSM behaviors and practices. To reduce households' climate vulnerability, these associated unsafe FSM behaviors can be targeted and mitigated.

Existing tools to identify less-visible, climate-vulnerable, challenging environments can be costly and difficult to deploy (groundwater mapping, precipitation/flood models, ground-soil assessments, etc.). By finding correlations and causal relationships between climate vulnerability, latrine functionality, and FSM behaviors, we identified feasible approaches to estimate and target households faced with different thresholds of vulnerability to climate change. This further enables us to identify and understand barriers to effective FSM products and services. On a national level, by using flood incidence maps from an existing reputable source, we can identify and prioritize

<sup>8</sup> Using 2011 Flood Zone with no buffer

<sup>9</sup> Model used the 2011 Flood Zone with no buffer

sanitation-challenging areas. Alternatively, in the absence of or in conjunction with a flood incidence map, increased occurrences of latrine dysfunction, pits filling up, and pierced pits can be used as proxy indicators to identify climate vulnerability at the household level. Sanitation Marketing implementers can use these proxy indicators to target households in challenging environments with more resilient fecal sludge containment and management products and services.

As latrine pits fill, the WASH sector must continue to apply evidence to implementation to improve rural FSM safety. This will be critical to ensure the sustainability of public health gains from Cambodia's expansion of basic sanitation coverage. Research into households' decision-making and challenges with rural sanitation systems must also continue to deepen our understanding of behavior, socio-economic vulnerability, and climate change impacts on rural sanitation.

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