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Regular Article

Understanding resilience capitals, agency and habitus in household experiences of water scarcity, floods and fire in marginalized settlements in the Cape Flats, South Africa

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ABSTRACT

A significant percentage of the urban population in most low- and middle-income countries live in informal settlements. Due to poor quality housing, dense settlement patterns and lack of risk reducing infrastructure, informal settlements are least prepared and at higher risk for climate change issues. Marginalized communities in settlements in the Cape Flats region of South Africa face a range of environmental hazards and risks including recurrent large-scale fires, localised flooding and inconsistent access to water. This paper presents findings from a household survey with 600 participants from three economically marginalized settlements in this region. The paper explores how different forms of capital come into play in the shaping of these experiences and responses and uses these to consider power structures and the creation of particular types of habitus amongst settlement residents. Results show that cultural (knowledge) capital is one of the most important capitals enabling resilience and adaptive capacities across all three sites. Findings show the complex interplay of forms of capital and the importance of recognizing ownership, control and power structures. Our findings also illustrate how repeated exposure to risk can shape a habitus of risk acceptance and a focus on coping rather than change. Insights from this study further enhance knowledge of community resilience that could potentially inform policy development and institutional disaster risk reduction strategies for climate change resilience of cities in low- and middle-income countries.

1. Introduction

Two interconnected, mutually exacerbating global trends are putting an ever-increasing number of people at risk of environmental disasters: increasing urbanization and the climate crisis. As average global temperatures rise, extreme weather events are experienced more frequently, with more frequent droughts (Cook et al., 2018), fire outbreaks (Jones et al., 2022), flooding events (Pour et al., 2020) and storms (Allen, 2018). Vulnerability to these risks is not evenly distributed; instead, it is affected by factors relating to both the natural and built environment, such as location of a settlement relative to coastlines and floodplains, depth of local water tables, proximity to wildfire fuel, and so on; and to socially constructed conditions, such as relative wealth, precarity, health and education (Abunyewah et al., 2018). This paper reports on

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research that set out to explore lived experiences of climate-change related hazards at the individual and household level in marginalized peri-urban settlements.

The complexity of these intersecting factors suggests a need for robust theoretical and conceptual frameworks in order to guide risk-reduction policy design and implementation, as well as post-disaster responses. However, the field of disaster research has been criticised as significantly under-theorised or 'theory light' (Matthewman and Uekusa, 2021, p. 965). This paper thus has the additional objective to contribute to growing efforts to address this problem by extending the use of theoretical concepts drawn from the work of Bourdieu (Matthewman and Uekusa, 2021; Uekusa, Matthewman and Lorenz, 2022) in an analysis of the experiences of people who are already living with climate-related environmental hazards in the Cape Flats region of South Africa.

We start by considering the implications for city and city-region resilience planning of the growing phenomenon of informality. We then outline a Bourdieusian theoretical framework that makes use not only of the concept of social and other forms of capital (as has been used by Uekusa and co-authors in relation to communitas) but also structure and agency and, importantly, the notion of habitus (Bourdieu, 1979, 1985, 2018). We then describe a survey of 600 households across three socio-economically marginalized settlements in the Cape Flats. We use the responses from these surveys to explore the utility of our proposed conceptual framework. Finally, we draw some conclusions about the implications of our work.

1.1. Climate change, urbanisation and informality

Increasing urbanization means that our global capacity to cope with climate change-related disasters is tightly tied to our cities' capacities to cope, making the development of city- and city-region strategies increasingly important.

Increasing urbanization is largely caused by a combination of overall population growth and population movements from rural to urban areas, itself a phenomenon accelerated by climate change. It is estimated that 66% of the world's population will be living in urban areas by 2050 (UN Department of Economic and Social Affairs, 2015; Williams et al., 2019). Urbanization is increasing most rapidly in low- and middle-income countries, putting additional pressures on limited formal settled spaces – that is, those spaces that are formally recognised by local authorities, where adequate quality housing is available, and where urban infrastructures such as electricity, water and sewerage, transport systems and waste management systems are in place. Ever-increasing numbers of people reside in *informal* settled spaces, especially across Asia, South America and Africa (UN-Habitat 'Informal Settlements', 2015; Satterthwaite et al., 2020). Informal settlements are likely to be particularly vulnerable to climate-change related environmental hazards such as drought, fire and flood events (da Silva et al., 2012; Jabeen et al., 2010; Satterthwaite et al., 2020). They are usually situated on land that was unoccupied due to unfavourable development characteristics, such as floodplains, landfill sites and coastal edges. They may also be far from employment opportunities. Population densities are usually very high, and residents are faced with a range of chronic socioeconomic challenges such as poverty, high unemployment rates and failure or absence of infrastructure including drainage, water and sewerage, electricity and transport (Douglas et al., 2008; Satterthwaite et al., 2020). These vulnerabilities are often compounded by weak levels of governance (UN-Habitat 'Informal Settlements', 2015).

If city- and city-region level strategies are to have lasting utility and positive impact, it is crucial that they recognize and speak directly to the significant fractions of the population who reside in informal and marginalized settlements. Although there is a growing body of research focusing on climate resilience in informal settlements (Jabeen, Johnson and Allen, 2010; Lakhani & Andharia, 2020; Revi et al., 2014; Satterthwaite et al., 2018; Usamah et al., 2014), there remains a need to deepen understanding of disaster risks and adaptive capacities at individual, household and community levels in informal settlements. This paper presents findings from an interview-based survey of 600 households in three economically marginalized township settlements in the Cape Flats. The aim of the survey was to understand the lived experiences, adaptive capacities and resilience attributes of these households as they face climate change related environmental hazards of water scarcity, fire and flood events.

2. Conceptual framework: resilience capacities, capitals and habitus

Much of the recent academic and policy discussion around responses to climate change adopts a discourse of "resilience" (see e.g. Davoudi, 2018; Department for International; Department for International Development, 2011; Manyena et al., 2011; Paton & Johnston, 2017; Satterthwaite et al., 2018; Theron, 2016; Usamah et al., 2014). Resilience, in disaster risk management and development contexts, is often defined as a system's capacity to recover from and adapt to shocks – that is, to persist through and maintain functionality after extreme disturbances from historically and locally normal conditions. The notion of shock can be further broken down into a three-phase "disaster cycle" (Gaisie, Han and Kim, 2021; Houston et al., 2019), comprising before, during, and after. Thus resilience relates to preparedness (including prevention and mitigation measures), abilities to absorb and cope with immediate impacts and capacities to recover, repair, rebuild and adapt.

There have been several recent efforts to explore conditions for resilience in terms of "resilience capitals" (Bruneau et al., 2003; Cutter et al., 2014; Dhakal, 2018; Gaisie, Han, & Kim, 2021; Lakhani & Andharia, 2020; Mayunga, 2007; Yoon et al., 2016). These are intended to emphasise capacity and agency over a deficit model of vulnerability. Although these authors generally draw on extended sets of capitals including economic, social, human, environmental, physical and infrastructural, and represent them as sources of resilience capacity, there is no agreement on which capitals to use as a framework for analysis, nor indeed what might comprise each capital. There is also no clear evidence that access to each of the capitals enrolled in this conceptual work always correlates with capacities to deal with all the phases of the disaster cycle, with recent research suggesting that, in some disaster contexts, some capitals may in fact correlate negatively with increased resilience in particular phases (Gaisie et al., 2021).

In line with recent work on communitas and the role of theory in disaster research more generally (Matthewman & Uekusa, 2021; Uekusa, Matthewman, & Lorenz, 2022), we suggest that the notion of resilience capitals may be more effectively put to work if we return to their origin in Bourdieu's (1979; 1985; 2018) introduction of symbolic capital. Bourdieu suggested that social structures and power relationships, as exemplified by social class, could not be explained with reference to the forms of wealth identified in Marxian economics (capital, human labour and land) alone. Bourdieu introduced social and cultural capitals to explain class-based differences in educational outcomes that he argued could not be explained by access to economic capital. Such capitals can be embodied (as knowledges and practices contained in the minds and bodies of individuals), objectified (as, e.g., works of art) and institutionalised (e.g., in the form of educational qualifications) and thus can be both accumulated and, to a greater or lesser extent, exchanged with economic capital. The purpose of these additional forms of capital is to help explicate inequality, competition, stratification, power and social reproduction, all of which are important in understanding disaster risk and response.

Bourdieu's capitals cannot, however, be understood and operationalised on their own. Capacity and agency, which may be enabled through the acquisition of specific forms of capital, are also constrained by systemic and contextual characteristics (especially those that set norms relating to value and values) and the prior history and pathway of an individual's interaction with the system she or he acts within. The

choices and actions that are open to any individual person are limited by both their access to different forms of capital and their *habitus* – that is, the set of physical, mental, cultural and social habits, attitudes, assumptions and presumptions that they hold at any given time. A lack of access to certain capitals can reduce a person's options and choices; their habitus may result in even narrower perceived horizons for action. It is thus particularly important to understand the multiple ways in which risk, hazard and disaster are experienced, and the multiple ways in which people – as individuals and as households – respond to and learn from these experiences. That is, we need to understand how a disaster-response habitus is shaped by experience of exposure to disaster and risk of disaster. As Gaisie, Han, and Kim (2021) demonstrated, access to or possession of particular capitals and resources may sometimes correlate negatively with resilience capacities in certain phases of the disaster cycle. An expanded set of physical and symbolic capitals, together with the idea of habitus, may thus be particularly useful in identifying ways in which "resilience actions" might actually serve to embed and reproduce structures of inequality. City-level resilience strategies may then be designed to explicitly recognize these social, material and technical structures.

3. Materials and methods

3.1. The three research sites

This study explores the experiences of water scarcity, flooding and fire outbreaks in three marginalized settlements in Cape Town's Cape Flats area in South Africa (Fig. 1).

3.1.1. Water scarcity in Delft South

Water scarcity is increasingly becoming the default condition in Cape Town (Enqvist & Ziervogel, 2019). From 2015 to 2018 the city experienced the worst drought in its recorded history, resulting in acute water shortages and city-imposed restrictions and controls (Millington & Scheba, 2021). Water tariffs were increased and water management devices installed to limit individual household consumption to 350 L per household per day. This exacerbated water challenges for households with many people and where lack of income and space prevented purchase and storage of extra water, as is common in township settlements.

Delft South (established 1989) is a formal township settlement of approximately 50,000 people with a significant and growing informal component. It is culturally diverse with various South African ethnicities and immigrant populations with languages including Xhosa, Afrikaans and English. There are high recorded levels of crime and violence. Although some households are middle-class, the majority are low-income or unemployed, with unemployment rates just above 40% (Scheba & Turok, 2020). Infrastructure is well-developed compared to other low-income areas in the Cape Flats, with more than 90% of households having access to basic services (Scheba & Turok, 2020). Water consumption controlling devices were installed there in 2018.

3.1.2. Flooding in Sweet Home Farm

The geology and topology of the Cape Flats mean that some settlements are also at risk of recurrent flooding. One of the worst-affected settlements is Sweet Home Farm. This informal settlement, established in 1992, was originally agricultural land, then used as a dumping site for building rubble before being occupied by informal settlements residents (Pharoah, 2014). The 2011 census estimated the population at 17,000 (likely to have increased now) comprising of Xhosa (79.8%) and Afrikaans (17.3%) language speakers. Work opportunities in the settlement or close-by are extremely limited with unemployment at 38% (Sacks, 2014).

Residents of this community endure drainage challenges and localized flooding induced by heavy rainfall and exacerbated by a rising water table in winter and inadequate drainage channels, undermined by poor connectivity to the external stormwater network (University of

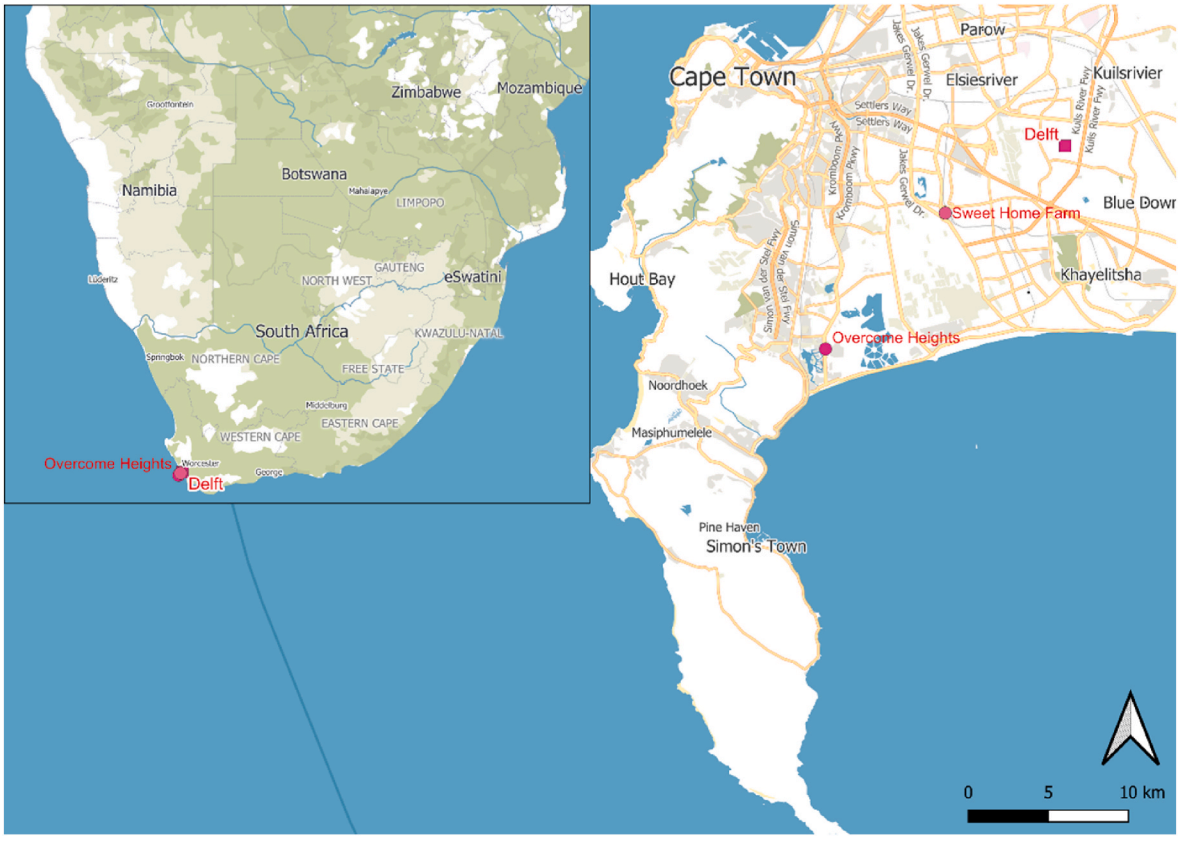

Fig. 1. Study area; Cape Town, South Africa (*Map created with QGIS (v.3.26.0) using data from OpenStreetMap contributors & MapTiler*).

Cape Town, 2019). Waste collection services are limited, leading to accumulation of litter and household waste (Drivdal, 2016) which mixes with floodwater and run-off.

3.1.3. Recurrent shack fires in Overcome Heights

Informal settlements around Cape Town are also at high risk of destructive, runaway fires (Pharoah, 2014; Kahanji et al., 2019; Flores Quiroz et al., 2021). Although fires have long been a problem in neighbourhoods with inadequate access to formal electrical connections, the increasing frequency of dry conditions and high winds combine to make fire weather more likely and thus fires become both more frequent and potentially more destructive (Williams et al., 2019).

Overcome Heights is affected by recurrent fire outbreaks (Chiguvare, 2018). It is a predominately informal settlement, with some parts deeply informal (houses and infrastructure), but other informal dwellings having access to some formal infrastructure (such as roads and street lighting). Recognised as an informal settlement in 2005, the 2011 census estimated the local population of Overcome Heights at 18,498 including migrants from other African countries.

Limited access to lighting and heating leads to use of candles and paraffin stoves that increase the likelihood of informal settlement fires (Strydom & Savage, 2016; Walls et al., 2017). In addition, the high density and haphazard pattern of homes restricts access to emergency services (Cicione et al., 2020).

3.2. Data collection and analysis methods

The research described here was the first phase of a larger-scale project that used a series of different methods to explore experiences of and responses to water scarcity, flooding and fires in the three sites (Mpofu-Mketwa et al., 2023). In this phase, the intention was to generate data that would both provide statistically significant information on experiences at the household and individual (rather than community) level and to identify important issues and recurring themes that could be used to identify foci for and shape methodological choices for subsequent in-depth research. Achieving this required a method that could be used with a large number of participants but that allowed for open-ended responses and free-form descriptions. We therefore developed a survey that could be answered by representatives of households and that included both closed and open-ended questions.

In each site, initial community engagement workshops introduced the research team, aims and objectives and generated collective feedback from participants to inform development of a household survey instrument. The survey (Appendix 1) (implemented using the online Commcare platform) included closed questions that generated demographic and macro-level quantitative data, and open questions that generated qualitative data about respondents' disaster and resilience experiences. The involvement of local residents in the design of the surveys was intended to ensure that data were collected that reflected their own concerns, and also to minimize any negative impact of surveys that asked people to reflect on and talk about what are likely to have been difficult and even traumatic experiences. The survey and delivery approach received ethical approval from the lead author's institutional Human Research Ethics Committee.

Six hundred responses were collected (200 per site) from adults representing individual households between April and July 2020, during the COVID-19 pandemic. Responses were therefore collected using mobile communication technologies including WhatsApp.

Respondents were recruited using a snowball sampling approach that started with people who had participated in the community engagement workshops. The team sought respondents from formal and informal dwellings, men and women, Xhosa and Afrikaans speaking residents, and foreign nationals. The surveys were conducted by local field research teams that included speakers of Xhosa, Afrikaans, English, Shona and Zulu. Data collected in Xhosa, Afrikaans, Shona and Zulu were subsequently translated into English by members of the research team to allow for analysis by the whole team.

The quantitative data generated in this way were analysed using basic descriptive statistics techniques. The responses to open-ended questions were analysed thematically, using a deductive analysis process where the three phases of the disaster cycle provided organising principles. The data were examined with the explicit intention of understanding how access to and ownership of different forms of capital affected respondents' experiences of and responses to each hazard. In this analysis, responses were categorised as relating to before, during or after a disaster episode. For those in the "before" phase, they were further categorised as relating to causes or levels of preparedness. For those in the "during" phase, they were further categorised as relating to impacts and coping mechanisms. For those relating to the "after" phase, they were further categorised as relating to recovery or lessons learned. Within these types of response, we looked for specific evidence of positive/negative experiences and factors that enabled or challenged recovery. Table 1 presents the high level codes and examples of sub-codes used in the analysis. These are explored and illustrated with excerpts from the responses in the results sections below.

4. Results

4.1. Household characteristics, buildings and infrastructure

Household characteristics are summarised in Table 2. Across all three sites, the majority of respondents were female. Respondents in Sweet Home Farm and Overcome Heights had a slightly younger age profile, with approximately two-thirds in both sites aged below 40. Delft

Table 1
Primary and secondary coding.

Disaster cycle phase	Primary (activity) code	Examples of relevant physical capital secondary codes	Examples of relevant social capital secondary codes	Examples of relevant cultural capital secondary codes
Before	Causes	• Leaking water meter • Blocked drain • Candles for lighting	• Relationship conflict • Addiction	• Ignorance of good waste disposal practices
	Preparedness	• Jojo tanks • Stepping stones • Sand	• Phone calls from friends/ family	• Warnings issued by CoCT
During	Impacts	• Overloaded toilets • Soaked carpets • Housing too close together	• Theft	• Religious requirements for water
	Coping mechanisms	• Stepping stones • Use of open space	• Shared vegetable garden • Help from friends/ family to move belongings	• Knowledge of locations of unmetered taps
After	Recovery	• Access to new building materials	• Family/ friends offer place to stay • Family/ community assistance to rebuild	
	Lessons learned	• Means of water storage	• Lack of external help	• Need for awareness raising

Table 2
Household characteristics.

	Delft	Sweet Home Farm	Overcome Heights
Gender			
Female	74%	61%	60%
Male	26%	39%	40%
Age			
<20	1%	1%	1%
20–29	22%	11%	24%
30–39	21%	52%	49%
40–49	20%	26%	21%
50–59	29%	5%	4%
60–69	6%	2%	1%
≥70	1%	3%	0%
Average number of years in current house	14	12	7.5
Number of people in household aged <18			
0	25%	33%	28%
1	23%	19%	31%
2	22%	24%	26%
3	15%	13%	11%
4	10%	7%	3%
≥5	5%	4%	1%
Number of people in household aged >65			
0	83%	94%	98%
1	14%	6%	2%
2	3%	0%	0%
Average number of people eating from the same pot the previous night	5	4	4

South had a flatter and older age profile, with less than half under 40. Most households included children (under 18 years). In contrast, very few included people over 60. The table also includes the average number of people eating from the same pot the previous night, as a proxy for the total number of people dependent on the household.

Survey questions that provided an indication of the degree of informality of the respondents' living conditions are summarised in Table 3.

Access to robustly constructed housing and basic service infrastructure is higher in the formal settlement of Delft South than in the informal settlements of Sweet Home Farm and Overcome Heights. However, most respondents had access to electricity, with approximately three quarters or more having metered, formal connections in all three sites. Delft South residents also have on property access to piped water and toilets while informal settlement residents rely on communal toilets or chemical portaloos provided by the local authority.

4.2. Lived experiences of water scarcity in Delft South

Our results show that Delft South residents still experience imposed water shortages even after 2018, as the CoCT continues to limit their supply to a maximum amount and stops the supply when that fixed amount is reached each day. This is an ongoing disaster.

4.2.1. Before a period of water shortage: causes and preparedness

Respondents in Delft South identified broken and burst water pipes and leaks from infrastructure that are not fixed quickly enough by the local authority as factors that exacerbate water scarcity beyond the regional shortage. Other causal factors were irresponsible use and wastage by residents, e.g., car washes, use of hosepipes and illegal water connections by back yard dwellers.

Table 3
Buildings and infrastructure access.

	Delft	Sweet Home Farm	Overcome Heights
Building materials			
Brick	98%	1%	1%
Timber	0%	6%	3%
Iron sheets	0%	50%	60%
Timber and iron sheets	0%	40%	36%
Other	2%	3%	0%
Access to electricity			
Metered connection	98%	74%	78%
From another house	2%	26%	22%

Residents also described a range of factors that both helped and hindered their capacity to prepare for water scarcity. Positive measures included: keeping water storage containers e.g., buckets and tanks; drilling boreholes; and buying bottled water. An important negative factor related to communication and advance warning. Most respondents indicated that they did not receive official early warning information from the local government about scheduled water restrictions that could have helped them to prepare for water shortage. Instead, they learned of cuts through self-experience and hearing from neighbours or members of their community. Most respondents (55.5%) were aware of some official information about the pending crisis through platforms including television, social media, radio, online and pamphlets issued by the local authority. However, some felt the information was not adequately communicated:

> We were not prepared, there was no information on when it would go, could not wash or keep hygiene. we couldn't even cook on some days. [AM007]

In addition, 62.5% of respondents in Delft could not identify or list any set formal responses that could be used to deal with the water shortages.

4.2.2. During a period of water shortage: impacts and coping mechanisms

The water restrictions created barriers to engaging in many activities and practices that normally defined people's lives. For example, residents described barriers to income generation:

> I had just arrived from Joburg and facing the water challenge was a terrible experience. Two building projects that I had come to do could not proceed because of the drought. I lost income. (AM028).

Health and sanitation were also frequently affected:

> I need to take medicine with water, I have little kids and regular washing is a must, in a place where 11 people using one toilet one needs water every time. (CC154)

Residents also described disturbances to religious and cultural practices:

> Ramadan is here and when we fast, we drink water a lot. Without it we won't be able to practice our religion well. (AM044).

Respondents described actions taken during the critical 'Day zero' period of water scarcity. These included reusing (grey) water to flush toilets and water gardens and buying bottled water. However, some measures were of a more dubious moral and legal status. Those with cars could sometimes source water outside Delft South, in informal settlements without metered provision to individual houses:

> Open taps in the informal settlement offer free water, that is where most people who have cars drive to. I do the same. (AM008).

People also described collecting water from broken pipes or fire hydrants:

> We get it from a fire hydrant, I know it's not a legal method … There is also a water pipe in the field, apparently it was exposed when a front end loader was clearing rubbish, now people get water from there, it not been covered or repaired. (AM028).

One respondent described offering bribes:

> We were affected badly, being Muslim we need water daily they cut water and I reacted by raising this issue with council officials, had to pay R500 to someone to fix my meter, now it's free flow. (AM044).

4.2.3. After a water scarcity period: recovery and lessons learned

Water storage and use of additional buckets, containers and tanks was cited by most respondents (82.5%) as the common strategy they would adopt should a similar situation repeat in future.

4.3. Lived experiences of flooding in Sweet Home Farm

Sweet Home Farm is prone to flooding because of its geohydrological setting, as it overlies an unconfined sand aquifer with a shallow water table. Flooding is thus both an event, when a person's house is inundated, and a constant presence in the form of standing water in the area. A flooding event takes place on the timescale of hours to days, but its aftermath can continue longer.

4.3.1. Before a flood event: causes and preparedness

Respondents attributed flood events in Sweet Home Farm to both natural and human induced factors including groundwater seepage and heavy rains. Most respondents identified lack of proper drainage infrastructure, blocked drains and toilets as the main causes of flooding in their homes. The situation is worsened by disposal of greywater (from washing, cleaning, cooking etc.) and the use of makeshift drains.

Respondents identified several preparation and mitigation measures and actions that they could take, plus factors that helped or hindered them to do so. The most important measure was seen to be the renovation and reinforcement of houses, particularly roofs and doors. However, many people cited lack of money to buy flood defence materials such as cement and better building materials. Respondents also noted the importance of reinforcing water diversion features and barriers such as trenches and sandbags. Money was seen as the main barrier to building proper drains.

4.3.2. During a flood event: impacts and coping mechanisms

Most (81.5%) respondents in Sweet Home Farm had experienced flooding in their own homes and they described extensive damage, including soaked property and damaged furniture. Key concerns were health and hygiene:

> People dump rubbish everywhere and when flooding comes, all the dirt is washed up people's doorsteps … Children play with contaminated water and adults walk in this dirt water. This causes skin diseases and diarrhoea. (AM018).

Respondents described a somewhat limited range of damage limitation measures that could be taken during a flood, such as scooping water out of houses, digging furrows or trenches and setting up barriers (e.g. sandbags). In case of an evacuation, many respondents (51%) identified essential documents such as identity cards, passports and bank cards and clothes as priority items to take with them. All these measures were taken by the respondents, their families and friends; respondents made it clear that government and civil society response was completely absent, with 81% indicating that emergency services do not attend to flooding events in their area. They consistently described being left to deal with the immediate impacts of flood events themselves.

4.3.3. After a flood event: recovery and lessons learned

Respondents explained how their houses remain damp and cold after being inundated. The damp conditions both inside and outside their homes were linked to diseases such as constant colds and flu, fever and skin rashes especially among children:

> Everyone got some fever each and every season no winter no summer and rash is affecting the children and everyone is coughing. (XM048).

Respondents also highlighted foul smells and water pools that allow for mosquito breeding.

Respondents described actions that could be taken after the flood including: salvaging belongings by drying and cleaning them, buying food and cleaning houses to remove mud and water. 70% of the respondents who had been flood victims said they had to rebuild their houses afterwards; respondents also described buying building materials, resurfacing and repairing their homes.

Although some respondents mentioned receiving external help after flooding (e.g., ward committees assessing the extent of damage, providing necessities such as food and blankets and even helping build trenches), almost 90% felt that councillors/ward committees did nothing to address flooding issues. Indeed, the majority described being left to fend for themselves, and more than 40% indicated that they did not have anyone to rely on for support. Street committee meetings were of mixed effectiveness:

> There used to be, but gangsters are making people scared. We used to hold meetings about crime, fire and floods but some of our leaders got targeted in violent attacks. Now people are scared to even attend meeting. (TLZ 090).

Given the frequency of flooding events, it is not surprising that residents have already learned lessons from their experiences. As a result, 95% of respondents indicated that before the predicted onset of the rainy season, they renovate and reinforce their houses; repair and add water diversion features such as trenches; and stock up temporary flood barriers including sandbags to minimize flooding impact.

4.4. Lived experiences of fire in Overcome Heights

Fires in Overcome Heights spread rapidly. A fire event takes place on the timescale of hours, but the immediate impacts spread over the next few days as people sleep outside until they can start to rebuild. There are also other longer-term impacts.

4.4.1. Before a fire event: causes and preparedness

Respondents largely blamed residents for fire outbreaks. Negligence was the most frequently reported cause (89%), and included illegal, faulty or insecure electricity connections, leaving stoves unattended, use of open flames such as paraffin stoves or candles, or explosion of gas bottles used for cooking. Drunkenness was identified by 46% of respondents as an important factor, leading to accidents such as knocking over open flames. Arson was also cited:

> our neighbours were fighting and the woman burned the shack in a feat of rage, we lost everything because it started close to us. (AM109).

Mitigation and avoidance actions were limited to storing water and sand in houses.

4.4.2. During a fire event: impacts and coping mechanisms

Respondents described significant losses: '*My house burned to ashes. I lost everything because I was away at work.*' (AM 020). Respondents described emotions brought on by witnessing fire outbreaks, including confusion, shock, fright, panic and anger: *'I was very furious, angry and stressed not knowing how am I going to recover my assets'* (PN178). Others described an additional risk of loss of property as thieves took advantage of the situation:

> We thought it was best to take out our stuff then help those where the fire was. In that chaos the thieves helped themselves to the items outside and even got into the houses to steal whatever they could. (AM006)

All respondents said their health had been affected by the fires in some way, either physically or psychologically. Respondents described death and injury:

> … people burn and die or get permanently maimed. The smoke from fire is toxic because so many different things get burnt. (AM030).

Respondents recognised that some people were particularly

vulnerable: '*In every community there are children and the elderly, these are usually victims of fire because they can't evacuate fast.*' (AM002). They also described respiratory issues such asthma and breathing difficulties. Psychological damage included stress, anxiety, panic attacks, living in fear and trauma:

> It means we are not safe. Every day we have to sleep with one eye open just in case there's a fire and we have to get out of the house. (CC193).

Despite these negative experiences, respondents also described a range of actions that they took during a fire event. They used sand and water to extinguish fire themselves. Some created fire breaks by dismantling houses close by: *'I take my house apart so that my place doesn't catch fire and that the fire can't spread any further'* (CC186). Other actions included removing essential household items and assets and evacuating their homes. Essential documents (identity cards, passports, banks cards etc) and clothes were mentioned by 82% of respondents as the main items they would take in case of evacuation.

Respondents mentioned calling and receiving a response from emergency services. However, because much of Overcome Heights is inaccessible to fire engines, respondents often relied on themselves, family, friends and neighbours to deal with fire. Other challenges included limited water points, limited access and escape routes and densely-packed housing constructed from fire-prone materials. Some respondents cited lack of knowledge of fire drills.

4.4.3. After a fire event: recovery and lessons learned

Immediately after a fire event, those who had been made homeless often slept in nearby open spaces. Others were able to sleep in the homes of family, friends and neighbours. They remained in this position until they obtained building materials, which were sometimes provided by the CoCT's Disaster Risk Management Centre (DRMC) but which may also be salvaged from burned dwellings. Support from ward councillors, private sector organisations such as supermarkets and NGOs, in the form of food, clothing and blankets were also cited. Only 8% of respondents reported having noone to help after a fire event.

Repair and rebuilding were carried out by members of the household, sometimes with the help of family members, friends or neighbours. Household items and belongings that were destroyed or otherwise lost (e.g., because of theft) also had to be replaced. Respondents highlighted the difficulties associated with the loss of essential documents.

After every fire incident, street committee meetings were held to raise awareness of precautions that residents should take. However, not all residents follow the advice or agreed plans.

Over two thirds of respondents described having learned to take preparatory measures from their experiences of fire including: storing water and sand in houses and packing essential items such as identity cards separately ready for evacuation.

5. Analysis and discussion

As well as revealing patterns of experience of and response to three different environmental hazards, our data highlight ways in which the control and ownership of different forms of capital shape the capacities and agencies of household actors. They also offer some insights into how, against the background of these power structures, the experience of continuous risk and regular crisis shapes the habitus of these actors.

5.1. Capitals: ownership and access

The concept of capitals as enablers of resilience capacities is now relatively widespread in the literature on disaster risk, response and policy (Bruneau et al., 2003; Cutter et al., 2014; Dhakal, 2018; Gaisie et al., 2021; Lakhani & Andharia, 2020; Mayunga, 2007; Yoon et al., 2016). By focusing on households, our data highlight the importance of not only identifying different capitals that are brought into play in experiences of disaster, but also recognizing ownership and control.

Households (and individuals) may have ownership and control of cultural and social capital in addition to economic capital, human labour and land. However, some other forms of capital may be, by social construction, always outside the (legal) ownership and control of households. Of significant importance here are what has elsewhere been termed infrastructural and institutional capital (see, e.g., Lakhani & Andharia, 2020). In the CoCT region, as in many cities around the world, infrastructure such as roads, drainage, water and sewerage, electricity supplies and emergency services are owned and controlled by the state, local authorities and/or private corporate entities. These were frequently cited in responses to the survey, emphasising their importance as capitals enabling or hindering disaster response and recovery. Households and individuals can acquire access to them (and so to goods they deliver) through the "generosity" of the state, through the payment of taxes or fees or through illicit means. Control of these infrastructural capitals is thus outside the hands of households, unless normal power structures are bypassed or subverted. Similarly, institutional capital, understood as the services provided by NGOs, charities, private companies and the state (here, CoCT's DRMC) are owned and controlled by external actors. The goods and services controlled by these actors may be distributed to households and individuals, thus transferring some economic capital to the recipients, but households and individuals have no control over when, where and how these institutions operate.

5.2. Water scarcity in Delft South

The data from Delft South show how water scarcity impacts on many aspects of daily life. Aside from thirst and inability to wash, respondents described negative consequences for income generation and ability to observe valued religious practices. Water scarcity thus had the effect of decreasing some respondents' economic and cultural capital.

The survey confirms that households in Delft South have access to infrastructural capital in the form of water, sewerage and electricity. Despite having access to these capitals, it appeared that households felt powerless to act to *prevent* water shortages. Ubiquitous media/social media messaging reminded them that the entire Western Cape was experiencing drought conditions and water supply challenges. Local exacerbations due to poorly maintained infrastructure were outside their horizons for action – no one suggested they could fix the broken pipes in their locality. Instead, economic capital was expended in exchange for bottled water or bribes. Cultural (knowledge) capital enabled coping mechanisms to develop, and social capital encouraged distributed, supra-household responses.

Strikingly, no one openly questioned whether water shortages should always lead to universally restricted supplies, suggesting a deeply engrained habitus of accepting state-imposed water scarcity as inevitable. Complaints were largely directed at a perceived lack of effective communication rather than at policy or strategy. These (relatively wealthy compared to the other two sites) households appear to be at risk of damage due to state control of the very infrastructural goods that contribute to their higher standards of living. Imposing a blanket restriction of 350L of water per household fails to recognize that some parts of the CoCT are at a pre-existing disadvantage and that households in other areas may be better equipped to purchase bottled water or to buy and make use of longer-term, larger-scale water storage such as rainwater tanks. Yet none of our respondents described lobbying the CoCT to change its water restriction strategy. Instead, respondents described actions that reproduced and embedded existing power structures and inequalities, such as the paying of bribes or the collection of water from communal taps in less formal and so less well-provisioned settlements. Relatively wealthy respondents were able to do this because of their car ownership; however this practice also relies on the existence of an underclass without piped water into their homes, who are effectively exploited as "their" water is taken by people who have perhaps already consumed their allocated 350L.

5.3. Flooding in Sweet Home Farm

The Sweet Home Farm survey data show multiple, complex and ongoing risks relating to flooding. Our respondents' experiences have furnished them with the cultural (knowledge) capital needed to identify mitigation and adaptation measures, such as using cement to seal gaps, digging trenches and acquiring sandbags and other defences. However, they often lacked the economic capital and human labour needed to buy materials to carry out these mitigation measures.

Respondents were also highly concerned about health risks. For residents of Sweet Home Farm, water and waste have become intermingled in both their thinking about flooding and in lived realities. This intermingling is a result of inadequate access to infrastructural capital, owned and controlled by the CoCT, in the form of good drainage, water and sewerage and waste management services. Potable water is available from communal taps; our respondents indicated that leaks from both the taps and the pipes that carry water are an additional cause of flooding. Without a sewerage system, as the survey responses confirm, almost all residents rely on communal toilets or chemical portaloos that have been provided by the CoCT. When these are broken, leaking or irregularly emptied, human waste mixes with the almost ever-present flood and standing waters, creating a public health risk. Sweet Home Farm does not have regular kerbside waste collection; as a result, household waste can also end up blocking storm drains, making flooding events more frequent and longer-lasting.

As in Delft South, our data suggest that the histories and contexts of the residents of Sweet Home Farm combine with the distribution and ownership of different capitals to create a habitus in which coping, rather than changing or even escaping, is quite deeply entrenched. The absence of state or city level immediate response to a flooding event reinforces perceptions that flood is not disaster or shock but is rather part of the normal conditions to which people must adapt.

5.4. Fire in Overcome Heights

Results show that risks from fire are also complex. Aside from the immediate risk to property, buildings and life, our respondents describe consequential risks of property loss as a result of theft, either in the chaos of a fire or in the aftermath, when they and their belongings are exposed in open areas. The data also show health consequences beyond burns and smoke inhalation including the impacts of trauma and anxiety as well as damage to people with pre-existing respiratory conditions.

Fire risk seems to be created and heightened by several factors. Although the most frequently cited immediate cause was negligence or accident, another important reported cause was informal connections to electricity infrastructure, such as through a neighbour's house or from a light pole. Thus in Overcome Heights, the partial availability of infrastructural capital may be responsible for exacerbating fire risk, as residents without formal connections to the electricity grid create their own illicit and dangerous connections.

Dense housing concentration and narrow roads have the effect of excluding many households in Overcome Heights from access to the infrastructural capital of emergency response services, as standard fire trucks cannot physically enter or operate within these confined spaces. Efforts to douse fires were also reported to be hindered by a lack of functioning fire hydrants and taps, again illustrating the impact of infrastructural capitals that are outside the ownership and control of residents.

Compared to Sweet Home Farm, economic capital was less frequently mentioned as a barrier to recovery, perhaps because more support was made available to those experiencing fire from both the CoCT's DRMC and other actors such as NGOs and private companies. Results suggest that initial recovery from fire events was largely dependent on access to institutional capital, outside the control and ownership of residents. However, longer term recovery, including the rebuilding of homes, depended heavily on respondents' own human labour and social capital, with family and friends helping with reconstruction. Residents' ongoing ability to generate income, and hence acquire economic capital, was also important in enabling them to replace damaged and destroyed belongings.

As with both the other sites, the histories and conditions of respondents in Overcome Heights seemed to have created, for many, a habitus in which the cycle of destruction and rebuilding is accepted as normal. However, respondents also seemed to have developed a habitus of assuming personal, individual responsibility for fires, attributing blame to other residents or themselves, rather than recognizing that there are significant structural causes. Respondents wanted more support, including psychological support for traumatic events, but seemed to have accepted that coping, rather than change, was their best and perhaps only strategy.

6. Data uncertainties and limitations

This study was undertaken during the COVID-19 pandemic in 2020 and although the initial data collection plan was to do face to face interviews, this had to be altered to a telephone approach in order to comply with the COVID-19 restrictions and safety requirements. Such a change could have introduced a bias in the selection of respondents as their selection was based on the snowballing approach. The telephone interview process also had practical challenges related to e.g., network connection issues in some places and verifying the respondents to ensure that they are eligible and able to participate in the survey. Also, the researchers couldn't witness and get the practical experience from the study sites as they had to rely on information shared by respondents. The use of WhatsApp social media platform allowed respondents to share photographs depicting various issues in their area in real-time. For example, at the time of data collection, Sweet Home Farm was under floods and interviewees were able to share their own images of this challenge. In contrast, respondents in Delft had to base their responses on water shortages experienced during the water crisis period in 2018. Despite these changes and challenges, the collected data provides an important baseline and insights on the lived experiences of the residents in the Cape Flats.

7. Conclusions

Findings from this study have implications for both the CoCT and other regions that are experiencing or will experience similar ongoing environmental crises and socio-economic living conditions.

The Bourdieusian capitals framework provides particular insights. These communities go through repeating cycles of preparing, encountering, and recovering from disasters. These cycles develop cultural capital in the form of knowledge acquired through experience. Across the three sites, most respondents felt they were able to rely on someone for support in the aftermath of a disaster, notably neighbours, family, friends and relatives. These support networks assist disaster victims with accommodation, food and psychosocial support. Thus, cultural and social capital are key to households' resilience. However, residents may become "trapped" in these recurrent disaster cycles because of dependencies on forms of capital that they neither own nor control.

One of the most important capitals available to respondents across all three sites was cultural (knowledge). Simply having lived through and learned from a particular type of disaster before was a huge factor in enabling resilience or adaptive capacities. Cultural knowledge is also rapidly evolving as a coping mechanism for such events. This has important implications as the impacts of climate change spread and communities find themselves in unfamiliar territory.

Also, the situations and experiences of respondents tend to limit their horizons for action and to shape habituses that reinforce or reproduce existing power structures. This is made clear where residents described being dependent on DRMC or repeatedly experiencing the same forms of loss, and where they exploited their own more marginalized neighbours

residing in more informal parts of their localities. Residents are constantly exposed to risk and/or immediate experience of what we characterise as disasters, but which have in fact become normality. As a result, their capacities and energy are likely to be devoted to actions directed at coping, leaving few reserves to take actions directed at change.

These findings are of potential importance to the CoCT's Resilience Strategy, which calls for partnerships and resilience strengthening at all scales/levels including individual, household, community, neighbourhood and city-wide approaches. They are also important for other cities around the world which are seeing growing levels of both informality and environmental hazards. Our data reveal household coping strategies before, during and after disasters in the most vulnerable sectors of the city residential landscape. They also show the complex interplay of forms of capital and the importance of recognizing ownership, control and power structures. Lastly, they illustrate how repeated (and even constant) exposure to risk can shape a habitus of risk acceptance and a focus on coping rather than change. Climate change means that environmental hazards such as those explored here will become more frequent experiences for people living in similar locations and regions. Disaster risk reduction, response and recovery policies will need to be developed that take into account the impacts on habitus of repeated cycles of ongoing risk and disaster episodes.

CRediT authorship contribution statement

Sikhululekile Ncube: Formal analysis, Writing – original draft, Writing – review & editing. **Anna Wilson:** Conceptualization, Formal analysis, Project administration, Supervision, Writing – review & editing. **Leif Petersen:** Conceptualization, Methodology, Validation, Investigation, Writing – review & editing, Supervision, Project administration. **Gillian Black:** Conceptualization, Methodology, Writing – review & editing, Project administration. **Amber Abrams:** Writing – review & editing. **Kirsty Carden:** Conceptualization, Writing – review & editing. **Liezl Dick:** Writing – review & editing. **Jennifer Dickie:** Conceptualization, Writing – review & editing. **Lesley Gibson:** Formal analysis, Writing – review & editing. **Niall Hamilton-Smith:** Conceptualization, Writing – review & editing. **Aileen Ireland:** Writing – review & editing. **Guy Lamb:** Conceptualization. **Tsitsi Mpofu-Mketwa:** Investigation, Writing – review & editing. **Laurence Piper:** Conceptualization. **Dalene Swanson:** Conceptualization, Funding acquisition, Supervision, Validation, Methodology, Project administration.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supplementary data

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