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Michael Mason [a], Mark Zeitoun [b] & Rebhy El Sheikh [c]

[a] Department of Geography and Environment, London School of Economics, Houghton Street, London, WC2A 2AE, UK

[b] School of International Development, University of East Anglia, Norwich, UK

[c] Palestinian Water Authority, Gaza City, Gaza

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Conflict and social vulnerability to climate change: Lessons from Gaza

MICHAEL MASON[1,*], MARK ZEITOUN[2] and REBHY EL SHEIKH[3]

[1]Department of Geography and Environment, London School of Economics, Houghton Street, London WC2A 2AE, UK
[2]School of International Development, University of East Anglia, Norwich, UK
[3]Palestinian Water Authority, Gaza City, Gaza

In societies marred by conflict, the propensity of populations to be harmed by climate hazards is likely to be increased by their exposure to violence and other coercive practices. Stakeholder assessments of climate vulnerability, as reported here for the Gaza Strip, can capture the qualitative experience of harm caused by conflict-related practices as these relate to, and interact with, forecasted climatic risks. The key pathways of climate vulnerability identified by stakeholders in Gaza relate above all to expected impacts on food security and water security. Exploration of these vulnerability pathways reveals conflict-structured non-climatic risks overwhelming forecasted climate risks. The prevalence in Gaza of short-term 'enforced coping' prevents the development of long-term adaptive capacity. Climate vulnerability assessments in (post)conflict environments should acknowledge the methodological and political-policy challenges caused by chronic, non-climatic sources of harm.

Keywords: climate vulnerability; conflict; enforced coping; Gaza Strip; human security

1. Introduction

What the Intergovernmental Panel on Climate Change (IPCC) labels as 'key' vulnerabilities to climate change – those meriting policy attention as symptomatic of 'dangerous anthropogenic interference' with the climate system (UNFCCC Article 2) – are seen to depend on the magnitude, timing and distribution of climate impacts. Deliberations on climate impacts are viewed as inherently political: they feature value judgements about the acceptability of potential risks, and potential adaptation and mitigation measures (Schneider et al., 2007, p.784). These are particularly testing considerations in societies affected by conflict, as the risks posed by future climate impacts may be overwhelmed by present threats to lives and livelihoods arising from the threat or use of violence. In such circumstances, participatory vulnerability assessments can, with appropriate expert assistance, provide essential information on climate risks as experienced within conditions of conflict. This article examines stakeholder representations of climate vulnerability in the context of a territory, the Gaza Strip, subject to Israeli 'occupation', including the imposition, since January 2006, of an economic blockade and closure regime.[1]

At least in terms of exposure to climate change, Palestinians in Gaza face disruptive climate impacts on par with the populations of other semi-arid territories in the eastern Mediterranean. There is some evidence that average temperatures in the region have increased steadily over the past four decades (e.g. El-Kadi, 2005; Krichak et al., 2007; Kafle and Bruins, 2009). Furthermore, climate simulations recently undertaken with regional models have delivered generally consistent results (Kitoh et al., 2008; Somot et al., 2008; Khatib, 2009). Over the

■ *Corresponding author: *E-mail:* m.mason@lse.ac.uk

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course of this century, and depending on the global emissions scenario employed: (i) a decrease in precipitation of up to 35 per cent (with significant seasonal variation), (ii) a significant warming of between 2.6 and 4.8°C, (iii) a tendency towards more extreme weather events and (iv) a rise in sea level have been predicted. For the Gazan population of the occupied Palestinian territory (oPt),[2] the biophysical impacts expected from these trends include an increased probability of flash floods, droughts, desertification and saline intrusion into groundwater (UNDP, 2010a, pp.9–13).

This article examines the stakeholder consultation component of a United Nations Development Programme (UNDP)-funded vulnerability assessment examining climate risk conditions in the Gaza Strip. The aim of the stakeholder consultation – undertaken between December 2008 and August 2009 – was to identify 'biophysical' determinants of climate vulnerability as experienced or judged by representatives of relevant governing authorities and civil society organizations. Framed by a UNDP human security perspective, and informed by a review of regional climate science predictions, the initial premise for stakeholder consultations was that the life and livelihood conditions particularly sensitive to water-related stresses were likely to be key areas of climate vulnerability. As noted below, this resulted in a focus on climate risks to public health and agricultural livelihoods, though conflict-related impacts were argued, by stakeholders, to compound forecasted climate changes. The next section of this article sets out the concept of climate vulnerability employed (Section 2). After outlining the stakeholder assessment methodology, the key pathways of climate vulnerability identified in Gaza are discussed (Section 3). Conjoined with short-term and long-term response capabilities (Section 4), these provide a collective Palestinian representation of key climate vulnerabilities. It is argued that, while the UNDP assessment process generated significant information on the climate risks perceived by stakeholder representatives, its preoccupation with climate impacts prevented a more in-depth scrutiny of the conflict-laden determinants of water and food insecurity.

2. Framing climate vulnerability in conflict zones

According to the IPCC, vulnerability to climate change is 'the propensity of human and ecological systems to suffer harm and their ability to respond to stresses imposed as a result of climate change effects' (Adger et al., 2007, p.720). While early IPCC formulations of vulnerability highlighted the biophysical impacts of climate change, it is now recognized that climate vulnerability includes both the 'external' exposure of socio-ecological systems and their 'internal' susceptibility and adaptive capacity (Kelly and Adger, 2000; Brooks, 2003; Adger, 2006; Füssel and Klein, 2006). This integrated understanding of vulnerability is evident in the *Fourth Assessment Report* and the IPCC-sponsored global research project, *Assessment of Impacts and Adaptations to Climate Change* (Leary et al., 2008). In principle, it opens up vulnerability assessments to consider the full range of non-climatic determinants, including socio-political and socio-economic evaluations of climate impacts, although the IPCC has still been charged with neglecting the root causes of vulnerability (Gaillard, 2010, p.224). Such criticism is misplaced insofar it ignores the role of IPCC Working Group II in identifying the high climate vulnerability of poor and marginalized communities (especially in developing countries), as well as its explicit call for more research on the causal links between development paths and vulnerabilities to climate change (Schneider et al., 2007, p.804). Nevertheless, the regional and sectoral scope of IPCC assessments can displace scientific and policy attention from key climate vulnerabilities facing poorer populations in sub-regions or territories exposed to the effects of conflict. The Gaza Strip is one such conflict zone where a finer-grained treatment is justified, and discussion – as here – on the interface of conflict and climate at the community level is neglected in the literature.

In its contribution to the *Fourth Assessment Report*, IPCC Working Group II acknowledges that fragile governance systems and conflicts, armed and otherwise, typically heighten the vulnerability of people to climate risks, though only recent conflicts in Africa – within the Greater Horn of Africa and the Great Lakes region – are discussed (Boko et al., 2007, pp.442–443). More widely, Barnett (2006, pp.117–125) identifies at least 37 countries facing or recovering from conflict since 1989, arguing that their affected populations are especially vulnerable to climate variability and extremes because of their low capacity to cope with, and recover from, such stresses. Most of these countries, he notes, have faced significant food shortfalls as natural resource assets and livelihood opportunities have been severely eroded by the effects of conflict (see also Barnett and Adger, 2010). In societies marred by protracted military occupation, as in East Timor (1975–1999) and the oPt (1967–), the entrenched social vulnerability created by systemic human rights violations is likely to overwhelm the impacts of particular climate hazards (Barnett, 2010, pp.260–262; Mason, 2011). For Gaza, as argued below, the Israeli closure regime significantly affects the capacity of Palestinians to cope with, and adapt to, key climate risks. The term 'enforced coping' is used to refer to the constrained (and possibly harmful) ways in which people seek to mitigate or avoid significant climate-related harm under conditions of exceptional vulnerability. The presence of enforced coping questions the view (e.g. Agrawal and Perrin, 2009, p.354) that governments and other external actors necessarily increase the adaptive capacity of economically marginal communities by strengthening the *existing* coping strategies of households and other social groups (cf. Smit and Wandel, 2006, p.289).

The focus here is on a UNDP-funded stakeholder assessment of climate vulnerability in Gaza, which took place between December 2008 and August 2009 and was part of a climate change adaptation initiative in support of broader 'good governance' capacity-building for the Palestinian Authority aligned with international donor interests (UNDP, 2010a). Given pressing humanitarian and development needs in Gaza and the West Bank, the UNDP climate adaptation work for the Palestinians was framed explicitly by the agency's perspective on 'human security', defined as 'the liberation of human beings from those intense, extensive, prolonged, and comprehensive threats to which their lives and freedom are vulnerable' (UNDP, 2009, p.2; see Dalby, 2009, pp.41–43). UNDP-sponsored human security reports covering the Middle East have paid growing attention to major environmental threats, notably those impacting on water availability and food production (UNDP, 2009, pp.47–50; 2010b, pp.89–93). Framing human security in a climate vulnerability context highlights human capacities and freedoms to pursue lives and livelihoods free from threats induced or compounded by climate hazards (O'Brien et al., 2007; Adger, 2010; Pelling, 2010). Yet, at least in conflict situations, a preoccupation with climate hazards or risks can in practice displace methodological and policy attention away from chronic non-climatic determinants of social vulnerability. As noted below (Section 3), stakeholder consultations in Gaza identified water insecurity and food insecurity as key threats to human security, but more from ongoing military and security practices than forecasted climate risks.

3. Climate vulnerability pathways in the Gaza Strip

With the Palestinian Environmental Quality Authority (EQA) as the leading agency, the stakeholder assessment of climate risk conditions in the Gaza Strip was part of a wider climate adaptation planning exercise for the oPt funded by UNDP. This initiative was directly informed by the UNDP *Adaptation Policy Frameworks for Climate Change*, which identifies stakeholders as those affected by, or with an interest in, climate change decision-making (Conde and Lonsdale, 2005, p.51). It also reflected developing

scholarship on participatory vulnerability assessments as vehicles for identifying risk conditions and anticipated community responses as experienced or judged by affected parties (Delica-Willison and Willison, 2004; Smit and Wandel, 2006; Vogel et al., 2007). The full stakeholder engagement in both Gaza and the West Bank included interviews with decision makers and NGO representatives, a questionnaire survey of relevant experts (eliciting perceptions on climate change impacts), stakeholder consultation workshops and feedback meetings on a draft *Climate Change Adaptation Strategy* (see UNDP, 2010a, pp.22–36). Both the stakeholder vulnerability assessments in Gaza and the West Bank featured a scoping meeting followed by two deliberative group sessions designed to reach agreement on key vulnerability pathways.

In Gaza, the relevant stakeholders included EQA, the Palestinian Water Authority (PWA) and Coastal Municipalities Water Utility (CMWU) officials (attending as independent water experts), UNDP Gaza Strip staff, environmental scientists from local universities and NGO representatives. UN-imposed rules prevented any meetings with officials from the Hamas government, which meant that representatives from several Islamist NGOs refused to become involved: this unsettled the ostensible political neutrality and impartiality of the climate assessment. The fragile security situation in Gaza at the time of the vulnerability consultations also placed major constraints on the timing and scope of the stakeholder engagement: the initial scoping meeting, held in December 2008 just prior to an Israeli military assault on the Strip (*Operation Cast Lead*), took place by video-conference between the UNDP offices in Gaza City and Ramallah. At this meeting, which included a review of regional climate scenarios in the scientific literature, it was agreed that the vulnerability assessment in the Gaza Strip should focus on human insecurity as it relates to *water resources insecurity* – defined as physically unsustainable withdrawal rates coupled with the lack of access of individuals to sufficient safe water for heath and well-being – and *food insecurity* – defined as the lack of access of individuals to sufficient safe food for health and well-being. Access restrictions on the researchers meant the stakeholder vulnerability assessments did not take place until May 2009 and August 2009 – both in Gaza City. These involved researcher-facilitated iterative discussions with 12 stakeholder representatives to map out chains of impacts on food and water resources arising from projected climate risks. This type of cognitive mapping involves qualitative deliberations on drivers of vulnerability, which can usefully inform the prioritization of adaptation measures if supplemented by a more formal multi-criteria decision analysis (Downing and Patwardhan, 2005, pp.74–75; Magnan et al., 2009, pp.13–14).[3]

Figure 1 summarizes graphically those key environmental risks relating to climate vulnerability identified collectively and consensually by stakeholder representatives in the Gaza City meetings. This highlights the multiple paths that were judged most likely to impact significantly on water security (primarily through degraded groundwater quality) and food security (primarily through reduced food production, which is related back to groundwater quality). The existing social vulnerability of the residents of the Gaza Strip to climate hazards is compounded by the expected longer-term risks of climate change set out on the right-hand side of the figure. An expected higher variability in precipitation translates into reduced yields for rainfed agriculture and a greater frequency of flash floods. Projected increased temperatures as a result of climate change were judged by stakeholders to trigger greater groundwater pumping because of increased evapotranspiration and desertification (particularly in the south of the Strip). In the case of sea temperatures, impacts on fish stocks were felt to be mixed, with forecasts that regional warming may stimulate growth of some fisheries (e.g. sardines), while at the same time threatening local population extinctions. The risk of sea-level rise, as well as eroding the coastline, was forecast to contaminate the coastal soil and increase the saline intrusion

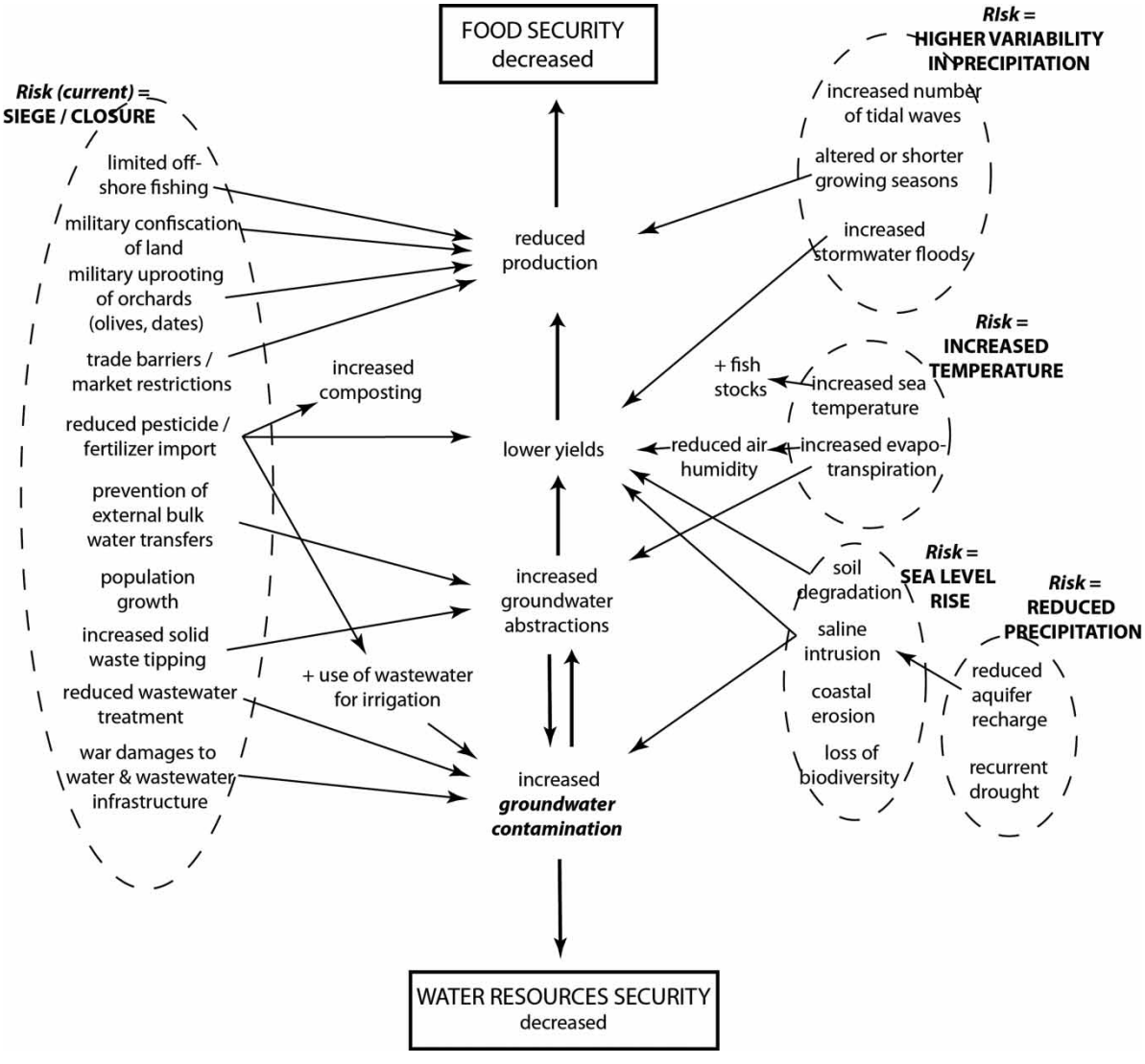

FIGURE 1 Climate vulnerability pathways in the Gaza Strip (adapted from UNDP 2010a, p.36)

already experienced throughout Gaza.[4] Interestingly, the risk of reduced amounts of precipitation from climate change was judged to put a greater strain on future water resources mainly by increasing the conditions for saline intrusion into the groundwater aquifer. This reflects a perception that insecurity of water resources is threatened more by contamination than simply by a volumetric deficit.

However, the bulk of the vulnerability pathways mapped out by stakeholders arise from, or are compounded by, Israeli sanctions on, and blockade of, the Gaza Strip. The negative effects on water security and food security resulting from *current* conflict-related practices can be seen on the left-hand side of Figure 1. These key security impacts, which had a strong *experiential* component when relayed by stakeholders, will now be briefly elaborated on in relation to the existing understanding of water and food insecurity in the Gaza Strip: are these representations of conflict risks as key drivers of climate

vulnerability corroborated by authoritative sources of environmental knowledge on the territory?

3.1. Vulnerability pathways to water resources insecurity

It is acknowledged by independent observers that Palestinians living in the Gaza Strip suffer the effects of water insecurity through both water quantity *and* water quality issues (Weinthal et al., 2005; GVC/PHG, 2009; UNEP, 2009; World Bank, 2009; Shomar, 2010). Gaza lies above part of the Coastal Aquifer Basin, which runs from Haifa in Israel to northern Egypt. Primarily due to its permeable sandy cover, the aquifer itself has 'intrinsic vulnerability' to pollution (Almasri, 2008). Israeli over-pumping of the Israeli portion of the Coastal Aquifer in the 1960s and 1970s led to high rapid salinization through seawater intrusion. The risk of serious damage to the aquifer was countered by reducing abstractions, and the flows were replaced through increased abstractions from other water sources (Zeitoun et al., 2009). Palestinians living in the Gaza Strip are prevented from accessing similar alternative water sources, which was registered by in the stakeholder vulnerability assessment as 'prevention of external bulk water transfers'. As a result, and in line with population growth (represented as a 'siege/closure' driver by stakeholders on account of barriers to population movement), the Gaza portion of the Coastal Aquifer Basin has been pumped beyond sustainable limits for decades. The 'sustainable limit'[5] of the Coastal Aquifer has been estimated from 299 (HSI, 1999, p.IV) to 420 million cubic metres/year (MCM/y) (World Bank, 2009, p.27), of which the Gazan portion is roughly 55MCM/y (Yacoubi, 2008). Total pumping within the Gaza Strip in 2008 was estimated at 170 MCM/y (UNICEF, 2010, p.12). Return flows of very poor quality from system leaks, wastewater and irrigation are estimated to be between 31 and 51 MCM/y (Palestinian Water Authority, 2010). All flows considered, the Gaza portion of the aquifer is being over-drawn at a rate up to three times its sustainable limit.

The abstraction rate and lack of alternative water sources lead directly to deteriorating water quality. It has been estimated that only 5–10 per cent of the portion of the aquifer under Gaza provides acceptable drinking water (Palestinian Water Authority, 2010, p.27), which vindicates the stakeholder emphasis on groundwater contamination as the key vector for water insecurity. As has been the case in Israel, the over-abstraction induces increased seawater intrusion and up-coning, leading to salinization of the freshwater.[6] Untreated or partially treated wastewater (including sewage infiltrating from the Northern Treatment Plant in Beit Lahiya, and the rapidly growing raw sewage outflows around Khan Younis, Rafah and Wadi Gaza) seeps into the groundwater, further increasing nitrate and chloride levels. 'Reduced wastewater treatment' was represented by the Gaza stakeholders as a 'siege/closure driver' of climate vulnerability, because Israeli restrictions on the import of construction materials have immobilized local and donor efforts to treat wastewater: this risk to water security has been recognized by international observers, though internal institutional weaknesses have also been indentified (UNEP, 2009, p.68; World Bank, 2009, pp.64–66).

As included in the 'siege/closure' set of risks by stakeholders, 'war damages to water and wastewater infrastructure' are perhaps the most direct conflict-related pathway to water insecurity in the Gaza Strip. Water quality and sanitation problems accentuated by the Israeli blockade and economic sanctions were further stressed during *Operation Cast Lead*, which took place during the period of stakeholder consultations. The Israeli military operation resulted in serious damage or destruction to 203 registered agricultural groundwater wells and four drinking water wells, as well as damage to over 19,000 metres of water pipes (Palestinian National Authority, 2009, p.29). Moreover, a direct hit to the embankment wall of the Az Zaitoun wastewater treatment plant led to a wastewater and sludge spillage affecting

55,000 square metres of agricultural land (UNEP, 2009, pp.33–36). It is clear that, compared to the current risks to water security posed by recurrent military attacks on Gaza, climate change impacts are negligible.

3.2. Vulnerability pathways to food insecurity

The priority accorded to food security in the stakeholder vulnerability assessment mirrors existing concerns by humanitarian and development agencies operating in the Gaza Strip.

For households in Gaza, the Food and Agriculture Organization (FAO) defines food insecurity as households with income and consumption below US$1.6 per capita per day and households showing a decrease in total food and non-food expenditures (Food and Agriculture Organization, 2007, p.58). At this scale of household food security, according to a Joint Rapid Food Security Assessment conducted in 2008, some 56 per cent of citizens of the Gaza Strip were 'food insecure' with 75 per cent receiving food assistance (WFP/FAO/UNRWA, 2008). A year later, with the onset of *Operation Cast Lead*, this had jumped to 61 per cent (973,600 persons) food insecure with a further 16 per cent (218,950 persons) vulnerable to food insecurity (WFP/FAO, 2009).

As shown in Figure 1, stakeholder perceptions of climate risks to food insecurity in the Gaza Strip highlighted *food production* threats, whereby various biophysical changes projected to negatively affect yields are compounded by the multiple effects of the Israeli closure regime. Food production is understood in these vulnerability pathways as a combination of physical production factors (e.g. water quantity and quality, agricultural supplements), social conditions of production (e.g. access to agricultural land, demographic growth) and economic variables (e.g. markets for exports, prices and availability of imported food). In these terms, the 'trade barriers and market restrictions' and 'reduced pesticide/fertilizer imports' were both highlighted by stakeholders as contributing to food insecurity in the Gaza Strip. For example, the closure of the Strip limits exports, thereby cutting off a source of income from the produce (generally strawberries, oranges and cut flowers) sold in markets in Israel, Egypt or Europe. Similarly, the stakeholder designation under current vulnerability risks of (Israeli) military land confiscation and destruction of Palestinian orchards is borne out by research on the impacts of the Israeli security barrier marking its border with Gaza: this restricted area (reaching up to 1,500 metres) has reduced Gaza's cultivable land by 35 per cent. Since 2000, according to the UN, Israeli access restrictions and the associated destruction of agricultural assets in this zone have resulted in the loss of 735 hectares of olive trees, almost 1,200 hectares of other fruit-bearing trees and 588 hectares of greenhouses: it has been estimated that the total economic value of all agricultural losses (including livestock farms) is US$267 million (OCHA-WFP, 2010, pp.19–22).

The closure regime also affects the Gaza Strip fishing zone, which stakeholders summarized as 'limited offshore fishing'. This zone has shrunk from 20 nautical miles (negotiated with Israel under the 1994 Gaza-Jericho Agreement) to more restricted limits unilaterally imposed by Israel – 6 nautical miles from October 2006 and 3 nautical miles since December 2008 ultimately reducing Palestinian access to maritime areas by 85 per cent (OCHA-WFP, 2010, pp.10–11). Israeli restrictions of the Gazan fishing zone have significantly reduced the local fish catch from 15,000 tonnes a month 10 years ago to 15–20 tonnnes a month in 2010 (OCHA-WFP, 2010, pp.24–25; UNDP, 2010c, p.69).

As shown in Figure 1, the current risks to food security perceived by stakeholders to derive from the closure regime constitute conditions for heightened social vulnerability to biophysical impacts arising from forecasted climate change – notably from reduced and more variable precipitation, temperature increases and saline intrusion from sea-level rise. These impact chains can generate positive feedback cycles; for example, reductions in precipitation can exacerbate

groundwater salinity levels through reduced soil flushing and groundwater recharge, whereas reductions in air moisture can increase the soil water requirement of crops and reduce fruit production.[7] Increased salinity levels in groundwater would reduce the yields of salt-tolerant crops (e.g. onions and pulses) and could even mean that some high-value export crops with little tolerance to high salinity levels (e.g. oranges, strawberries, cherry tomatoes and cut flowers) can no longer be grown across most of the Gaza Strip. Thus, overall the food production conditions for domestic consumption and export-led income generation are simultaneously eroded.

4. Response capabilities: enforced coping and adaptation planning

The vulnerability of individuals and groups to climate-related hazards can be reduced by enhancing both short-term (coping) and long-term (adaptation) response capabilities. In the Gaza Strip the current means of avoiding or moderating such hazards are above all *short term and reactive*, with little, if any, opportunity at present to develop longer-term resilience.

4.1. Household and community coping

The high level of climate vulnerability reported by stakeholders in Gaza is perpetuated by insufficient resources and livelihood opportunities, as well as weak institutional capacities. Coping strategies in the face of water and food insecurity reveal social resilience, for example, individual well-digging, rainwater harvesting, purchasing food on credit and decreasing the amount of food consumed. In the midst of a hostile political and economic context, where conventional low-cost coping strategies (e.g. use of life savings) have generally been exhausted (WFP/FAO, 2009), enforced coping is prevalent, with often harmful long-term effects. In the stakeholder consultations, for example, negative public health impacts were reported as a result of farmers using raw sewage for irrigation (due to reduced wastewater treatment). It is not surprising to find that community coping practices responding to water and food insecurity are related with ways to bypass the Israeli closure regime, notably increased 'smuggling' through the hundreds of tunnels dug under the border with Egypt. The capacity of Palestinians in Gaza to survive under the Israeli blockade is almost entirely defined by such enforced coping mechanisms, which have over time become institutionalized. Thus, the smuggling tunnels are now reported to be regulated and taxed by the Hamas government.

The poor quality of drinking water in Gaza, anticipated by stakeholders to decline even further with climate change, has already necessitated enforced coping. This is evident from the increased purchase of desalinated water from private-sector neighbourhood-level reverse osmosis units, or the purchase of under-the-sink water filtration units, both of which contribute to the ever-greater share of household income spent on basic services (Palestinian Water Authority, 2008a; 2008b). However, much of the water stored in household water tanks remains biologically contaminated for lack of proper maintenance (GVC/PHG, 2009, p.15). Neighbourhood water vendors have developed to sell treated water (again, through small-scale reverse osmosis plants) to people at a more affordable cost. As noted by PWA and CMWU representatives in the stakeholder consultations, the quality of this water is not regulated. Contamination is likely either at the source (because of poor maintenance) or during transportation (contaminants entering the jerry-cans and buckets used to transport the water). The PWA, CMWU and local municipalities have adapted their water-supply systems to the situation. In Khan Younis, for example, the CMWU notifies the residents about occasional contamination from wastewater intrusion and when less polluted water may still safely be used for washing. The water authorities have also developed the habit of mixing sources of safe and unsafe water

to increase the amount of water available for drinking, at a marginally safer quality level.

While not extensive, longer-term spontaneous adaptation to the combined water and food insecurity is becoming evident through the selection by farmers of less water-intensive and more salt-resistant crops, such as dates. Such agricultural practice is in fact a return to the traditional crops of the Gaza Strip, whereas cultivation of water-intensive citrus production originated with Israeli settlers who used to reside in Gaza. The non-availability of fertilizers is encouraging farmers to rediscover organic methods, while they have also piloted the use of solar food-drying techniques as a result of the limited availability of cooking gas. Yet if, in a worst-case climate change scenario, an increase in crop water requirements combines with a further decrease in water quality, such coping mechanisms may prove insufficient to sustain farming livelihoods.

4.2. Climate change adaptation planning for Gaza

Without the capacity to move beyond enforced coping, which is often destructive of social capital (e.g. local disputes over water), communities in Gaza face present and future climate hazards with little institutional protection. Adaptation to climate change can involve governmental, civil society and private sector actors. Logically, the initial focus of any such adaptation in Gaza would lie with state institutions, as they are responsible for setting the general plans and policies by which significant climate change impacts can be addressed by all societal actors. However, due to Israeli occupational practices and the political split between the Hamas-led government in Gaza and the Ramallah-based Palestinian Authority, there is currently little political capacity for managing climate risk in the Gaza Strip.

In the UNDP-funded climate adaptation consultations, it was noted by stakeholders in Gaza that an existing *Environmental Preparedness Plan* for the Gaza Strip could serve as a vehicle for adaptation planning. It was claimed that this plan could be developed (and integrate water resources management, coastal management, agricultural planning, land use, etc.) to take into account real and potential climate change impacts (Palestinian Water Authority, 2008b, p.14; UNDP, 2010a, pp.30–31). Similarly, there is a *Coastal Area Protection and Management Plan*, which has been awaiting implementation since 2000 (Ministry of Environmental Affairs, 2000). This plan addresses observed and expected damages to seawater quality (e.g. from solid waste dumping and wastewater runoff) and the coast (e.g. dune erosion from sand mining) as a result of human activities. It also considers the impacts of sea-level rise attributed to climate change and makes specific recommendations to help conserve coastal areas – such as 'set back lines' (beyond which no construction is allowed), improvements in fisheries legislation and habitat conservation efforts. The weak regulatory and legal context in the Gaza Strip means that that these recommendations have not been implemented, while the political situation has seen policy-making in the Strip detached from relevant disaster risk reduction and climate planning initiatives in the West Bank.[8]

In response to the severe water insecurity in Gaza, governmental actors are considering new bulk-water solutions, whether from transportation, importation or desalination (Palestinian Water Authority, 2008a). Large-scale (but step-by-step) desalination is a possible long-term solution to the freshwater crisis in the Strip. Increased purchase of water from Israel is currently seen as problematic by Palestinian authorities for reasons of cost, quality and national security. Imported water from Egypt is another option for mitigating increasing water scarcity in the context of climate change, although this is problematic as well due to Egypt's strained relations with other riparian states sharing the Nile Basin. The prospect for such large-scale interventions is currently remote, as the major international donors needed to finance them have a policy of non-engagement with the Hamas government.

5. Conclusion

This article has situated the potential impacts on climate risk to communities in Gaza in terms of their existing exposure to violence and other coercive practices. Building on a UNDP-supported participatory vulnerability assessment (2008–2009) designed to identify climate risk conditions in Gaza, the study has employed a human security framing to identify life and livelihood threats induced by perceived climate harm, particularly at the community level. The terms of reference for the UNDP assessment were initially restricted to the 'technical' mapping of biophysical risks, and were unsurprisingly challenged by stakeholders in Gaza who stressed the overwhelming influence of Israeli military and security practices on their lives. Stakeholder feedback identified occupation-related conditions as constitutive of the social vulnerability of Palestinians to climate variability and change; for example, a third of arable land in Gaza Strip is off-limits to farmers because it falls within the Israeli Defense Force-declared no-access zone adjoining the border, while Israeli restrictions also prevent bulk imports of clean water into Gaza.

The Israeli blockade of Gaza significantly affects the manner in which Palestinians cope with, and adapt to, key climate risks.[9] The UNDP stakeholder consultations identified 'vulnerability pathways' leading to severe food and water insecurity (seen primarily in terms of food production and water quality). These responses unsettled a donor-driven 'human security' methodology designed to identify climate vulnerability in Gaza according to *future* climate risks – part of a 'good governance' agenda portrayed as politically neutral, which prevented a more in-depth scrutiny of sources of vulnerability. Exploration of these vulnerability pathways reveals conflict-structured non-climatic risks overwhelming forecasted climate risks. The prevalence in Gaza of short-term 'enforced coping' prevents the development of long-term adaptive capacity, though enforced coping strategies may be resilient for short periods in protecting lives and livelihoods from significant harm. Climate vulnerability assessments in (post)conflict environments should acknowledge the methodological and political-policy challenges caused by the extensive presence of chronic, non-climatic sources of harm.

Notes

1. While Israel has stated that, with its unilateral withdrawal from the Gaza Strip in September 2005, its status as an occupying Power there has finished, it still maintains effective control of the Strip and thus remains bound by international humanitarian obligations regarding belligerent occupation (Dinstein, 2009, pp.276–280).
2. The use, in this article, of the term 'occupied Palestinian territory' follows the accepted nomenclature used by the United Nations agencies in the region.
3. On the use of this stakeholder vulnerability assessment in the identification and prioritization of proposed climate adaptation measures, which is not discussed here, see UNDP (2010a, pp.41–47).
4. There is much uncertainty over the magnitude of this rise for the eastern Mediterranean by 2100: Israeli scientists have forecast an increase of 0.1 m every decade (Office of the Chief Scientist, 2008), which falls within recent global estimates of 0.6–1.6 m (see Jevrejeva et al., 2010).
5. The concept of safe yield and sustainable limits of aquifers is highly contested (e.g. Bredehoeft, 1997). Here 'sustainable limit' refers to the rough mean recharge rate, that is, the amount of rainwater flowing into the Gaza portion of the Coastal Aquifer.
6. It should be noted that an additional source of contamination of the aquifer occurs through natural processes – the Eocene salts migrating under the border from Israel (Vengosh et al., 2005).
7. For example, according to CROPWAT simulations conducted by the PWA, an annual average increase in temperature of 1°C will increase crop water requirements in the Gaza Strip by 6–11 per cent (UNDP, 2010a, p.31).
8. The reconciliation pact signed in May 2011 by Fatah and Hamas representatives offers hope for an improved domestic political environment – at

least for more integrated Palestinian planning on climate change adaptation.

9. In June 2010, under diplomatic pressure, Israel announced an easing of the blockade, though major restrictions continued on imports of humanitarian materials and all exports from Gaza remained banned (International Federation for Human Rights, 2010).

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