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ARTICLE

Climate Change's Role in Disaster Risk Reduction's Future: Beyond Vulnerability and Resilience

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Abstract A seminal policy year for development and sustainability occurs in 2015 due to three parallel processes that seek long-term agreements for climate change, the Sustainable Development Goals, and disaster risk reduction. Little reason exists to separate them, since all three examine and aim to deal with many similar processes, including vulnerability and resilience. This article uses vulnerability and resilience to explore the intersections and overlaps amongst climate change, disaster risk reduction, and sustainability. Critiquing concepts such as "return to normal" and "double exposure" demonstrate how separating climate change from wider contexts is counterproductive. Climate change is one contributor to disaster risk and one creeping environmental change amongst many, and not necessarily the most prominent or fundamental contributor. Yet climate change has become politically important, yielding an opportunity to highlight and tackle the deep-rooted vulnerability processes that cause "multiple exposure" to multiple threats. To enhance resilience processes that deal with the challenges, a prudent place for climate change would be as a subset within disaster risk reduction. Climate change adaptation therefore becomes one of many processes within disaster risk reduction. In turn, disaster risk reduction should sit within development and sustainability to avoid isolation from topics wider than disaster risk. Integration of the topics in this way moves beyond expressions of vulnerability and resilience towards a vision of disaster risk reduction's future that ends tribalism and separation in order to work together to achieve common goals for humanity.

Keywords Adaptation · Climate change · Disaster risk reduction · Mitigation · Resilience · Vulnerability

1 Common Goals and Interests: Beyond "Normal"

Humanity has created numerous challenges for Planet Earth and, consequently, for ourselves. A seminal policy year for environment and development takes place in 2015 due to three parallel but interacting United Nations processes: (1) seeking a long-term agreement on dealing with greenhouse gases and climate change impacts; (2) aiming for the finalization and adoption of the Sustainable Development Goals; and (3) striving to develop a successor to the Hyogo Framework for Action as a global disaster risk reduction plan.

Why three separate processes? Why not join them? They all have common themes, use common approaches, and deal with common terms, including the examples of "vulnerability" and "resilience." In theory, there should be no need to separate them, but instead to use 2015 as an opportunity to bring them together and to learn from each other in order to improve society and build a better future. The point of these processes is to create something new, beyond the normal situation of poor development, poverty, vulnerability, and disaster.

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Seeking something new, rather than perpetuating the normal, seems to be at odds with many conceptualizations of "resilience" in which the core idea is to return to "normal" or, after a disaster, to return to the pre-disaster state. Yet returning to normal means returning to poor development, poverty, vulnerability, and disaster, not building a better future. As one example from among many, with a heavy basis in ecosystem science, the Resilience Alliance (epitomized by Folke 2006) states that resilience is about "still hav[ing] the same identity (retain[ing] the same basic structure and ways of functioning)." No explanation is given for why it should necessarily be an objective to retain the same identity, structure, and ways of functioning. Conversely, overcoming racial segregation and giving women equal rights is based on overturning the standard functions and controls of society; that is, permitting a disturbance to fundamentally change a system.

In fact, the assumption that society has a "normal" state could be questioned, since society always changes. Is society ever on an even, steady trajectory that could be called "stable," "usual," or "normal" over the long-term? The assumption that society would not wish to, or should not, change is questionable, because there are fundamental aspects of society's controls, functions, and processes that have changed in the past—such as excluding people on the basis of gender and race—and that should change in the future—such as continuing sexism and racism. How these changes may be enacted should be discussed in order to avoid accusations of external imposition for societal change and cultural imperialism, if it is desired to avoid such accusations.

Glantz and Jamieson (2000) and Tobin (1999) note that if resilience involves a return to pre-disaster conditions, then it is simply a return to the conditions, including vulnerability, which led to a disaster in the first place. Vulnerability is the chronic, "normal" condition related to poor development and sustainability practices (Hewitt 1983; Lewis 1999; Wisner et al. 2004, 2012). Should a desire exist to return to that "normal" of the vulnerability process? That would be setting up another disaster. If post-earthquake Haiti rebuilt to its status prior to the 2010 disaster, then the country is deliberately constructing the conditions which killed over 200,000 people in the first place.

Furthermore, survivors carry a disaster with them for life, through emotions and reactions. An example is flood survivors feeling stressed when it rains (Tapsell et al. 2002). "Recovery" can be achieved through continuing with life without letting the flood experience control all decisions—an appropriate development approach. But the experience of being flooded might never, and perhaps never should, go away and be forgotten as if it never happened. Instead, hazards can be "normalized" through response mechanisms that are fully embedded within people's everyday life (Anderson 1968; Bankoff 2003). "Return to normal" might never be feasible after a disaster (Fordham 1998; Hills 1998)—and it might never be desirable. Rather than "bouncing back," resilience and sustainability could instead be demonstrated through a society that does not get "back to normal," but instead does better, even through "bouncing forward" (Manyena et al. 2011). The post-disaster development paradigm of "Build Back Better" personifies that perspective, within the critiques of that term and process (Kennedy et al. 2008).

The three 2015 processes have an opportunity to embrace, promote, and make practical these notions, including using vulnerability and resilience concepts that would break out of the trajectories leading to disasters and sustainability difficulties. Applying long-term, deeper perspectives seeks a "normal" in which hazard effects, including those from climate change, are less detrimental and more advantageous for society. Part of this strategy entails deepening our approach to vulnerability and resilience in order to step beyond standard approaches that have proven counterproductive to the common 2015 goals.

2 Deepening Our Approach to Vulnerability and Resilience

To facilitate improvement and integration, five points are suggested here because they embrace wider and deeper meanings that ensure a robust future for disaster risk reduction. These points are presented a priori but emerge from a long history of research, policy, and practice for which only a few example citations were given in the previous section.

(1) Vulnerability and resilience are dominated by quantitative approaches, even though they are also qualitative. Not all aspects of vulnerability and resilience can be demonstrated by calculation or quantification, even where these actions assist with some aspects. Qualitative characteristics are shown by the value of intangible items, including photographs and archaeological sites, in understanding how people and communities avoid, react to, and recover from disasters (Parker et al. 2007).
(2) Vulnerability and resilience are presented as being objective, when subjectivity is more realistic. For example, Russia has been saved at least three times from invading armies when the harsh winter weather, coupled with poor strategic military decisions by the invader and solid tactics from the Russians, contributed to the invaders' defeat. The invasions were

by Charles XII of Sweden from 1708 to 1709, Napoleon Bonaparte at the end of 1812, and Adolf Hitler from 1941 to 1943. Similarly, the victory of the English navy in the Camperdown Campaign in 1797 has been attributed as much to weather as to military tactics (Wheeler 1991). In such cases, one side in a military conflict saw weather damage as vulnerability, while the other saw it as resilience. The perspective depended on to whom the damage was being done. A parallel interpretation is that the environmental phenomena itself can be a hazard or a resource/opportunity, depending on one's perspective. If it is viewed as a hazard, then vulnerability is emphasized. Conversely, if it is viewed as a resource or opportunity, then resilience is emphasized. In this way, environmental phenomena can be intertwined with the interpretation conferred on it by society.

(3) Vulnerability and resilience are assumed to have absolute metrics, but proportional approaches are important too. Lewis (1979, 1999), amongst others, provides an alternative to the frequent focus on presenting absolute numbers to describe vulnerability and resilience. He describes why proportional impact, indicative of proportional vulnerability, provides important information for development activities. For instance, islands have small populations relative to cities. Even if 100 % of an island country's population is affected by a poor water supply or by a cyclone, that situation is unlikely to match the numbers of people who would be affected in a megacity with only 1 % of the population affected. Yet 100 % of a population affected can be much worse than 1 % of a population affected. Absolute and proportional metrics provide different characteristics of vulnerability and resilience, so both are needed.

(4) Vulnerability and resilience are assumed to be non-contextual, when contextuality or localization tends to be more realistic. Often, a method for quantifying objective vulnerability or resilience is assumed to be transferable to other contexts. That assumption might not be appropriate. Vulnerability and resilience might be predominantly Western constructs that makes their understanding and application highly contextual (see also Bankoff 2001; Baldacchino 2004). In fact, some languages do not have words for "vulnerability" or "resilience" and the concepts can be difficult to explain within those cultural contexts.

(5) Vulnerability and resilience are often presented as being the current state, whereas examining a long-term process with a past and future is needed. Vulnerability and resilience are not only about the present state, but are also about what society has done to itself (and especially what some sectors have done to other sectors) over the long-term; why and how society has taken that set of actions in order to reach the present state; and how society might change the present state to improve in the future (see also Lewis 1999; Bankoff 2001; Garcia-Acosta 2004; Wisner et al. 2004, 2012).

These five points show how varying perspectives and wider contexts would contribute to fully accounting for development's long-standing contributions to vulnerability and resilience studies. Multiple theoretical and practical difficulties emerge when broader temporal and spatial perspectives and contexts are not considered, as shown by examining the suggestion of "double exposure."

"Double exposure" describes how vulnerability is augmented by having to deal simultaneously with problems from the impacts of global environmental change and economic globalization (Leichenko and O'Brien 2008). The history of and literature from vulnerability and resilience research and on-the-ground practice, from the 1970s to today, has highlighted "multiple exposure" (Glantz 1977; Cuny 1983; Hewitt 1983; Lewis 1999; Bankoff 2003; Wisner et al. 2004; Shaw et al. 2010a). Climate change, globalization, poverty, earthquakes, injustice, tropical cyclones, lack of livelihood opportunities, inequity, landslides, overexploitation of natural resources, epidemics, and lack of water supply—amongst many other ongoing challenges—often converge to most affect those who have the fewest options and resources for dealing with those challenges.

Consequently, those with the fewest options and resources tend to be most vulnerable across all forms of threats, demonstrating multiple exposure to multiple threats simultaneously. To refer to "double exposure" by assuming that only two forms of threat are especially important does not factor in the more expansive forms of the notion that have been long established in the literature. Leichenko and O'Brien (2008, p. 31) mention "multiple stressors", but do not reference the multiple exposure approaches of prior literature and they nonetheless continue to focus on global environmental change and economic globalization as being the most important factors for their analyses. Is this simply a theoretical dispute without much practical meaning?

The practical problem arises from the fact that, in many locations, the most prominent or fundamental development challenges are neither climate change nor globalization. Decision-makers might be distracted by double exposure and forget about, or wish to ignore, the 20 % HIV infection rate or the upslope deforestation destroying the delta. That does not deny potential globalization inputs into these phenomena, but accepts that multi-scalar processes across time and space are influential. Elsewhere, double exposure

is more sinister. Exacerbated sea flooding in certain places in Bangladesh was blamed on climate change whereas it was actually due more to using structural sea defences (Auerbach et al. 2015). Villagers in Vanuatu were termed "climate change refugees" even though the increased sea flooding was due more to tectonic subsidence than to sea-level rise (Ballu et al. 2011).

Research in Maldives (Kothari 2014) shows how climate change and globalization are being used as excuses by the government to force a policy of population consolidation (resettlement) on outer islanders. Yet the government has long been trying to resettle the outer islanders closer to the capital using other reasons, such as that it is hard to provide a scattered population with services including health, harbors, and education. Both arguments have legitimacy and can be countered, but climate change is used as an excuse to do what the government wishes to do anyway. "Double exposure" can be used insidiously to achieve hidden agendas by obscuring the full picture of multiple exposure.

3 The Role of Climate Change

Yet misuse of climate change does not obviate climate change as a significant concern that will cause major problems, not just for low-lying islands such as Maldives and low-lying coasts such as Bangladesh, but for all of humanity (IPCC 2013–2014). Many good practice examples of resilience exist, to climate change impacts and to other hazard drivers and hazards. These practices demonstrate what can be achieved when broader concepts of vulnerability and resilience are accepted and applied (Global Network of Civil Society Organisations for Disaster Reduction 2009, 2011). An ongoing challenge is framing climate change in research, policy, and practice to try to avoid the difficulties resulting from narrow views of vulnerability and resilience or too much focus on a single phenomenon such as climate change.

It is not appropriate to disparage or to ignore climate change. Nor should a false duality be created by suggesting that the debate is climate change versus other concerns such as earthquakes, injustice, HIV/AIDS, gender equity, or water resources. Care is nonetheless needed when highlighting climate change, since addressing climate change has the potential to create or exacerbate other development concerns.

For example, large hydroelectric dams might contribute to climate change mitigation through reduced dependence on fossil fuels. Large dams might also contribute to climate change adaptation by permitting a more stable water supply, irrespective of precipitation variations. But large dams tend to increase flood risk over the long-term in a process termed "risk transference" (Etkin 1999). Structural defences including large dams stop smaller floods and permit people to live in floodplains while remaining relatively dry. As a result of this false sense of security, vulnerability to flooding increases (Fordham 1999). Most structural defences could fail at some point, often from an event that exceeds or has different characteristics from the design flood but sometimes because maintenance requirements have not been met. Then the damage incurred by the flood is much greater than it would have been without the false sense of security imposed by the structural defences. Short-term flood risk has decreased, but long-term flood risk has increased. Risk is transferred into the future and augmented, hence the term "risk transference" (Etkin 1999). Risk can also be transferred amongst locations, sub-populations, and sectors (Graham and Weiner 1995), which makes it important to consider a multitude of challenges (similarly to "multiple exposure") when assessing and addressing vulnerability and resilience. Other than risk transference, many other development concerns have also been identified through relying on large dams (World Commission on Dams 2000) irrespective of their potential contributions to climate change mitigation and adaptation.

Rather than keeping climate change as a separate or dominating topic, the proposal from a development perspective is to enact the "multiple exposure" perspective by viewing climate change as one challenge amongst many (Gaillard 2010; Mercer 2010). Researchers and practitioners have long published on and tried to address vulnerability and resilience to the consequences of change, positive and negative, at all time and space scales and based on many forms of change (Glantz 1977; Lewis 1979, 1999; Hewitt 1983; Aysan and Davis 1992; Etkin 1999; Bankoff 2001; Wisner et al. 2004, 2012). Examples are aridification and desertification, climatic changes from meteorite strikes and volcanic eruptions, local water drawdown, and availability and use of local and locally appropriate building materials. Contemporary climate change is one more to add to this well-established list—and it should be added to ensure that climate change vulnerability and resilience are addressed. Nonetheless, climate change should not be tackled at the expense of other challenges and opportunities in everyday life.

The subset within development work that is best suited for placing climate change adaptation in perspective and context is disaster risk reduction (Shaw et al. 2010a, 2010b). That arises due to the long history within disaster risk reduction of dealing with climate-related changes at all time and space scales and from multiple causes (Glantz 1977; Hewitt 1983; Lewis 1999; Garcia-Acosta 2004; Wisner et al. 2004, 2012). Therefore, research, policy, and practice should accept contemporary climate change as one challenge amongst many within disaster risk reduction.

Climate change as a subset within disaster risk reduction can be elaborated through three main points.

First, climate change is one contributor to disaster risk amongst many. Climate change should not be ignored but neither does it necessarily dominate other contributors. Those contributors include, but are not limited to, non-climate-related environmental phenomena (for example, earthquakes and volcanoes), inequities, injustices, social oppression, discrimination, poor wealth distribution, and a value system that permits exploitation of environmental resources irrespective of the long-term consequences. Climate change drives both hazards and vulnerabilities.

It drives hazards, for instance, in that a hotter atmosphere can hold more water vapor leading to increased precipitation. When and where that moisture is released can augment the intensities of floods and blizzards as they occur. Sometimes climate change drives hazards by making the hazards less extreme such as by reducing the frequencies of Arctic storms called polar lows (Zahn and von Storch 2010), Atlantic hurricanes (Knutson et al. 2010), and winter floods in central Europe (Mudelsee et al. 2003). Climate change drives vulnerabilities by changing local environmental conditions so rapidly that local environmental knowledge cannot keep pace with and is less applicable to, for example, local food resources. Whether climate change is a more significant or a less significant contributor than other factors—such as relying on structural approaches for floods or increasing the social oppression that creates and perpetuates food-related vulnerabilities—depends on the specific context.

Second, climate change is one "creeping environmental change" amongst many. Creeping environmental changes are incremental changes in conditions that cumulate to create a major problem, apparent or recognized only after a threshold has been crossed (Glantz 1994a, 1994b). Climate change fulfils that definition. Other creeping environmental changes not linked to contemporary anthropogenic climate change include soil erosion due to intensive farming, salinization of freshwater supplies due to excessive drawdown, and slow subsidence of land due to water or fossil fuel pumping (Glantz 1994a, 1994b; Wisner et al. 2012). Development work has long dealt with such topics (such as the historical descriptions provided by Crush 1995; Glantz 1999; Gaillard 2010; Mercer 2010) and climate change can readily be integrated into this set of development concerns.

Third, the reality is that climate change has become politically important, within and outside of development. That should provide an opportunity, not to focus exclusively on climate change, but rather to raise the points made in this article in order to engage interest in more comprehensive development processes. Little point exists in building a new school with natural ventilation techniques that save energy and that cope with higher average temperatures, if that school will collapse in the next moderate, shallow earthquake. Similarly, if a hospital is renovated with water-resistant materials and finishes for climate change adaptation due to the projected expansion of the floodplain, but is put out of action by toxic contaminants in the floodwater, then little has been achieved.

Climate change is one topic amongst many and should be dealt with in wider contexts. Since climate change drives hazards and vulnerabilities and since disaster risk reduction efforts provide more comprehensive views of vulnerability and resilience, a prudent place for climate change would be placement within disaster risk reduction. Climate change adaptation therefore becomes one of many processes within disaster risk reduction.

4 Moving Beyond Climate Change, Vulnerability, and Resilience

By placing climate change within disaster risk reduction, while using the prominence of climate change to promote and achieve wider development agendas, a long-term perspective is supported in which related research better serves policy and practice—and vice versa. The long-term perspective further assists in addressing the vulnerability process and the resilience process. An historical perspective avoids being distracted by a myopic concentration on climate change, instead directing attention to root causes and the fundamentals of vulnerability and resilience as long-term processes. Research, policy, and practice would move forward in concert by accepting the widespread, long-term causes and consequences of vulnerability and resilience from multiple sources and requiring multiple, integrated interventions.

Achieving this theoretical approach in practice would set aside and move beyond vocabulary differences, instead bringing together the 2015 processes under the common banner of sustainability. Oliver-Smith (1979) referred to a 400-year earthquake in examining the 31 May 1970 earthquake and rock avalanche in Yungay, Peru that killed thousands of the city's inhabitants. The "400 year" timeframe is not the geological return period of the seismic or avalanche event. Instead, it refers to the fact that the root causes of the vulnerability, which were exposed as a result of the event, took 400 years to build up—a long-term process. The vulnerability that caused the disaster can be traced back to the Spanish conquest of the region, in terms of demographics, settlement locations, and ways of living—exactly the aspects that the Sustainable Development Goals aim to address. No longer must ways of living and livelihoods be categorized as vulnerability and/or resilience, but instead they are accepted as supporting multiple sustainability goals, tackling multiple exposure.

Expanding the school and hospital examples at the end of the previous section, disaster risk reduction is not the ultimate endeavour. A school that withstands multiple hazards might not achieve development and sustainability goals if only boys are permitted to attend. A hospital built with all disaster risk reduction considerations, including with climate change adaptation factored in, but serving only the most affluent people, sets back development by expanding the rich-poor gap.

Consequently, although the role of climate change is to be positioned within disaster risk reduction, disaster risk reduction's future is to be a subset of wider development and sustainability processes. Having three separate streams for international negotiations duplicates efforts and disperses energy. But given this situation, bringing them all together would be challenging; for instance, the climate change negotiations seek a legally binding accord ratified by world parliaments while the disaster risk reduction process and the Sustainable Development Goals aim for voluntary agreements. None of the three has yet articulated a verifiable monitoring and enforcement mechanism, although that could potentially develop. With effort and will, these practical difficulties could be overcome, although territorialism and vested interests are likely to preclude such action.

The theoretical strength of climate change sitting within disaster risk reduction, which in turn sits within development and sustainability, can lead to positive policy and practice outcomes. This approach would represent a vision for disaster risk reduction's future, ending tribalism and separation in order to work together to achieve common goals. Although the prospect of this integrated approach occurring seems unlikely, not despite but because of the three 2015 processes and their long histories, the momentum of three independent but overlapping institutional paths should not stop us from doing our best to bring all areas together in order to save humanity from itself.

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