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ARTICLE

Climate Change and the Sendai Framework for Disaster Risk Reduction

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Abstract This article reviews climate change within the Sendai Framework for Disaster Risk Reduction 2015–2030 (SFDRR), analyzing how climate change is mentioned in the framework's text and the potential implications for dealing with climate change within the context of disaster risk reduction. Three main categories are examined. First, climate change affecting disaster risk and disasters, demonstrating too much emphasis on the single hazard driver and diminisher of climate change. Second, cross-sectoral approaches, for which the SFDRR treads carefully, thereby unfortunately entrenching artificial differences and divisions, although appropriately offering plenty of support to other sectors from disaster risk reduction. Third, implementation, for which climate change plays a suitable role without being overbearing, but for which other hazard influencers should have been treated similarly. Overall, the mentions of climate change within the SFDRR put too much emphasis on the hazard part of disaster risk. Instead, within the context of the three global sustainable development processes that seek agreements in 2015, climate change could have been used to further support an all-vulnerabilities and all-resiliences approach. That could be achieved by placing climate change adaptation as one subset within disaster risk reduction and climate change mitigation as one subset within sustainable development.

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1 Introduction

In 2015, three separate global sustainable development processes aimed for long-term agreements. First, in March in Sendai, Japan, the Sendai Framework for Disaster Risk Reduction 2015–2030 (SFDRR) (UNISDR 2015) laid out a voluntary pathway for the next 15 years of disaster risk reduction, following on from the 10 years of the Hyogo Framework for Action 2005–2015 (HFA) (UNISDR 2005). Second, in September in New York, the United States, the United Nations will meet to ratify the Sustainable Development Goals (not yet public), also voluntary and the successor to the Millennium Development Goals (UN 2000), which ran from 2000 to 2015. Third, in Paris, France in December, the United Nations Framework Convention on Climate Change (UNFCCC) will pursue a legally binding treaty for dealing with climate change. The focus is on climate change mitigation efforts, which means reducing greenhouse gas emissions and increasing sinks. Any agreement could potentially include many elements for climate change adaptation, the reduction of the expected adverse impacts of climate change and the application of possible benefits.

The separation of these three processes has historical and political reasons, but to achieve the goals of each they ought to be joined (Kelman et al. 2015). Nonetheless, they will not come together fully, although they are making efforts to connect better and to follow each other closely, even if that means clearly demarcating territory for each one. For example, in the draft leading up to the Sustainable

Development Goals (UN 2014), Goal 13 "Take urgent action to combat climate change and its impacts" has an asterisk that states "Acknowledging that the UNFCCC is the primary international, intergovernmental forum for negotiating the global response to climate change." Those words explicitly separate the UN's legal process to address climate change from the UN's voluntary process to address sustainable development.

Similarly, there is no doubt that climate change affects aspects of disasters and of disaster risk reduction, even though some parties promoting climate change have separated climate change from disaster risk reduction. Climate change work has recently made efforts to impose climate change views on disaster risk reduction (IPCC 2012), often without learning many disaster-related lessons. Other literature proposes different ways forward, but often seeks to continue the partition between climate change and disaster-related topics without questioning why they are assumed to be separate or without fully exploring the difficulties which could ensue due to the separation (Thomalla et al. 2006; Solecki et al. 2011).

There is no dispute that some involved with climate change have kept it separate from wider processes, for research, policy, and practice. Consequently, it would be difficult realistically to bring climate change, disaster risk reduction, and sustainable development under one umbrella due to academic territorialism and lock-into the separate global processes. When analyses are completed to determine whether they should actually be separate, possible solutions emerge. Kelman and Gaillard (2010) and Kelman et al. (2015) start from basic definitions, showing that climate change and its associated processes are fully embraced by disaster-related efforts, so a proposed joining of the two would be to place climate change within disaster work. That has two pillars.

First, climate change is one hazard driver amongst many; it is one factor influencing certain hazards with the potential to contribute to disasters where vulnerability and exposure exist. Second, climate change adaptation is a subset of disaster risk reduction. Empirical studies such as in Shaw et al. (2010a, b) and Mercer et al. (2014) demonstrate how this theoretical approach would be achieved in practice. In recognizing the similarities alongside the reality that both fields have strong vested interests in remaining separate, Glantz (2015) suggests seeking specific programmes and projects which would "blend" climate change and disaster activities, in order to bring both on board.

A third aspect can be described, but for climate change mitigation, placing climate change mitigation within sustainable development since climate change mitigation is the same as pollution prevention, but it focuses on greenhouse gases as specific pollutants. Air pollution prevention was being regulated and engineered long before climate change became a global concern (Ross 1972). Reducing greenhouse gas sources employs similar principles and practices, including the reduction of consumption at the individual level that has long been advocated (van Sickle 1971). Increasing greenhouse gas sinks relates to general environmental management actions such as land use practices (Starr 1961) and ecosystem conservation (Usher 1973), which, again, are long-standing and well-known activities. No claim is made that knowledge and techniques stagnated decades ago nor that climate change mitigation fails to bring new, innovative ideas. The principles and ethos, however, remain the same. Climate change mitigation introduces different pollutants to reduce, preferably to prevent their excessive production, becoming an important element of ongoing pollution prevention principles and practices.

Despite the strong impetus to retain and entrench the artificial separation amongst the three global processes mentioned at the outset, thereby retaining the separation for the next 15-and-more years, the SFDRR nonetheless acknowledges and emphasizes the importance of climate change and sustainable development for disaster risk reduction and vice versa. The challenge is knowing whether the included acknowledgement, emphasis, and cross-overs suffice to avoid problems, or whether more harm than good will be done by having three separate agreements—voluntary ones for disaster risk reduction and sustainable development and aiming for a legal one for climate change.

To contribute to such analyses, this article reviews climate change within the SFDRR, analyzing how climate change is mentioned in the framework's text and the potential implications for dealing with climate change within the context of disaster risk reduction. The next section details how climate change does and does not influence disaster risk. Then in due course, presents and critiques the mentions of climate change in the SFDRR, followed by discussion on how climate change is and is not represented and included. The conclusions summarize the implications for the three 2015 processes.

2 Climate Change Influencing Disaster Risk

Disaster risk, by definition, is a combination of hazard and vulnerability, with different approaches taken to combine the two parameters depending on the theory adopted or the practice being pursued (Lewis 1999; Wisner et al. 2004, 2012; UNISDR 2009). To examine how climate change does and does not influence disaster risk, both hazard and vulnerability need to be considered. As an influence upon hazards, the Earth's climate has always changed throughout humanity's and the planet's history, including long-

term trends, shifts in the state and baseline, variabilities, and cycles.

Contemporary climate change has two principal definitions. The main scientific body responsible for assessing and synthesizing climate change science for governmental approval is the Intergovernmental Panel on Climate Change (IPCC). The first IPCC assessment was published in 1990 with the latest one, the fifth assessment, published in 2013–2014. The IPCC regulations state that all reports are reviewed and approved by member state governments. The IPCC's (2014, p. 5) definition of climate change is "Climate change refers to a change in the state of the climate that can be identified (e.g., by using statistical tests) by changes in the mean and/or the variability of its properties, and that persists for an extended period, typically decades or longer. Climate change may be due to natural internal processes or external forcings such as modulations of the solar cycles, volcanic eruptions, and persistent anthropogenic changes in the composition of the atmosphere or in land use." Meanwhile, the main international treaty for addressing climate change is the UNFCCC which defines climate change as "a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods" (UNFCCC 1992, Article 1, Paragraph 2, p. 3).

The main difference between the IPCC and UNFCCC definitions is that the science examines all climate changes irrespective of the cause of the change, while the international policy process considers anthropogenic climate change only. Both the IPCC and the UNFCCC agree that the human influence on the climate seems likely to push the planet into a climate regime that humanity has not before experienced, although it is not as extreme as the planet has witnessed in the past long before humanity existed.

Contemporary global climate change is marked by human influence, through two main mechanisms (IPCC 2014), with climate change mitigation seeking to tackle these two mechanisms. First is the anthropogenic release of greenhouse gases such as methane and carbon dioxide that trap heat and increase the global mean temperature. Second are anthropogenic changes to the Earth's surface, which reduce absorption of the greenhouse gases emitted by human activities. One prominent land use change is deforestation, since trees are an excellent source of uptake for and storage of carbon dioxide.

Contemporary human-induced climate change influences many hazards, exacerbating some and diminishing others. Climate change is, in effect, a potential hazard driver or a potential hazard diminisher, rather than being a hazard itself. The complexities of the interactions between climate change and specific hazards in specific locations sometimes make attribution and projections challenging. The Intergovernmental Panel on Climate Change (IPCC 2012) attempted to analyze links between climate change and hydrometeorological hazard trends and extremes. Few strong associations were found, with daily high temperature being the most prominent. It is conceivable that IPCC's (2012) method might not be robust enough to discover correlations or lack thereof by: (1) highlighting climate change perspectives and theories without equal consideration of wider disaster and development topics; and (2) aiming to analyze connections that would require centuries of consistent and comparable data from around the world—data that do not and potentially cannot exist. Nonetheless, individual studies provide insights into possible influences of climate change on some hazards or potential hazards.

For tropical cyclones, it appears as if—particularly for Atlantic hurricanes—climate change could lead to reduced frequency of storm formation but increased intensity once a storm forms (Knutson et al. 2010). There are feedbacks amongst sea surface temperatures, stratospheric winds, and the lessening temperature differential between the poles and the tropics (because the poles are warming faster than the tropics), in addition to other factors, which make analysis challenging. It is much clearer that storms in the Norwegian Sea termed "polar lows" are expected to decrease in frequency due to climate change because the North Atlantic's ocean water is projected to warm more slowly than the air above it, leading to more atmospheric stability which discourages polar low formation (Zahn and von Storch 2010).

Nonetheless, precipitation is expected to become more intense in many locations around the world due to climate change. Warmer air can hold more moisture, which means that quantity and intensity of rain can increase, with one likely consequence being increased rainfall-induced flooding overall. Meanwhile, as sea ice around the Arctic diminishes due to climate change, storms can produce more wave energy, which exacerbates coastal erosion. Some communities in Alaska are already experiencing this problem and are preparing to resettle inland due to it (Bronen and Chapin III 2013). Sea levels rising due to climate change—as water warms it becomes less dense, so its volume expands leading to an increasing sea level—are impacting some low-lying islands, through worsening floods, erosion, and water salinization. As a result, communities in Papua New Guinea, for example, are planning and enacting resettlement (Mercer 2010). Again, interactions are complex and climate change is not certain to increase floods in all locations. As a specific example, climate change is expected to decrease winter flood frequency in central Europe's Elbe and Oder rivers due to fewer ice jams (Mudelsee et al. 2003).

Such complexities impact other hazards. Increased precipitation (and even increased earthquakes, as discussed below) under climate change could be expected to increase the frequency and magnitude of landslides, but this outcome is not straightforward. For a mass movement to occur, there must be material to slide. An initial increase in the frequency of mass movements due to climate change could potentially use much of the available slideable material, leading to smaller movements in the future because less material can build up before it moves. With avalanches, increased precipitation could lead to more snowfall accumulation and hence more avalanches, whilst elevated air temperatures could reduce avalanche magnitude if the precipitation falls as rain rather than snow. The effects of climate change on all forms of slides will be highly localized, not only due to local changes in precipitation and air temperature but also due to local topography, infrastructure, and human decisions regarding slide risk management.

Costello et al. (2009) summarize the likely impacts of climate change on microbiological hazards by focusing on rodent-borne and vector-borne diseases. As temperatures increase, vectors and parasites tend to breed and mature more quickly. More life cycles are permitted within a given timeframe along with an increased rate of biting, each of which supports the spread of vector-borne diseases. In addition to these time factors, vector density over a given area tends to increase as temperature rises. Vectors are able to survive at higher altitudes and latitudes than before because the climate in these locations matches conditions to which the vectors are adapted. Populations living at higher altitudes and latitudes often have not before had to deal with these vectors or pathogens, so their immunity and their knowledge of countermeasures could be limited.

Costello et al. (2009) particularly highlight mosquito-borne and tick-borne diseases such as malaria, encephalitis, and dengue fever, but their arguments likely apply to many other diseases such as lyme disease, leptospirosis, and West Nile Fever. The authors also indicate some factors inhibiting vector-borne and rodent-borne diseases due to climate change. For instance, where hydrometeorological hazard frequency or intensity increases, or where the environmental hazards change in nature, vector eggs and larvae could be harmed. Heavy rains can wash away vectors at many life cycle stages. Salinization of water due to sea-level rise and coastal inundation could inhibit vectors that need freshwater or could induce them to move inland or to higher elevations.

Prospects for geological hazards being influenced by climate change are discussed by McGuire (2013), who provides geophysical explanations for how volcanic eruptions, tsunamis, and earthquakes have the potential to be augmented, but there are high levels of uncertainty. Simplistically, as sea levels rise and as glaciers melt, a shifting of the weight on the Earth's crust has the possibility for affecting seismicity and underwater landslides, with subsequent effects on tsunamis. Similar impacts could potentially affect volcanic eruptions. There is much speculation and many uncertainties regarding the interaction between climate change and geological hazards. In contrast, since climate change by definition affects only planet Earth, there seems little scope for impacts on astronomical hazards. One possibility is that any space weather influencing the atmosphere could have its impacts altered due to changing atmospheric composition under climate change.

Climate change is an example of a major environmental hazard driver and diminisher, indicating the intricacies and complexities involved in trying to understand the overlaps, connections, and interactions amongst environmental hazards. Other environmental hazard influencers could also be affected, examples of which are cycles such as El Niño-Southern Oscillation, the Indian Ocean Dipole, and the North Atlantic Oscillation.

Climate change's projected impacts on disaster risk are not confined to the hazard side, but also encompass vulnerability. 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 and water resources along with pest management, especially where new species enter an ecosystem due to the changing environment. 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 vulnerabilities—depends on the specific context. As well, vulnerability's root causes are social and political conditions (Hewitt 1983, 1997; Lewis 1999; Wisner et al. 2004, 2012), which can be addressed irrespective of climate change, whereas hazards usually have an environmental component, which is not always so straightforward to influence successfully.

Consequently, climate change's influence on disaster risk is much more on the hazard side than on the vulnerability side, affecting hazard parameters so that sometimes the hazard is exacerbated and sometimes the hazard is diminished. With this understanding of how climate change influences disaster risk, the next section explores mentions of climate change in the SFDRR.

3 SFDRR Mentioning Climate Change

SFDRR mentions the phrase "climate change" 15 times in its 50 paragraphs, compared to the HFA 2005-2015 (UNISDR 2005), which mentioned the phrase 13 times in 34 paragraphs. These basic numbers show that climate

change is well-represented within the SFDRR and HFA, but it is not domineering and its relative influence might have diminished due to lower rate of appearances per paragraph in the SFDRR compared to the HFA. This section clusters, discusses, and analyzes those appearances according to three main themes: (1) Climate change affecting disaster risk and disasters; (2) Cross-sectoral approaches; and (3) Implementation.

3.1 Climate Change Affecting Disaster Risk and Disasters

Several paragraphs in the SFDRR mention how climate change affects disasters and disaster risk. Paragraph 4 states "Disasters, many of which are exacerbated by climate change and increasing in frequency and intensity, significantly impede progress towards sustainable development" (UNISDR 2015, p. 4). Meanwhile, Paragraph 42 refers to the Small Island Developing States noting that "The effects of disasters, some of which have increased in intensity and have been exacerbated by climate change, impede their progress towards sustainable development" (UNISDR 2015, p. 22) These statements are fair since, as discussed in Sect. 2, climate change does exacerbate some hazards, which in turn exacerbates some disasters. The SFDRR does not include an equivalent statement that many hazards and hence disasters are diminished by climate change, indicating an imbalance in how climate change is portrayed. The choice of the words "many" and "some" in those respective paragraphs is vague, perhaps deliberately so, not even indicating whether or not climate change would be expected to impact the majority, the worst, or some other descriptor of hazards.

That is particularly surprising since disaster risk reduction by definition considers all hazards while, as discussed in Sect. 2 of this article, climate change affects mainly hydrometeorological hazards with discernible effects on biological hazards and a currently expected modicum of influence on geological hazards. The SFDRR could have made it much clearer that hazards exist which need to be addressed by disaster risk reduction but which are not affected, and perhaps cannot be affected, by climate change.

Meanwhile, climate change is appositely accepted as a disaster risk driver. Paragraph 6 describes how "More dedicated action needs to be focused on tackling underlying disaster risk drivers, such as the consequences of poverty and inequality, climate change and variability" (UNISDR 2015, p. 4) while Paragraph 13 highlights the importance of "Addressing climate change as one of the drivers of disaster risk" (UNISDR 2015, p. 6). In referring to only disaster risk, rather than decoupling risk into hazard and vulnerability, an opportunity is lost to further emphasize that climate change affects principally the hazard side of risk while humanity has much more opportunity to reduce vulnerability, thereby reducing disaster risk irrespective of climate change. Elsewhere in the SFDRR, the importance of vulnerability is raised and the message is relatively clear that vulnerability is the fundamental driver of disaster risk. Given that this ethos is accepted and stated, it could have been reiterated with respect to climate change to continue indicating that humanity can and should tackle disaster risk no matter what climate change might bring—which is done by tackling vulnerability.

Yet this point is not acknowledged in the final mention connecting climate change with disaster risk: Paragraph 25b states as part of "Understanding disaster risk" that "global and regional levels" should "Promote the conduct of comprehensive surveys on multi-hazard disaster risks and the development of regional disaster risk assessments and maps, including climate change scenarios" (UNISDR 2015, p. 11). This approach is reasonable and is needed as one component within wider tasks, but it is far from sufficient since these assessments and maps provide only a small component of what is needed regarding "comprehensive surveys." An important wider task would be to consider multivulnerability disaster risks in tandem with multihazard disaster risks. Such a task entails recognizing the numerous sources from which vulnerability is created and supported, such as marginalizing certain groups, not monitoring and enforcing planning and construction regulations, allocating resources away from those who need the most support for disaster risk reduction, and environmental degradation through resource over-extraction and biodiversity loss (Hewitt 1983, 1997; Lewis 1999; Wisner et al. 2004, 2012). Yet the SFDRR contains multiple mentions of "multi-hazard" without a single mention of "multi-vulnerability" and without calling for "comprehensive surveys" for vulnerability, despite the decades of research on multiple vulnerabilities and the importance of tackling vulnerability for dealing with disasters (Hewitt 1983, 1997; Lewis 1999; Wisner et al. 2004, 2012). Similarly, while climate change scenarios are needed, so are future vulnerability scenarios, yet those are not asked for in the SFDRR.

When it comes to climate change affecting disaster risk and disasters, the SFDRR usefully incorporates climate change as one factor, and especially as one risk driver, amongst many. The inadequate emphasis on disaggregating risk into hazard and vulnerability in order to recognize what climate change does and does not influence weakens the document by potentially leading to the interpretation that solving climate change will necessarily reduce disaster risk. That is not the case since climate change does not exacerbate all hazards and since vulnerability must be

addressed in order to truly reduce disaster risks, an area over which climate change has some but limited impact.

3.2 Cross-Sectoral Approaches

Section 1 of this article describes the situation of three separate global processes in 2015 that set three separate agendas for development-related topics in coming years. The SFDRR addresses cross-sectoral interaction between climate change and disaster risk reduction in many ways, providing an impressive indication of the importance of not remaining isolated, but instead connecting with the other processes. These paragraphs stop short of directly suggesting approaches for integration for specific players to embrace and implement.

This point on the need for cross-sectoral approaches without indicating how to integrate them is explicitly made in Paragraph 11 describing that "The intergovernmental negotiations on the post-2015 development agenda, financing for development, climate change and disaster risk reduction provide the international community with a unique opportunity to enhance coherence across policies, institutions, goals, indicators, and measurement systems for implementation, while respecting their respective mandates" (UNISDR 2015, pp. 5–6). In other words, connections and "coherence" are essential, including for climate change, but specific actions further for integration are not provided.

This point is reiterated by Paragraph 19h as a guiding principle: "The development, strengthening and implementation of relevant policies, plans, practices and mechanisms need to aim at coherence, as appropriate, across sustainable development and growth, food security, health and safety, climate change and variability, environmental management and disaster risk reduction agendas" (UNISDR 2015, p. 9). The acknowledgment of all these topics is well-done, but the baseline is again to maintain cross-sectoral "coherence," rather than considering further, specific steps for connecting topics alongside operational connections. The absence is poignant of methodologies to achieve improved integration or even intersectoral approaches seeking overlaps and more operational connections. Instead, according to the SFDRR, existing silos are to be maintained.

Paragraph 13 is entirely about respecting climate change's territory through stating that "Addressing climate change as one of the drivers of disaster risk, while respecting the mandate of the UNFCCC [footnote 6], represents an opportunity to reduce disaster risk in a meaningful and coherent manner throughout the inter-related intergovernmental processes." Footnote 6 reads "The climate change issues mentioned in the present framework remain within the mandate of the UNFCCC under the competences of the Parties to the Convention" (UNISDR 2015, p. 6). The messages are clear that a boundary has been drawn around climate change, that UNFCCC has control over climate change, and that it would not be appropriate to try to take down that fence nor to consider changes to existing mandates in order to better integrate climate change within disaster risk reduction. There is no doubt that this approach is practical, pragmatic, and has been deemed essential by the parties involved. The likelihood of those entrenched in the system giving up power because it makes sense is so low that it would be a non-starter to even raise the topic. Even though there might be little sense in maintaining these boundaries, the SFDRR is being sensible in comforting those focused on climate change by assuring them that their power will not be challenged or removed.

This territorialism is reinforced under the section "Support from international organizations" through Paragraph 48 which moves into implementation by stating "To support the implementation of this framework, the following is necessary" (UNISDR 2015, p. 23). Several subparagraphs within this paragraph follow, with two mentioning climate change:

(1) *Paragraph 48c* "The United Nations Office for Disaster Risk Reduction (UNISDR), in particular, to support the implementation, follow-up and review of this framework through […] supporting the development of coherent global and regional follow-up and indicators and in coordination, as appropriate, with other relevant mechanisms for sustainable development and climate change" (UNISDR 2015, p. 24).

(2) *Paragraph 48e* "Other international organizations and treaty bodies, including the Conference of the Parties to the UNFCCC, international financial institutions at the global and regional levels, and the International Red Cross and the Red Crescent Movement to support developing countries, at their request, in the implementation of this framework, in coordination with other relevant frameworks" (UNISDR 2015, p. 24).

Both paragraphs support "coordination," which is an important step in cross-sectoral approaches. The mechanism and leadership for such coordination are not clear, again due to the reality of not wishing to appear to infringe on the mandate and power of others. The importance in these two paragraphs is that they recognize climate change without letting it dominate. Paragraph 48c highlights "sustainable development and climate change" (UNISDR 2015, p. 24) thereby embracing the two other 2015 global processes and seeking to join together the follow-ups and indicators from all three. Paragraph 48e includes UNFCCC, as is necessary, along with several others from numerous sectors, as is also necessary. While climate change is the only framework mentioned directly,

UNFCCC is a key organization and hence deserves to be identified. By not listing other frameworks, but instead leaving it generic, the SFDRR is not limiting its actions and collaborations. Instead, it retains the opportunity to link with any existing and future frameworks that would be relevant to disaster risk reduction. This open approach is suitable for remaining connected with others without seeming to attempt to infiltrate their territory or to undermine their power base.

In tandem, throughout the SFDRR, there are numerous mentions of and encouragements for integration amongst sectors—with a strong emphasis on ensuring that disaster risk reduction is integrated into other sectors. That is a generous approach from the SFDRR to ensure that disaster risk reduction is included in wider actions than merely disaster-related activities, an important step for cross-sectoral approaches. More details are provided in Sect. 3.3.

Taken together, all the cross-sectoral mentions of climate change present pragmatism. It is disappointing that opportunities are not grasped to place climate change within the wider contexts where it belongs, but the reasoning is political and it helps to maintain the historical momentum which separated the three global processes. Realistically, many researchers, policymakers, decision makers, and practitioners have significant vested interests in retaining climate change's separation from other topics. Those will not be overcome easily and efforts to do so might be counterproductive, debasing both disaster risk reduction and climate change work. The SFDRR treads carefully with regards to cross-sectoralism, sadly entrenching artificial differences and divisions in the process. Unfortunately, taking other options would not likely be realistic, but the SFDRR nonetheless does well in offering plenty to other sectors from disaster risk reduction, as described in the next section.

3.3 Implementation

The SFDRR has strong paragraphs on implementation mechanisms at different governance levels, with climate change being mentioned but without the treatment being overbearing. Three implementation-related paragraphs mention climate change.

Despite the difficulties mentioned in Sect. 3.2 regarding the support for continued separation of climate change from disaster risk reduction, the SFDRR nonetheless offers to support the placement of disaster risk reduction measures into other sectors. That helps to ensure that disaster risk reduction is not overlooked, but cooperates with other interests. As part of implementation, Paragraph 47d instructs "Incorporate disaster risk reduction measures into multilateral and bilateral development assistance programmes within and across all sectors, as appropriate, related to poverty reduction, sustainable development, natural resource management, environment, urban development and adaptation to climate change" (UNISDR 2015, p. 23). That is helpful for moving forward by accepting the situation that many sectors prefer siloization and so support can be proffered for disaster risk reduction within those silos. The SFDRR is creating opportunities to work with others on their terms, rather than trying to dictate what might work best overall, even though that would not be accepted in order to protect territory. A powerful tool for implementing disaster risk reduction is represented through striving to integrate, or "mainstream," disaster risk reduction into other activities, adopting experience-based recommendations from places such as southern Africa (Holloway 2003) and from actors such as NGOs (Twigg and Steiner 2002).

The SFDRR further discusses implementation of disaster risk reduction with respect to governance. Under Priority 2, "Strengthening disaster risk governance to manage disaster risk," Paragraph 28b states "Foster collaboration across global and regional mechanisms and institutions for the implementation and coherence of instruments and tools relevant to disaster risk reduction, such as for climate change" followed by several other topics. This approach is encouraging. Climate change is mentioned but as part of a list alongside "biodiversity, sustainable development, poverty eradication, environment, agriculture, health, food and nutrition and others, as appropriate" (UNISDR 2015, p. 14). Climate change is thus placed as one important issue amongst many, which assists in ensuring that climate change neither is forgotten nor dominates. Additionally, the links amongst all of these concerns are implicit with the explicit point that they feed into disaster risk and are needed for disaster risk reduction. The cross-sectoral aspects discussed in Sect. 3.2 are boosted, with the hope that those implementing the SFDRR would recognize and apply the need for a cross-sectoral approach. The "collaboration" mentioned in this paragraph is not just for the mechanisms and institutions, but is also for involving those who have concerns in the specific sectors listed.

The third mention of climate change in an implementation context comes under Priority 4 "Enhancing disaster preparedness for effective response and to 'Build Back Better' in recovery, rehabilitation and reconstruction" (UNISDR 2015, p. 17). Paragraph 33a suggests "Prepare or review and periodically update disaster preparedness and contingency policies, plans and programmes with the involvement of the relevant institutions, considering climate change scenarios and their impact on disaster risk" (UNISDR 2015, p. 18). The same comment is made as in Sect. 3.1 with regards to climate change scenarios. These scenarios are needed and it is positive that they are considered explicitly, but other scenarios are also of concern and should have been mentioned. Most notable are vulnerability scenarios, since they have the most

"impact on disaster risk." Other hazard scenarios should also be considered, rather than merely climate change related ones. To ensure that "disaster preparedness and contingency policies, plans and programmes" are up-to-date and effective, other examples of hazard scenarios that ought to be considered are astronomical hazards such as space weather (not mentioned in the SFDRR) and non-climate change related trends and variabilities in the climate including decadal and longer cycles (which are nonetheless affected by climate change). The latter include El Niño-Southern Oscillation, the Pacific Decadal Oscillation, the North Atlantic Oscillation, and the Indian Ocean Dipole (also not mentioned in the SFDRR). These cycles can require preparedness for and sometimes response to precipitation, drought, King Tides, coral bleaching, and epidemics afflicting people, livestock, and crops, amongst many other hazards, irrespective of climate change.

Additionally, the entire cohort of creeping environmental changes (also termed "creeping environmental problems" and "creeping environmental phenomena") ought to be considered. Creeping environmental changes refer to incremental changes in conditions that cumulate to create a major catastrophe or crisis, apparent only after a threshold has been crossed (Glantz 1994a, b). Aside from climate change, examples are desertification, salinization of freshwater supplies, and degradation of arable land. As with climate change, most creeping environmental changes have both natural and human contributors and they can drive both hazards (mainly) and vulnerabilities (to a lesser extent), which each influence disaster risk. Some creeping environmental changes are mentioned in the SFDRR, for instance "land degradation" in Paragraph 30f (UNISDR 2015, p. 15), while land use features prominently in several recommendations. An overarching framework, such as that in Glantz (1994a, b), and connections amongst creeping changes are missing.

Nevertheless, it is useful to see climate change playing a role in implementing "Build Back Better." Notwithstanding concerns about and critiques of the phrase "Build Back Better" and its inadequate implementation (Kennedy et al. 2008; Khasalamwa 2009), communities need to account for climate change, whether affected by a disaster or not. When a disaster has manifested and reconstruction is in progress, then opportunities should be grasped to factor climate change into the rebuilding amongst other hazard drivers and hazard diminishers, which would be part of "Build Back Better." The key as always is not to ignore climate change while not permitting climate change to dominate or dictate. Instead climate change ought to be one factor amongst many in postdisaster reconstruction. The SFDRR does that well, based on the three mentions discussed above, by including climate change within the implementation, but not making climate change overbearing, and by having only a handful of mentions of "climate change" in this context. The limitation in the SFDRR's approach is in not treating certain other hazard drivers and hazards similarly.

4 Discussion

The exploration and examination of "climate change" within the SFDRR reveals mixed results. The articulation of climate change's contributions to disaster risk and disasters does not give the full picture while few specifics are given regarding implementation (Zia and Wagner 2015). Meanwhile, the cross-sectoral mentions are encouraging in explicitly admitting gaps and separations between disaster risk reduction, climate change, and sustainable development, but then focusing on mainly coherence and coordination to redress the challenge, although also offering plenty from disaster risk reduction to integrate into other sectors. Due to the limitations, the SFDRR leaves two operational aspects unaddressed.

First, no effort is made to close the gaps or even to narrow them substantively. Instead, the opposite happens. The territories are lucidly delineated and the SFDRR states openly that those territories should remain. As discussed in Sect. 3, that is a political decision and little option remains but to follow this continued separation. Otherwise political problems are liable to result through accusations of trying overstep one's mandate and encroach on someone else's turf. This protectiveness of mandates is unfortunate by avoiding the best overall, integrated approaches (Weichselgartner and Pigeon 2015).

The second operational aspect which is not fully addressed is the details regarding how the cross-sectoral coherence and coordination will be established and maintained. Appropriate principles regarding collaboration are articulated with none missing—a needed starting point. The "then what?" question is neither asked nor answered. How would these principles be effected in practice in order to ensure that collaboration and cross overs actually occur and are successful? A high-level, country-based, voluntary framework might not be the appropriate venue for that query, which is a fair stance. The challenge remains of which venue(s) would be appropriate and how the question might be asked and answered in reality.

Aside from the phrase "climate change," the SFDRR mentions "climate" in three other places. Paragraph 25c includes "Maintain and strengthen in situ and remotely-sensed earth and climate observations" (UNISDR 2015, p. 11) while Paragraph 28c discusses global and regional engagement through existing platforms "including on development and climate issues, as appropriate, as well as promote the integration of disaster risk management in other relevant sectors" (UNISDR 2015, p. 14). The third

mention of "climate" other than "climate change" is Paragraph 34c, which supports connections with the Global Framework for Climate Services. All three are important and sit well within disaster risk reduction, because disaster risk reduction certainly includes climate observations (IPCC 2012), "climate issues" (Holloway 2000), and "climate services" (Glantz 2003).

Yet it is unclear why climate is treated as being so special, since the SFDRR does not treat other hazards or hazard drivers similarly. There are no mentions of earthquakes, volcanoes, tsunamis, or even weather (or variations of those words), although some hazards such as droughts and flooding appear. Those hazards, along with "storm observations," "fog issues," and "landslide services," go beyond merely the climate dimension, but barely appear in the SFDRR—although this would be a highly hazard-centric approach anyway. The point is not to list all hazards comprehensively nor to treat them with equal amounts of text; instead, it is to seek a balance amongst hazards while placing most emphasis on dealing with vulnerabilities—the multivulnerability or all-vulnerabilities/all-resiliences approach. Instead, the SFDRR emphasizes climate, particularly climate change, amongst all hazards and hazard drivers—which, to a large extent, is done simply because it reflects high-level global processes even though that it is not what the science provides or what workers and communities on the ground experience (Tozier de la Poterie and Baudoin 2015).

While the SFDRR cannot and does not have a role in critiquing the emplaced system, accepting what is offered is bureaucratically and politically appropriate, scientifically unfortunate, and operationally detrimental by supporting the status quo without comment. The Global Framework for Climate Services is an example.

The World Meteorological Organization defines "climate services" as "the dissemination of climate information to the public or a specific user" (WMO n.d.). Services are important and are needed as part of disaster risk reduction, but it is unclear why climate should be the main environmental phenomenon with a global framework for services. Many other hazards affect humanity, especially the poorest people and communities with the least choices and resources (Hewitt 1983, 1997; Lewis 1999; Wisner et al. 2004, 2012). While many parallel structures exist, there is no specific global framework for earthquake services, landslide services, meteorite services, epidemic services, flood services, wind services, or many other environmental phenomena. WMO (2013) does propose a Global Framework for Space Weather Services while WMO's World Weather Watch, started in 1963, tends to be seen as a Global Framework for Weather Services.

This compartmentalization by hazard is the structure of the international system, which feeds into the climate change structure, unnecessarily separating it from disaster risk reduction. The SFDRR has no scope for trying to overturn this structure or even for pointing out the difficulty and suggesting improvements, so it is no surprise that the structure is accepted unconditionally. The consequence, then, is to perpetuate the hazard focus of many existing systems and accept the separation of climate change from disaster risk reduction and sustainable development processes.

The SFDRR nonetheless tries to make the best of existing structures, notably through separating its recommendations according to governance scale. Each of the four priorities is subdivided according to "National and local levels" and "Global and regional levels." That is cooperative, dealing with governance entities on their own terms and further ensuring that concerns do not emerge about overstepping mandates. As with the rest of the issues raised, that process also serves to reinforce the separation between climate change and disaster risk reduction, as well as between climate change and sustainable development. It cements the gaps at each governance level. Instead of advising or recommending to each governance level that climate change be viewed as one hazard driver/diminisher within disaster risk reduction, the recommendations push the authorities and institutions towards keeping the topics separate. That repeats the same advantages of working within the current system and not being threatening to it, while repeating the same disadvantages of not being willing to move the system forward and do what is best for people on the ground, such as by placing climate change adaptation as one subset within disaster risk reduction (Kelman and Gaillard 2010; Kelman et al. 2015) and climate change mitigation as one subset within sustainable development.

5 Concluding Comments

This article has reviewed "climate change" within the SFDRR, analyzing how the topic appears and is addressed within the framework's text, alongside the potential implications for dealing with climate change within the context of disaster risk reduction. While it is understandable why the SFDRR is so carefully politic in accepting the separation of climate change from disaster risk reduction, the SFDRR is found lacking an appropriate framing of climate change. The overall focus of the SFDRR's recommendations on tackling root causes of disaster risk, namely vulnerability, is welcome, but that is undermined by keeping one hazard driver/diminisher (climate change) divorced from that work due to the separate intergovernmental process. While few practical options are available with which to change the situation, climate change as a

separate entity is now accepted and engraved for at least the next 15 years.

Similar challenges emerge for the third global process in 2015, that of the Sustainable Development Goals. While it is possible that the final accepted version of the goals will rectify some of the concerns, given the drafts so far it seems that the Sustainable Development Goals will also cement for the next 15 years, perhaps longer, since the asterisk to draft Goal 13 explicitly separates climate change from wider sustainable development processes. Neither the Sustainable Development Goals nor the SFDRR even raise the question of why their agreements continue to be voluntary while climate change aims for a legally binding accord.

As noted at the outset, the world's sustainable development endeavours are left with stark contrasts even though, together, the trio of processes and agreements from 2015 converges and culminates a generation's work on sustainability. The fear is that the convergence will end in 2015, followed by a divergence to parallel routes, albeit with some bridges. Those bridges will be built by those practitioners and administrators who continue to try to connect the topics and processes, recognizing that they all have common goals and common pathways, with the separation being political and territorial rather than practical.

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