Towards Sustainable Futures

The Role of Evaluation

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Evaluating their contributions to sustainable development

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Introduction

Disaster risk management is part of sustainable development (Kitagawa, 2021), and yet, if disaster risk management is essential to engage on the sustainability path (United Nations, 2015), its contribution is not given. Evaluation can play a role in providing society with knowledge regarding, among other things, the impact, worth, coherence and relevance of disaster risk management in relation to sustainable development. In this chapter, I develop conceptual ideas that can help evaluators to assess this contribution, with a focus on the impacts of disaster risk management on sustainability, rather than the sustainability of those impacts. A disaster risk management strategy might be considered successful from a silo perspective, yet its contribution to sustainable development would be assessed differently from a complex system perspective since there can be contradictory impacts on different aspects of sustainable development. For a simplified example, take the case of installing air conditioning to reduce the health risks associated with heatwaves. Cooling down interiors indeed helps bodies regulate their temperature, which improves individual wellbeing, yet this strategy is energy-intensive and results in the emission of greenhouse gases that in turn contribute to climate change (International Energy Agency, 2018) and therefore hinder sustainable development.

In general, disaster risks affect the wellbeing of society: for instance, floods affect the economy, the environment and human health, which are all assets of sustainable development (Priest et al., 2016). These impacts should be considered in management practices. Indeed, the implementation of the Sendai Framework for Disaster Risk Reduction (United Nations, 2015), which groups international guidelines for the governance of disaster risks, should lead to risk-informed sustainable development according to UNDRR (2019). The framework description clearly states that the reduction of disaster risks contributes to sustainable development (United Nations, 2015). Therefore, since disaster risk management is assumed to generally support sustainable development, how can we evaluate this contribution?

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Prior to describing further the relationship between disaster risk management and sustainable development and its evaluation, let us clarify some key definitions. Disaster risks concern 'the potential loss of life, injury, or destroyed or damaged assets which could occur to a system, society or a community in a specific period of time, determined probabilistically as a function of hazard, exposure, vulnerability and capacity' (UNDRR, 2017), for example, such loss and damage can be caused by a fire, an explosion, a terrorist attack, a flood or a landslide. The definition of disaster risk management, on the other hand, is 'the application of disaster risk reduction policies and strategies to prevent new disaster risk, reduce existing disaster risk and manage residual risk, contributing to the strengthening of resilience and reduction of disaster losses' (UNDRR, 2017). In other words, disaster risk management aims at reducing potential loss and damage in a system.

Evaluations play an essential role in disaster risk management, in several ways: the object of evaluation can be the risks, the impacts of disasters or the management strategies. First, the evaluation of the risk itself, often called risk assessment, determines the probability of a harmful event happening and its potential negative consequences. Second, the evaluation of the disaster impacts, after the event has happened, gives a description of the actual harm provoked by the disaster. Third, the evaluation of the management strategies, whether the strategies are implemented ahead of the events (prevention, preparedness) or after the disaster strikes (response, recovery), investigates if the management was successful. This chapter focuses on this third type of evaluation. However, evaluations of disaster risk management strategies are actually informed by the two other types of evaluations described earlier. Strategies should include learning from past disaster events and so the evaluation of disaster impacts, and they should be based on the evaluation or assessment of disaster risks to be adapted to the actual and future risks. The complexity of evaluating management strategies that anticipate the risk is reflected by the fact that their success or failure can be observed only if an adverse event that could turn into a disaster happens: 'evaluating and measuring effects in the context of DRR [Disaster Risk Reduction] is particularly challenging, as these evaluations are subject to a disaster occurring' (Sarabia et al., 2020, p. 2).

As described before, disaster risk management can have significant effects on efforts to achieve sustainable development, and therefore this aspect should be considered when evaluating the successes or failures of management strategies. Sustainability is increasingly discussed in evaluations in general. In the article 'How dare an evaluator go toward saving the world?', Stake (2004) advocates inclusion of the evaluators' personal values in evaluation, since evaluators are generally trying to increase the wellbeing of societies by offering knowledge about the merit and worth of initiatives. Patton (2021) takes this idea forward and advocates sustainability as a value that evaluators should include in their reasoning in addition to equity, inclusion and diversity, which are the main issues

the evaluators declare that they care about in his study. Because 'the values we bring to evaluation reflect the times we live in, both in how they are expressed (language) and what commitments they represent (substance)' (Patton, 2021, p. 177), sustainability must be integrated into evaluation concerns.

In spite of sustainability being a societal concern and the interest given to it in the evaluation field, it is complicated to give a unique definition of it. Since it has become a buzzword, many different interpretations of what is or is not sustainable development have been offered. Our book provides various understandings of how sustainability can be interpreted in relation to evaluation. As Martinuzzi and Meyer (2016) point out, there is no consensus on a definition of the concept. They attempt a categorisation of the three most common aspects in the definitions of sustainable development to guide future evaluations, and the present chapter relies on these categories. The first one is what they call 'horizontal integration'. It is about integrating different targets of sustainable development, such as its so-called three pillars: social, economic and environmental issues. The second one is called 'vertical integration' and is about the coordination of actions in different territories, which aim towards reaching shared global goals. The third one is 'intergenerational integration', which is about the temporal issues related to sustainability, based on the definition from the Brundtland report: sustainable development is to meet 'the needs of the present without compromising the ability of future generations to meet their own needs' (World Commission on Environment and Development, 1987, p. 16).

Based on these three dimensions of sustainable development, I develop here two mechanisms that influence whether disaster risk management hinders or promotes sustainable development. Then I present concrete implications for the evaluation of disaster risk management strategies. To put it succinctly, this chapter offers a general conceptual discussion of the potential effects of disaster risk management on sustainability and suggests implications for the evaluation of those impacts. To do so, it is essential to investigate the complex and interrelated systems in which disaster risk management has influence, in other words the many ways it can contribute to sustainable or unsustainable practices. It is indeed essential to understand how disaster risk management may provoke unsustainability in order to be able to judge its contribution to sustainability.

The first part of the chapter describes the relationship between disaster risk management and sustainable development, while the second part provides practical suggestions for evaluators. What I present here may be considered as a contribution to the literature by linking different fields of research (disaster risk management, sustainable development, and evaluation), but it does not claim to provide an exhaustive picture of the issue. It is based on scientific literature, reports and personal thoughts, and is written in the form of an essay rather than an academic paper, to 'allow the development of an argument regarding a topic worth discussing' (van den Berg, Magro, & Mulder, 2019, p. 8).

Two mechanisms illustrating the relationship between disaster risk management and sustainable development: transfers of risks and path dependency

If the priority of our society is to become (more) sustainable, then evaluation can provide the information and learning necessary for pursuing that goal. To do so, the evaluation of disaster risk management strategies must include a judgment of the contributions of these strategies to sustainable development. In line with the different aspects of sustainable development detailed in the introduction, there are at least two main mechanisms resulting from the management of disaster risks that should be analysed as part of evaluating their (potential) contributions to sustainability: transfers of risks and path dependency. Figure 6.1 summarises the main contributions of each of them.

Transfers of risks

Risk transfers are usually described as 'the process of formally or informally shifting the financial consequences of particular risks from one party to another' (UNDRR, 2017). This formal definition thus focuses on mechanisms such as insurance systems. Nevertheless, the understanding of transfers of risks could be extended to the phenomenon happening when the actions taken to reduce or limit a specific disaster risk result in creating or increasing another one as a side effect (Nilson & de Goër de Herve, 2023).

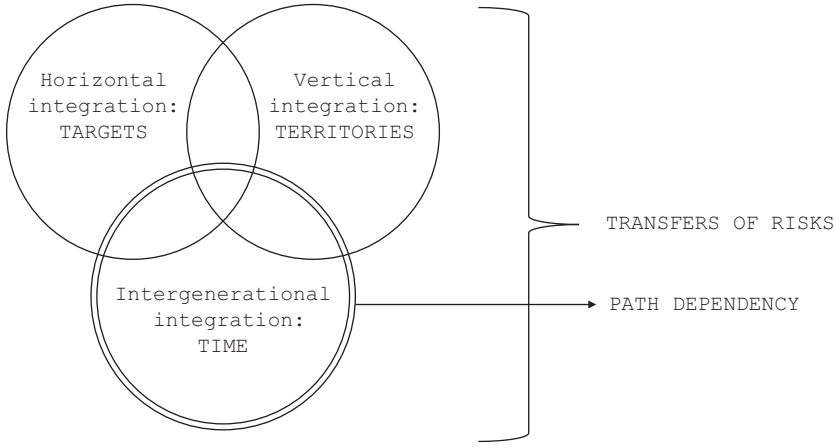

Figure 6.1 The different components of sustainable development according to Martinuzzi and Meyer (2016) and which ones are affected by the two mechanisms studied in this chapter.

The model of transfers of disaster risks presented in this chapter builds upon the notion of risk-risk trade-offs (see e.g. Graham & Wiener, 1995; Hansen, Von Krauss, & Tickner, 2008; Lofstedt & Schlag, 2017). A risk trade-off is 'the change in the portfolio of risks that occurs when a countervailing risk is generated (knowingly or inadvertently) by an intervention to reduce the target risk' (Graham & Wiener, 1995, p. 23). Therefore, the idea of transfers of risks presented here can be seen as an application of the concept termed risk-risk trade-offs via the three components of disaster risks (hazards, vulnerability and exposure) in various spatial and temporal scales.[1]

There are clear interconnections between the different disaster risks (UNU-EHS, 2021), which justify the crucial examination of transfers of risks. 'The level of interconnection and interdependency may be determined by interactive causality chains, which can spread out in space and time' (Pescaroli & Alexander, 2018, p. 2248). Therefore, it is likely that the modification of one specific disaster risk (its probability of happening and/or its potential negative consequences) through its management can affect another one, either positively (reducing the other risk) or negatively (increasing the other risk).

Each disaster risk evolution is based on changes within the three components of risk (GFDRR, 2016): hazard, exposure, and vulnerability. Hazards are physical phenomena with the potential to harm human and/or natural systems if they happen. Exposure is 'the presence (location) of people, livelihoods, environmental services and resources, infrastructure, or economic, social, or cultural assets in places that could be adversely affected by physical events and which, thereby, are subject to potential future harm, loss, or damage' (IPCC, 2012, p. 32). And vulnerability is the propensity to be negatively affected by an event based on the predispositions of the person, object or system in question (IPCC, 2012). In other words, if one of these three components is modified, then the disaster risk evolves (GFDRR, 2016). That is why we can speak of a transfer of disaster risks when the management of one risk affects one of the elements for another risk negatively.

Transfers of risks constitute a complex phenomenon to study. The risk that is created or increased (called 'new risk' hereafter) due to the management of another one (called 'former risk' hereafter) can be of the same type or a different type: there can be a change in the *hazard* or not. The new risk can be a disaster risk as well (see examples 1, 3, and 4 in Table 6.1), or a risk that does not classify as a 'disaster' but is still an uncertain and unwanted event (see example 2 in Table 6.1).

There can also be a change in who and what is *exposed* as well as their *vulnerabilities*. The new risk can threaten the same people as the former one (see examples 2 and 3 in Table 6.1) or different people (see examples 1, 3, and 4 in Table 6.1). The risk can also be transferred from humans to non-human living entities (see examples 1, 3, and 4 in Table 6.1). These aspects relate to issues of sustainable development that are part of horizontal integration, that is, the targets

Table 6.1 Simplified illustrations of transfers of risks with a description of how the dimensions are affected

Examples	*Hazard dimension*	*Stakeholders dimension*	*Spatial dimension*	*Temporal dimension*
1 Prevention of urban flooding through upstream retention basins in the countryside.	Same hazard for former and new risks: floods.	Former risk affects people and assets living in the urban area while new risk affects people, assets, and non-human entities in the countryside.	Former risk affects the downstream city, new risk affects the upstream countryside.	Both former and new risks in the same temporal frame (before/after the implementation of the strategy).
2 Reduction of the health-related risks of heatwaves by creating cooling-down areas with fountains in a city.	Same and different hazards: the former one was a heatwave, the new ones are drowning, mosquito-spread diseases, gentrification. Note that the risk of heatwaves is still there, only the consequences are reduced.	Same people for both the former and the new risks: people living in the city.	Same place for both former and different risks.	Same temporal frame: before/after the implementation of the strategy.
3 Reduction of landslides and avalanches in a mountainous area by strategically planting trees.	Different hazards: the former ones are landslides and avalanches while the new ones are forest fires and tree pests.	Same and different people are affected: the former risks threatened valley communities and people living or visiting the upward areas (e.g. farmers, tourists). The new risk is affecting people visiting the upward areas but also forest ecosystems.	Same and different places are affected: the new risks do not affect much of the valley, but the former risks were already affecting the uphill areas as are the new ones.	Growing trees take several years so the former and new risks are distinct in time, and are both present in between (during the time the trees are small).
4 Any disaster risk reduction strategy that requires important building work and fuel consumption to be implemented and therefore causes large greenhouse gas emissions.	Same and/or different hazards: the new hazards are extreme meteorological events, whatever were the former risks.	Different people and non-human living entities: the ones that will be living in the future. In addition, some ecosystems are more sensitive to climate change and may be affected already today.	Same and different places: everywhere that gets affected by climate change.	Strong temporal gap between the former and new risks since the new ones will appear and get stronger as climate change progresses.

of sustainable development. The transfer of disaster risks can be spatial, from one place to another (see examples 1, 3, and 4 in Table 6.1), which affects the vertical integration of sustainable development. Some strategies are even spatially targeted on purpose, such as in fluvial flood management with implications for both the downstream and upstream communities (Machac, Hartmann, & Jilkova, 2018). The transfer of disaster risks can be temporal as well and therefore affects the intergenerational integration of sustainable development: reducing a risk today may increase or create a risk (the same or a different one) in the future (see examples 3 and 4 in Table 6.1). For instance, a strategy that would increase greenhouse gas emissions would contribute to climate change and thus increase climate-related risks in the future, both at the location where the strategy is implemented and in other places.

As it is possible to notice in Table 6.1, transfers of disaster risks often gather several of the previously listed characteristics, which make them very hard to grasp or predict. Reducing one risk can increase (or decrease) another one for other people, non-human living entities and assets, in a different place, at a different point in time. Figure 6.2 describes the mechanism of transfers of risks.

Since disaster risk management can transfer risks to other people, assets, non-human living entities, in a different place and at a different time, it can be analysed using complexity and system theories. Complexity theory describes interventions as 'fluid and continuously developing, reacting and responding to emerging challenges and opportunities, many of which are difficult to predict' and beyond control (Lemire, Peck, & Porowski, 2020, p. S57). System thinkers make sense of the complexity of the world by looking at 'wholes and relationships rather than splitting it down into its parts and looking at each in isolation' (Ramage & Shipp, 2009, p. 1). Transfers of risks can be understood in terms of these concepts as they encompass relationships between the management of one disaster risk and the overall risk landscape, including people, nature, places and time, inviting a complex system perspective.

Disaster risk management has traditionally been considered from a single hazard perspective, and part of the literature now promotes different models such as 'integrated' or 'holistic' risk management. Some theoretical frameworks consider several risks at once, such as the one developed by De Angeli et al. (2022), which suggests the consideration of various hazards over time and space. There is a need to shift from static to dynamic risk assessment according to GFDRR (2016) and therefore consider the changes in hazards, vulnerability and exposure over time. These two examples focus on the identification of the risks themselves, yet I argue here that the various impacts of disaster risk management policies, including the transfers of risks, should also be taken into consideration to be able to choose strategies based on their potential for risk reduction and risk creation at the same time.

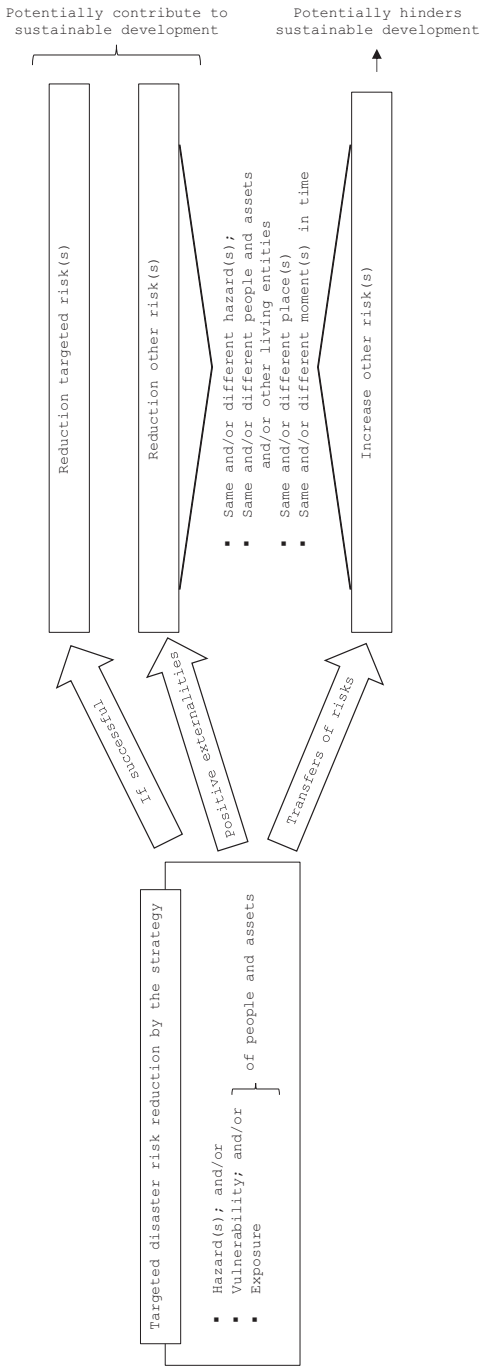

Figure 6.2 Transfers of risks mechanism and contributions of disaster risk reduction to sustainable development.

The IPCC (2022) underlines that the management of disaster risk today determines the landscape of risks in the future. This can be interpreted as an illustration of the transfer of risks over time. In addition, the management of disaster risks today also determines the management of disaster risks in the future, which leads to the second mechanism developed in this chapter: path dependency.

Path dependency

Path dependency theory comes from economics and has since been applied in the political and social sciences in attempts to explain current institutions and policies. As disaster risk governance is embedded in policy systems, I will now discuss how this concept can be relevant for the understanding of the contribution of disaster risk management to sustainable development.

There is no unique definition of path dependency; it ranges from the broad 'history matters' explanation to the more precise notion of self-reinforcement mechanisms, also called positive feedback (Pierson, 2004). Pierson (2004) defines path dependency as 'social processes that exhibit positive feedback and thus generate branching patterns of historical development' (p. 21). This self-reinforcement mechanism is based on two key elements: the costs of switching from one alternative to another increase over time, and the timing (when things happen) matters. Put simply, earlier choices going in a particular direction make it complicated to reverse the course of action, which means that alternative possibilities will be fewer later on. Therefore, deciding how to manage a disaster risk today is influenced by past strategies, and also affects how disaster risks will be managed in the future. The increasing costs of reversing an earlier course of action come from (sometimes massive) monetary investments, but not exclusively. For example, the cognitive search capacities for alternatives are inevitably influenced and framed by previous choices (Magnusson & Ottosson, 2009), for instance as regards targeted R&D. This means that the capacities of future decision-makers to imagine different solutions are partly determined by the implementation of past strategies.

It is important to note that path dependency is not necessarily considered a problematic phenomenon. It can, for instance, offer opportunities for dynamic efficiency and accumulate returns on investment, as well as help decision-makers deal with uncertainties (Magnusson & Ottosson, 2009), which are legion in disaster risk management. Simply put, it is an essential mechanism that can promote or hinder sustainable development, especially through its inter-generational integration dimension since the choices of today frame potential choices in the future, and by extension the wellbeing of future generations.

The theory of path dependency could be applied to various features of disaster risks and their management, in general terms the path dependency of the management itself, and the path dependency of the drivers of its three components: hazard, vulnerability and exposure. Various examples of path dependency

in disaster risk management can be found in the literature. I will use the case of flood risk management here as an illustration. The path dependency is more or less strong (or stable) depending on what country we are looking at (Liefferink et al., 2018). Various mechanisms can explain the path dependency of flood risk management in Europe. Liefferink et al. (2018) identify clusters of stability forces that reinforce each other: the infrastructure cluster groups high transitional costs and strongly established discourses, and the responsibilities cluster groups elements dealing with the responsibility of flood risk governance such as coordination effects, laws, and adaptive expectation. Marshall and Alexandra (2016) also underline costs and how they create lock-ins in environmental water recovery management. For van Buuren, Ellen, and Warner (2016), the path dependency of the Dutch flood risk governance is characterised by three patterns: mobilising enough resources at the right time to change the path is complicated, learning about the possibilities of new policies is hindered by their framing in the old paradigm, and power asymmetries are reinforced because of the way in which flood issues are presented. Parsons et al. (2019) also show how power asymmetries underpin the institutional exclusion of some specific communities, which renders the New Zealand river management path dependent by privileging a 'Western' scientific understanding and colonial representations over Maori values.

The management of other disaster risks has also been shown as path-dependent, such as, for examples, climate-related risks (see, e.g. Barnett et al. (2015) and Bardsley, Palazzo, and Pütz (2018)) and wildfires (see, e.g. Calkin, Thompson, and Finney (2015)). Some of these studies demonstrate how path dependency in disaster risk management can be valuable, for instance in relation to innovations that help agricultural practices adapt to climate change (Bardsley et al., 2018), while others show how harmful it can be, for example in the case of maladaptation to forest fires that provokes new forest fires, which encourage more maladaptation (Calkin et al., 2015). Therefore, the context affects path dependency's contribution or hindrance to sustainable development.

It is important to note that the path dependency of actions in disaster risk governance does not mean that the strategies do not evolve at all over time. As an illustration, incremental changes in California's groundwater management policies are based on and a result of path dependency (Dennis et al., 2020). Usually, the study of path dependency looks back to the past and asks what decisions have laid out the path for today. However, when it comes to contributions of disaster risk management to sustainable development, it can be relevant to turn the concept of path dependency into a forward-looking tool. The choices made today frame the possibilities of choices that will be available tomorrow, and thus the capacities of future generations to cover their own needs since 'our future arises from our present day actions just as today's reality has flowed from generations of actions before us' (Dhillon, Keene, & Parsons, 2020, p. 261).

In addition to the path dependency of disaster risk management strategies, the components of disaster risks are themselves path-dependent, which affects in turn future disaster risk management. On the one hand, society is facing an increasingly hazardous world partially due to climate change, as it is now recognised with high confidence that climate change is a driver of the intensity and frequency of extreme meteorological events (IPCC, 2022). To put it simply, because of climate change there is an increase in the frequency and intensity of certain hazards, and the actions taken to adapt to future disasters and recover from current ones can themselves be a source of emissions of greenhouse gases and therefore contribute to climate change. On the other hand, there are self-reinforcement mechanisms that lead some people or assets to be more exposed and more vulnerable than others to disaster risks, and when a disaster indeed strikes, the health impacts and losses of assets render the people and places even more vulnerable to the next disaster risk. For instance, Duvat et al. (2021) show the accumulating pattern linked to cascading effects and path dependency of exposure and vulnerability to climate-related hazards on Saint-Martin Island. The complex interrelationships between different drivers, including historical ones, lead to the propagation and amplification of risks and disasters over time (Duvat et al., 2021). Another example is given by Preston (2013), who explores the path dependency of socio-economic exposure to climate extremes and its relationship to physical vulnerability in the United States and concludes that 'the ultimate driving force underlying the increase in losses . . . is path dependence in the settlement of hazardous landscapes, which is a key determinant of socioeconomic exposure to extreme events' (Preston, 2013, p. 729).

Figure 6.3 summarises some examples of path dependency in relation to disaster risks and their management. Since the management of today impacts the one of tomorrow, both directly and indirectly (through the hazard, vulnerability and exposure), this path dependency phenomenon influences the contributions of disaster risk management to sustainable development as it affects how future generations will be able to choose their own disaster risk governance that will consequently affect their wellbeing.

The relationship between disaster risk management and sustainable development illustrated here by the mechanism of transfers of risks and the mechanism of path dependency is a reason – if one is needed – to evaluate disaster risk management strategies, and specifically their contributions to sustainable development, which may not be as straightforward as one could think.

Suggestions for evaluation

Evaluators are increasingly expected to address the sustainability of the evaluand (Julnes, 2019). The limited understanding of the OECD-DAC criterion named sustainability has been challenged (Patton, 2019b) because its definition refers

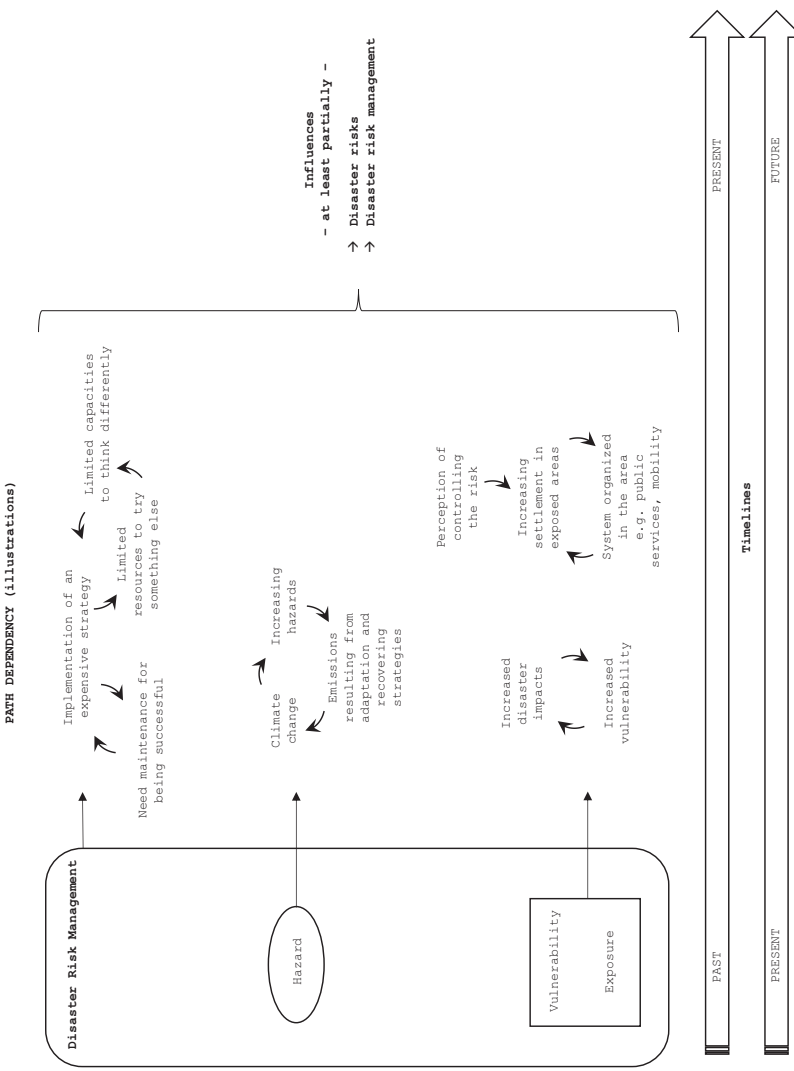

Figure 6.3 Illustrations of path dependency mechanisms in disaster risk management.

more to the durability of the activities rather than englobing the various perspectives included in the term 'sustainability'. Without entering a debate about its meaning or what it should cover, I note that the OECD-DAC criterion called sustainability is about the *sustainability of impacts* while the point of this chapter is to discuss *impacts on sustainability*. Therefore, the OECD-DAC criterion measures a different aspect than the object of this chapter, and the two are not mutually exclusive.

Given the primordial role of disaster risk management for sustainable development described earlier, this part develops some suggestions for evaluation. As an editor of this book aptly pointed out (personal communication, 2022), disaster risk management is not a recurrent theme at evaluation conferences, compared to other policy fields such as education or social programs. Yet, Uitto (2021) shows that evaluation has to be adapted to a hazardous world. Therefore, I will now develop some thoughts on how to evaluate disaster risk management to inform future choices of strategies that will contribute as much as possible to sustainable development. The complexity described in the previous part highlights some aspects that need to be taken into consideration while evaluating disaster risk management, whether at the governance, policy, intervention or project levels. Even though disaster risk management is a specific field, its evaluation can be framed by existing evaluation frameworks that are adapted to the complexity and systemic aspects of disaster risk management.

Before getting into the substance of this part, it is important to note that evaluation of disaster risk management can refer to different objects of evaluation, for instance, policies and programs, specific projects or initiatives, and that we often speak about strategies in disaster risk literature, which is considered here as the umbrella term. As much as in other fields, evaluation methodologies should be adapted to the specific context of the evaluand.

It is possible to look at the contributions (positive and/or negative) of a strategy through the different targets of sustainable development, which represent the horizontal integration of sustainable development. Some will regard it in terms of impacts on economic, environmental and social assets. Some will consider impacts on the economy, ecology and equity, and someone else will prefer looking at the impacts on people, planet and profits, or perhaps people, prosperity, planet, peace and partnership. All these different views have in common the aim to categorise sustainability in 'smaller' pieces in order to look at them more or less independently, even though they are not actually independent. Uitto (2019) notes that evaluation practices have been focusing mostly on social and economic aspects, often leaving environmental issues aside. Yet, Chelimsky (2019) suggests accepting and taking into consideration the pluralism of public interest values rather than choosing among them. A single disaster risk management strategy can affect all sustainable development facets, intentionally or not, and directly or indirectly, through, for instance, a transfer of risks, which is an illustration of this complexity.

Complexity is something evaluators often care about and aim to acknowledge and take into consideration in their evaluations (Patton, 2021). While system theory and complexity science have been considered in the recent evolution of program evaluation, and theoretical discussions are held in the evaluation communities, few implement system thinking in evaluation in practice (Lemire, Peck, & Porowski, 2020). Yet, some practical ideas to apply system thinking can be found in the literature, such as Koleros (2021) suggesting the use of several actor-based theories of change in order to illustrate the complexity of the system in which the evaluand takes place. To find out changes in disaster risks and to assess transfers of risks, a potential tool is to develop riskscapes. Riskscapes constitute pictures of all the risks in a certain place at a certain moment, and they describe all the potential damages of the hazards associated with that place (Khan, 2012). By establishing riskscapes before and after an intervention, it may be possible to discuss which one is the most suitable for sustainable development based on a set of criteria to be defined. The two tools (actor-based theories of change and riskscapes) can reveal conflicting impacts on sustainable development.

Indeed, it is complicated to judge the contribution of a strategy to sustainability when it has positive effects on one aspect of sustainable development and negative effects on another aspect, as can happen with transfers of risks. Since sustainable development is such a broad concept and integrates at least the three dimensions developed in the introduction, which themselves can be divided into categories (such as the horizontal dimension, which includes various targets as described earlier), it is most likely that a disaster risk management strategy will contribute positively to some elements and negatively to others. This adds to the complexity of judging long-term and unintended effects in general. Evaluations that aim at supporting sustainability have to deal with managing trade-offs and conflicting goals of sustainable development (Julnes, 2019). It might be the case that for a specific strategy, some aspects of sustainability are clearly prioritised, like the social issues for example, while in some others the environmental perspectives are predominant. A suggestion is to establish a clear decision process to choose the hierarchy of sustainability elements with inputs from the stakeholders, in order to facilitate understanding of the evaluation results related to the contributions to sustainable development. It can also be relevant to set a threshold under which none of the negative contributions should go, like a maximum level of accepted harm in each aspect of sustainable development in order to impact the other aspects positively. Going back to the example in which a protection strategy necessitates important building work and so produces a large amount of emissions (and thus contributes to climate change and therefore hinders sustainability); what level of emissions is acceptable in order to save current and future lives, given that the project aims at reducing the long-term risk? Is there a maximum amount of emissions that should not be reached, no matter the direct benefits in terms of

disaster risk reduction? These questions mirror the complex issues related to transfers of risks.

The transfers of risks mechanism also points out the impacts on ecosystems, since the risk can be transferred from human actors and assets to non-human living entities and nature, which raises the question of spatial and temporal scales of the evaluation. Since human and non-human systems are interrelated, the impacts of disaster risk management on ecosystems should be assessed when evaluating the contributions to sustainable development. However, the spatial and temporal scales of human systems and natural systems are most of the time different (Rowe, 2019; Uitto, 2019). Rowe (2019) explains that it is easier to delimitate spatial scales for human systems, thanks to different levels of governmental entities for instance, while ecosystem boundaries do not fit this kind of delimitation, and that temporal scales of natural systems are various and usually do not fit the temporality of the intervention or program. To face this additional complexity, Rowe (2019) encourages evaluators to use a two-systems evaluand, which takes into account both the natural system and the human one, without forgetting that the natural system is multi-species. Moreover, disaster risk management has its own specific spatial and temporal frames, which vary depending on the type of disaster and the type of management strategy. For instance, Simpson et al. (2016) show how the warning time and the spatial scale vary for different types of natural hazards. Therefore, evaluations should consider the relevant spatial and temporal frames for both the human and the natural systems, as well as the ones of the evaluated disaster risk and its management. To add to this already highly complex situation, there is an interplay of slow-moving and fast-moving variables in complex systems (Koleros, 2021) that evaluations of disaster risk management need to consider.

Moreover, as has been indicated earlier in the section on path dependency, evaluators concerned with the contributions of disaster risk management to sustainable development should wonder what path is opened or reinforced for the future: is it a path that goes in the direction of sustainability? Integrating reflections on the long term and the types of change can help evaluators formulate answers to that question. Indeed, long-term perspectives can assist evaluators to detect path dependency, among other things (Forss, Lindkvist, & McGillivray, 2021). Knowing if the choice of today will reinforce a certain path requires identifying the mechanisms that create path dependency, instead of focusing only on temporal links between choices by describing how one policy is related to the previous one (Pierson, 2004). The type of identified change is also important. It can be developmental, transitional or transformational; planned or emerging; episodic or continuous; gradual or punctuational; radical-incremental or core-peripheral (Forss, 2021). According to Forss (2021), identifying the type of change can help evaluators understand possible long-term impacts. By extension, such analysis provides information on the contributions to sustainable development, whether they are positive or negative, intended or unintended, direct or indirect.

Integration of the study of transfers of risks and path dependency in the evaluation of disaster risk management strategies can benefit from using existing evaluation frameworks that take a complex system perspective. I will mention here only a few examples and a few illustrations of some selected principles and key questions, and I do not claim that it is an exhaustive list, but it might spark ideas for interested practitioners.

The first one is Blue Marble Evaluation (Patton, 2019a) which groups 15 principles to evaluate system transformation. It is of particular relevance when including consideration of transfers of risks during the evaluation of disaster risk management. Indeed, considering the transfers of risks is fitting in relation to the global thinking principle, and the cross-silo and transboundary principles, since disaster risks and their management are interconnected.

Another potential approach is Footprint Evaluation (BetterEvaluation, 2022), which focuses on integrating environmental sustainability in all evaluations. Footprint Evaluation differs from Blue Marble Evaluation in its scope: it aims at integrating issues of environmental sustainability into any type of evaluation, not only system changes but also 'traditional' projects or programs, even if they do not present specific goals for environmental protection. It is therefore relevant for the evaluation of disaster risk management strategies, since those are usually aimed at the protection of humans and their livelihood and not of nature and non-human entities. Key questions refer to the impacts of a strategy on coupled human and natural systems to highlight environmental consequences. As discussed earlier, transfers of risks can occur from human to natural systems, and therefore the system thinking promoted by Footprint Evaluation as one of its principles is relevant. To expand spatial and temporal framing is one of the other principles of Footprint Evaluation, and it is an essential step to be able to point out transfers of risks on different territories and in the future, as well as to identify path dependency in the long term.

A third example is the framework called Visionary Evaluation (Parsons, Dhillon, & Keene, 2020). It encourages the evaluator's commitment to sustainable and equitable futures, and since disaster risk management can promote or hinder sustainable development, Visionary Evaluation can be a relevant framework. Among its principles is to recognise the world as composed of living, entangled systems and to discover, reveal and respect intersectionalities. These principles are directly relevant both to the mechanism of transfers of risks and to the one of path dependency. As part of Visionary Evaluation, Norman (2020) promotes the use of foresight methodologies to help evaluators to design the future. These methodologies result in suggesting what the future could be like based on current and past trends. They do not aim at giving a full and exact picture based on a guess but rather at showing how things could evolve under current trends. It may be a useful tool for evaluating the path dependency of disaster risk management. The past trends of path dependency mechanisms in disaster risk management, combined with more general trends of societal evolution (such

as the increase of risks due to, for instance, climate change, population growth and urbanisation), can give an indication of how the current way of managing risks will impact future strategies.

Concluding remarks

Disaster risk management can contribute to or hinder sustainable development, and therefore the evaluation of management strategies should include an analysis of their impacts on sustainable development. I have highlighted two mechanisms in this chapter: transfers of risks and path dependency. Both affect sustainability, at least through one of the three main elements of sustainable development: targets, territories and time. Transfers of risks illustrate the situation in which reducing one disaster risk provokes the increase or creation of another, which can in turn threaten different people, assets or non-humans, in a different spatial scale and a different time frame. Path dependency is a phenomenon in which self-reinforcement mechanisms frame subsequent choices based on previous ones. It affects the components of disaster risks (hazard, vulnerability, exposure), as well as their management. These two mechanisms underline the importance of using complex and system theories in the evaluation of disaster risk management, and existing evaluation tools and frameworks can guide evaluators in this task.

This chapter is a conceptual work, and therefore its goal is to inform and guide practices, but it cannot, in any case, replace the real-situation experiences of evaluators. The ideas developed concerning the mechanisms of transfers of risks and path dependency need to be tested and improved with empirical data, and the evaluative tools have to be adapted to the local context of the evaluation. Further studies could develop a related aspect of disaster risk management evaluation, which is the nexus between disaster risk management and the justice theory branch of evaluation (see Alkin (2013) about the theory branches of evaluation in general and Mertens and Wilson (2018), who identify social justice as separated from the value branch). Justice, understood as fairness, is a central issue of sustainable development that evaluations need to consider (Segone & Kalugampitiya, 2016). Path dependency and transfers of risks raise questions of distributive justice: is it fair to increase a risk for some people in order to reduce one for other people? Or to transfer a risk from one place to another? Is it fair that some people indirectly benefit from a disaster risk management strategy that was not targeted at them, while some others are negatively affected by the same strategy? Is it fair to limit future disaster risk management possibilities in order to apply a strategy to reduce the current disaster risks? Is it fair to implement a strategy today that will force future generations to maintain it because it would cost too much to terminate it? We can notice in these few examples of questions about fairness that they concern both the distribution of the burdens of the disaster risks themselves and the distribution of the benefits and burdens of

their management. Various aspects of justice are important issues in disaster risk management, and a transparent and honest discussion about them can help disaster risk management to contribute to sustainable development. These aspects concern at least distributive, corrective and procedural justice in four overlapping dimensions related to sustainable development: social, ecological, spatial and temporal issues (de Goër de Herve, Schinko, & Handmer, 2023). Analysing and discussing these concerns when evaluating disaster risk management is a way to learn and encourage its contribution to sustainable development. In turn, working on justice issues in disaster risk management evaluation can also inform policy evaluation in general and develop the justice branch of evaluation theory. Evaluation of disaster risk management can learn from evaluation theory and practice in general, and policy evaluation in general can learn from disaster risk management evaluation specifically, which is why the exchange between actors in these two fields can only be encouraged and expected to benefit both parties.

Note

1 Graham and Wiener (1995) consider risk transfer being one specific type of risk trade-off characterised by two elements: (i) a similar type of target and countervailing risks and (ii) a different population affected by the countervailing risk in comparison to the target risk. In this chapter, I use a different terminology in which transfers of risks can be characterised either by a change of hazard, exposure, or vulnerability, or by a combination of those elements.

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References

Alkin, M. C. (2013). *Evaluation Roots: A Wider Perspective of Theorists' Views and Influences* (Second ed.). Los Angeles: SAGE Publications, Inc.

Bardsley, D. K., Palazzo, E., & Pütz, M. (2018). Regional path dependence and climate change adaptation: A case study from the McLaren Vale, South Australia. *Journal of Rural Studies*, *63*, 24–33. doi:10.1016/j.jrurstud.2018.08.015

Barnett, J., Evans, L. S., Gross, C., Kiem, A. S., Kingsford, R. T., Palutikof, J. P., Pickering, C. M., & Smithers, S. G. (2015). From barriers to limits to climate change adaptation: Path dependency and the speed of change. *Ecology and Society*, *20*(3). doi:10.5751/ES-07698-200305

BetterEvaluation. (2022). *Footprint evaluation*. Retrieved from www.betterevaluation.org/en/themes/footprint_evaluation [last access: November 2022].

Calkin, D. E., Thompson, M. P., & Finney, M. A. (2015). Negative consequences of positive feedbacks in US wildfire management. *Forest Ecosystems*, *2*(1). doi:10.1186/s40663-015-0033-8

Chelimsky, E. (2019). Improving the match between sustainability questions and evaluation practice: Some reflections and a checklist. *New Directions for Evaluation*, *2019*(162), 69–86. doi:10.1002/ev.20363

De Angeli, S., Malamud, B. D., Rossi, L., Taylor, F. E., Trasforini, E., & Rudari, R. (2022). A multi-hazard framework for spatial-temporal impact analysis. *International Journal of Disaster Risk Reduction*, *73*, 102829. doi:10.1016/j.ijdrr.2022.102829

de Goër de Herve, M., Schinko, T., & Handmer, J. (2023). Risk Justice: Boosting the contribution of risk management to sustainable development. *Risk Analysis*, 1–15. doi:10.1111/risa.14157

Dennis, E. M., Blomquist, W., Milman, A., & Moran, T. (2020). Path dependence, evolution of a mandate and the road to statewide sustainable groundwater management. *Society and Natural Resources*, *33*(12), 1542–1554. doi:10.1080/08941920.2020.1772926

Dhillon, L., Keene, M., & Parsons, B. (2020). Conclusion: Living as a Visionary Evaluative. In B. Parsons, L. Dhillon, & M. Keene (Eds.), *Visionary Evaluation for a Sustainable, Equitable Future*. Charlotte, NC: Information Age Publishing, Inc.

Duvat, V. K. E., Volto, N., Stahl, L., Moatty, A., Defossez, S., Desarthe, J., Grancherm, D., & Pillet, V. (2021). Understanding interlinkages between long-term trajectory of exposure and vulnerability, path dependency and cascading impacts of disasters in Saint-Martin (Caribbean). *Global Environmental Change*, *67*, 102236. doi:10.1016/j.gloenvcha.2021.102236

Forss, K. (2021). From Measuring Impact to Understanding Change. In K. Forss, I. Lindkvist, & M. McGillivray (Eds.), *Long Term Perspectives in Evaluation: Increasing Relevance and Utility*. New York and Oxon: Routledge.

Forss, K., Lindkvist, I., & McGillivray, M. (Eds.). (2021). *Long Term Perspectives in Evaluation: Increasing Relevance and Utility*. New York and Oxon: Routledge.

GFDRR. (2016). *The Making of a Riskier Future: How Our Decisions are Shaping Future Disaster Risk*. Washington, USA: Global Facility for Disaster Reduction and Recovery.

Graham, J. D., & Wiener, J. B. (Eds.). (1995). *Risk vs. Risk: Tradeoffs in Protecting Health and the Environment*. Cambridge, Massachusetts and London, England: Harvard University Press.

Hansen, S. F., Von Krauss, M. K., & Tickner, J. A. (2008). The precautionary principle and risk-risk tradeoffs. *Journal of Risk Research*, *11*(4), 423–464. doi:10.1080/13669870801967192

International Energy Agency. (2018). *The Future of cooling: Opportunities for energy-efficient air conditioning*. Retrieved from www.oecd-ilibrary.org/energy/the-future-of-cooling_9789264301993-en [last access: November 2023].

IPCC. (2012). *Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation: A Special Report of Working Groups I and II of the Intergovernmental Panel on Climate Change* [Field, C. B., Barros, V., Stocker, T. F., Qin, D., Dokken, D. J., Ebi, K. L., Mastrandrea, M. D., Mach, K. J., Plattner, G.-K., Allen, S. K., Tignor, M., & Midgley, P. M. (editors)]. Cambridge, UK and New York, NY, USA: Cambridge University Press.

IPCC. (2022). Summary for Policymakers. In H.-O. Pörtner, D. C. Roberts, M. Tignor, E. S. Poloczanska, K. Mintenbeck, A. Alegría, M. Craig, S. Langsdorf, S. Löschke, V. Möller, A. Okem, & B. Rama (Eds.), *Climate Change 2022: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the*

Intergovernmental Panel on Climate Change (pp. 3–33). Cambridge, UK and New York, NY, USA: Cambridge University Press.

Julnes, G. (2019). Evaluating sustainability: Controversies, challenges, and opportunities. *New Directions for Evaluation*, *2019*(162), 13–28. doi:10.1002/ev.20361

Khan, S. (2012). Disasters: Contributions of hazardscape and gaps in response practices. *Natural Hazards and Earth System Science*, *12*(12), 3775–3787. doi:10.5194/nhess-12-3775-2012

Kitagawa, K. (2021). Connecting Disaster Risk Reduction, Climate Change and Sustainable Development. In *Transforming Universities for a Changing Climate, Working Paper Series No. 2*. London: Climate-U.

Koleros, A. (2021). Using a Wide Lens to Take a Long View: How Integrating Systems Thinking into Evaluations Can Assist in Taking a Long-Term Perspective. In K. Forss, I. Lindkvist, & M. McGillivray (Eds.), *Long Term Perspectives in Evaluation: Increasing Relevance and Utility*. New York and Oxon: Routledge.

Lemire, S., Peck, L. R., & Porowski, A. (2020). The growth of the evaluation tree in the policy analysis forest: Recent developments in evaluation. *Policy Studies Journal*, *48*(S1), S47–S70. doi:10.1111/psj.12387

Liefferink, D., Wiering, M., Crabbé, A., & Hegger, D. (2018). Explaining stability and change. Comparing flood risk governance in Belgium, France, the Netherlands, and Poland. *Journal of Flood Risk Management*, *11*(3), 281–290. doi:10.1111/jfr3.12325

Lofstedt, R., & Schlag, A. (2017). Risk-risk tradeoffs: What should we do in Europe? *Journal of Risk Research*, *20*(8), 963–983. doi:10.1080/13669877.2016.1153505

Machac, J., Hartmann, T., & Jilkova, J. (2018). Negotiating land for flood risk management: Upstream-downstream in the light of economic game theory. *Journal of Flood Risk Management*, *11*(1), 66–75. doi:10.1111/jfr3.12317

Magnusson, L., & Ottosson, J. (2009). Path Dependence: Some Introductory Remarks. In L. Magnusson, & J. Ottosson (Eds.), *The Evolution of Path Dependence. New Horizons in Institutional and Evolutionary Economics* (pp. 1–18). Cheltenham: Edward Elgar Publishing Limited.

Marshall, G. R., & Alexandra, J. (2016). Institutional path dependence and environmental water recovery in Australia's Murray-Darling Basin. *Water Alternatives*, *9*(3), 679–703.

Martinuzzi, A., & Meyer, W. (2016). Evaluating Sustainable Development in a Global Society. In R. Stockmann, & W. Meyer (Eds.), *The Future of Evaluation: Global Trends, New Challenges, Shared Perspectives* (pp. 81–94). London: Palgrave Macmillan.

Mertens, D. M., & Wilson, A. T. (2018). *Program Evaluation Theory and Practice: A Comprehensive Guide* (Second ed.). New York: The Guilford Press.

Nilson, F., & de Goër de Herve, M. (2023). Exploring the transfer of risks. *Safety Science*, *166*, 106240. doi:10.1016/j.ssci.2023.106240

Norman, C. (2020). Design: Creating the Future We Want. In B. Parsons, L. Dhillon, & M. Keene (Eds.), *Visionary Evaluation for a Sustainable, Equitable Future*. Charlotte, NC: Information Age Publishing, Inc.

Parsons, B., Dhillon, L., & Keene, M. (Eds.). (2020). *Visionary Evaluation for a Sustainable, Equitable Future*. Charlotte, NC: Information Age Publishing, Inc.

Patton, M. Q. (2019a). *Blue Marble Evaluation: Premises and Principles*. New York: The Guilford Press.

Patton, M. Q. (2019b). Transformation to global sustainability: Implications for evaluation and evaluators. *New Directions for Evaluation*, *2019*(162), 103–117. doi:10.1002/ev.20362

Parsons, M. Q., Nalau, J., Fisher, K., & Brown, C. (2019). Disrupting path dependency: Making room for indigenous knowledge in river management. *Global Environmental Change*, *56*, 95–113. doi:10.1016/j.gloenvcha.2019.03.008

Patton, M. Q. (2021). How far dare an evaluator go toward saving the world? Redux, update, and a reflective practice facilitation tool. *American Journal of Evaluation*, *42*(2), 162–184. doi:10.1177/1098214020927095

Pescaroli, G., & Alexander, D. (2018). Understanding compound, interconnected, interacting, and cascading risks: A holistic framework. *Risk Analysis*, *38*(11), 2245–2257. doi:10.1111/risa.13128

Pierson, P. (2004). *Politics in Time: History, Institutions, and Social Analysis*. Princeton and Oxford: Princeton University Press.

Preston, B. L. (2013). Local path dependence of U.S. socioeconomic exposure to climate extremes and the vulnerability commitment. *Global Environmental Change*, *23*(4), 719–732. doi:10.1016/j.gloenvcha.2013.02.009

Priest, S., Suykens, C., van Rijswick, H. F. M. W., Schellenberger, T., Goytia, S., Kundzewicz, Z., van Doorn-Hoekveld, W. J., Beyers, J.-C., & Homewood, S. (2016). The European union approach to flood risk management and improving societal resilience: Lessons from the implementation of the floods directive in six European countries. *Ecology and Society*, *21*(4). doi:10.5751/ES-08913-210450

Ramage, M., & Shipp, K. (2009). *System Thinkers*. London, UK: Springer.

Rowe, A. (2019). Sustainability-ready evaluation: A call to action. *New Directions for Evaluation*, *2019*(162), 29–48. doi:10.1002/ev.20365

Sarabia, M. M., Kägi, A., Davison, A. C., Banwell, N., Montes, C., Aebischer, C., & Hostettler, S. (2020). The challenges of impact evaluation: Attempting to measure the effectiveness of community-based disaster risk management. *International Journal of Disaster Risk Reduction*, *49*, 101732. doi:10.1016/j.ijdrr.2020.101732

Segone, M., & Kalugampitiya, A. (2016). Foreword. In R. Stockmann, & W. Meyer (Eds.), *The Future of Evaluation: Global Trends, New Challenges, Shared Perspectives* (pp. x–xii). London: Palgrave Macmillan.

Simpson, M., James, R., Hall, J. W., Borgomeo, E., Ives, M. C., Almeida, S., Kingsborough, A., Economou, T., Stephenson, D., & Wagener, T. (2016). Decision analysis for management of natural hazards. *Annual Review of Environment and Resources*, *41*, 489–516. doi:10.1146/annurev-environ-110615-090011

Stake, B. (2004). How far dare an evaluator go toward saving the world? *American Journal of Evaluation*, *25*(1), 103–107. doi:10.1177/109821400402500108

Uitto, J. I. (2019). Sustainable development evaluation: Understanding the nexus of natural and human systems. *New Directions for Evaluation*, *2019*(162), 49–67. doi:10.1002/ev.20364

Uitto, J. I. (2021). Confronting storms, fires and pestilence: Meaningful evaluation for a hazardous world. *Evaluation Matters – He Take Tō Te Aromatawai*, *7*, 96–126. doi:10.18296/em.0068

UNDRR. (2017). *Terminology: Online glossary*. Retrieved from www.undrr.org/terminology [last access: November 2022].

UNDRR. (2019). *Global Assessment Report on Disaster Risk Reduction*. Geneva, Switzerland: United Nations Office for Disaster Risk Reduction.

United Nations. (2015). *Sendai Framework for Disaster Risk Reduction 2015–2030*. Geneva, Switzerland: UNISDR.

UNU-EHS. (2021). *Interconnected Disaster Risks* [O'Connor, J., Eberle, C., Cotti, D., Hagenlocher, M., Hassel, J., Janzen, S., Narvaez, L., Newsom, A., Vargas, A. O., Schütze, S., Sebesvari, Z., Sett, D., & Walz, Y. (authors)]. Bonn, Germany: United Nations University – Institute for Environment and Human Security (UNU-EHS).

van Buuren, A., Ellen, G. J., & Warner, J. F. (2016). Path-dependency and policy learning in the Dutch delta: Toward more resilient flood risk management in the Netherlands? *Ecology and Society*, *21*(4). doi:10.5751/ES-08765-210443

van den Berg, R. D., Magro, C., & Mulder, S. S. (2019). Introduction: Bringing Challenges for Evaluation for Transformational Change from Guanajuato to Prague. In R. D. van den Berg, C. Magro, & S. S. Mulder (Eds.), *Evaluation for Transformational Change: Opportunities and Challenges for the Sustainable Development Goals* (pp. 1–15). Exeter: United Kingdom: International Development Evaluation Association (IDEAS).

World Commission on Environment and Development. (1987). *Our Common Future*. Oxford, UK: Oxford University Press.