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Research Article



Identifying different frames of resilience–vulnerability nexus in disaster study

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ABSTRACT

The purpose of this article is to investigate how vulnerability and resilience have been constructed in the disaster literature to unpack the resilience–vulnerability nexus. This study identifies four different frames of the resilience–vulnerability nexus in the disaster literature: opposite, overlap, separate, and inclusion. It points out that the concepts of disaster resilience and vulnerability share some conceptual underpinnings but have incompatible conceptualizations in their emerging phases, states, diving mechanisms, relationships with hazards, and modes of depiction. Accordingly, we suggest that it is theoretically possible to reframe disaster vulnerability and resilience as gradable antonyms, at least in the dimension of capacity or loss potential. We note how there has been little theoretical work addressing the resilience–vulnerability nexus within the field of disaster research. The arguments presented in this article thus have the potential to aid disaster researchers and disaster risk reduction (DRR) practitioners who might be confused regarding the relationship between resilience and vulnerability. This study may also be conducive to bridging the gap between academic study and DRR practice by facilitating dialog between the disaster vulnerability and resilience research communities.

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Vulnerability; resilience; nexus; disaster study; disaster risk reduction (DRR)

1. Introduction

The naturalization of disasters is very common in the public imagination and policy-making (Marino & Faas, 2020; Sun & Faas, 2018). However, nearly every scholar in the field of disaster research continues to be informed that so-called ‘natural’ disasters are not natural (O’Keefe, Westgate, & Wisner, 1976). Disaster researchers have been making tremendous efforts to divide natural hazards from disasters since the 1970s. They argue that disasters are socially produced or social constructs (Sun & Faas, 2018). Natural hazards, such as earthquakes and floods, are just disaster triggers or risk drivers (Wisner et al., 2004).

Existing studies emphasize that social vulnerability partially determines what hazards will become and whether they will become disasters (Cutter, Boruff, & Shirley, 2003; Wisner et al., 2004). Namely, the vulnerabilities produced by human actions and social

processes are the fundamental causes of disasters. Accordingly, scholars, especially those in social science communities, have emphasized that disasters cannot be reduced by focusing solely on natural hazards (Birkmann et al., 2013; O'Keefe et al., 1976). In most cases, reducing vulnerability might be more important because hazards are hard to control.

This vulnerability paradigm is influential and has constituted the conceptual core of disaster sociology (e.g. Tierney, 2007), disaster geography (e.g. Cutter et al., 2003), disaster anthropology (e.g. Marino & Faas, 2020; Oliver-Smith, 1996), and other disaster-related disciplines (e.g. McEntire, Fuller, Johnston, & Weber, 2002) for several decades. Currently, it continues to attract strong theoretical and empirical attention and is still considered a useful theoretical construct to guide disaster risk reduction (DRR) practices. However, recently, vulnerability has had to share space with another popular paradigm—disaster resilience. As this resilience discourse continues to exert growing influence on disaster studies, disaster researchers have inevitably encountered a theoretical question regarding the conceptual relationship between vulnerability and resilience.

Accordingly, in this article, we argue that exploring the resilience–vulnerability nexus is vital for refining both disaster studies and DRR practices. First, the concepts of vulnerability and resilience denote ways of conceptualizing the relationship between natural hazards and human society. They thus further respond to the classic puzzle in the field of disaster research, i.e. ‘what is disaster?’ (Quarantelli, 1999). For example, they explore whether human actions, physical phenomena, or their interactions are the fundamental causes of disasters. Second, developing a more holistic understanding of resilience and vulnerability fosters merging these two areas of disaster research and transforms disaster study into a stronger discipline with more logical self-consistency. Third, a theoretical consideration of the resilience–vulnerability nexus can better inform DRR policies. Different understandings of this relationship may result in increasing confusion when undertaking DRR policies and governance interventions (Aldunce, Beilin, Handmer, & Howden, 2014; Sanchez, Jeroen, & Osmond, 2018). Through this kind of study, policy-makers can thus gain insight into whether vulnerability-reduction and resilience-enhancement practices can reflect the same policy objective.

However, although disaster vulnerability and resilience have attracted a great deal of scholarly attention, for a variety of reasons, there has been little theoretical research on their relationship (Bergstrand, Mayer, Brumback, & Zhang, 2015). For example, Miller et al. (2010) argue that resilience research is more strongly influenced by positivist approaches, while most members of vulnerability communities are followers of a constructivist tradition. Epistemological tension therefore contributes to the lack of dialog between vulnerability research and resilience communities (Miller et al., 2010). Kelman, Gaillard, Lewis, and Mercer (2016) state that developing an unambiguous relationship is not straightforward due to the various definitions and boundaries in the disciplinary mindset. In addition, various dimensions of vulnerability and resilience (e.g. physical, social, and cultural) and numerous interconnected and dynamic relevant factors (e.g. demography, beliefs, and materials) also increase the difficulty of discussion (Birkmann et al., 2013; Manyena, 2006; Ryder, 2017). Hence, exploring the processes behind the formation of resilience and vulnerability is challenging. In most cases, the two terms are used by different scholars and DRR practitioners according to their own ‘term of convenience’ (Rashid, 2013).

Accordingly, this article explores the resilience–vulnerability nexus in the context of disasters. Following Manyena (2006) and Fekete, Hufschmidt, and Kruse (2014), we specifically focus on the field of disaster research. We address our research question through a nonsystematic literature review combined with speculative thoughts. We gathered some literature on the construction of resilience and/or vulnerability (e.g. Alexander, 2013; Cutter et al., 2003; Fekete et al., 2014; Ji, Wei, Sim, Yang, & Scheffran, 2021, Sun & Qi, 2023) from different databases such as Web of Science, Google Scholar and Elsevier. After analyzing these sources, we investigated how resilience and vulnerability have been constructed and what kind of resilience–vulnerability nexus can be inferred. We further employed both retrospective (i.e. searching for relevant literature in the reference lists of the reviewed articles) and prospective (i.e. searching for literature that cites the reviewed articles) methods to expand literature. We continually examine various frames of the resilience–vulnerability nexus until we no longer identified any new ones after reviewing several new articles. This article aims to complement the existing limited discussion on the relationship between disaster vulnerability and resilience (e.g. Adger, 2006; Manyena, 2006; Miller et al., 2010) and to provoke further discussion on how to link vulnerability and resilience concepts and theories in disaster scholarship.

We organize this article as follows: Following the introduction, we elaborate the mainstream understanding of vulnerability and resilience in disaster studies (Section 2). In the third section, we identify the relationship between the two concepts using the extant theoretical arguments in disaster studies, i.e. their shared conceptual understandings and sources or exhibitions of incompatible conceptualization. Then, we discuss the impacts of different frames of the resilience–vulnerability nexus on DRR policy design. Finally, we conclude the article with a brief summary of our arguments.

2. Understanding disaster loss through the lenses of vulnerability and resilience

2.1. Disaster vulnerability

Since the 1970s, with the increasing influence of human ecology (Burton et al., 1968; Hewitt, 1983) and more recently, of the theories of environmental justice (Ryder, 2017), social inequality and marginalization (Wisner & Luce, 1993), and political ecology (Garcia-Acosta, 2007; Miller et al., 2010; Tierney, 1989), as well as postcolonial critique of disasters (Sun & Faas, 2018), the notion that disasters have their root causes in society and history has emerged. Some studies thus question the popular assumption that most disasters are due to natural hazards (e.g. earthquakes, tornados, and floods) (Hewitt, 1998). Such studies have been conducted with an emphasis on social structure and social process to explore and interpret why and how disasters happen (Lavell & Maskrey, 2014; Sun & Faas, 2018). Hence, disaster vulnerability theory is becoming increasingly popular.

Before academics conceptualized humans as the causes of vulnerability, some studies had identified hazards and the costs of DRR strategies as the main components of vulnerability (for a review see Anderson, 1995). According to them, people are regarded as vulnerable partly because they are impoverished and live in zones that are prone to hazards. Therefore, high hazard frequency, high hazard magnitude, and long hazard duration

result in high vulnerability. In terms of the cost component, those who cannot afford advocated hazard mitigation measures are also vulnerable. Some of these relevant assertions remain popular today. For example, several recent works have conceptualized hazard as part of vulnerability, although its importance to vulnerability production is decreasing (e.g. Menoni, Molinari, Parker, Ballio, & Tapsell, 2012).

The hazard and cost-related viewpoint, however, cannot effectively explain why the same hazardous event has differential impacts on people who live in the same areas (Anderson, 1995) and why those with the same level of income suffer unequally in a disaster (Wisner & Luce, 1993). Disaster studies have begun to support the new notion that people create vulnerability by including both objective and subjective factors. For example, some people want to live outside a hazard-prone zone but cannot afford to leave it. Nevertheless, in some cases, influenced by intangible cultural factors, some people can afford to leave, but they are simply unwilling to do so. Namely, to a large extent, human actions, decisions, and choices collectively account for disaster vulnerability. Contemporary vulnerability studies have thus further explored the complex and dynamic factors of human actions, decisions, and choices that result in vulnerability. These risk factors (e.g. poverty, fatalism, settlement patterns) that magnify harmful effects in social systems are defined as 'liabilities' by some scholars and are regarded as 'root causes' of vulnerability (McEntire, 2001; Zakour & Gillespie, 2013). For example, Wisner et al.'s political ecology-oriented pressure and release model indicates that such risk factors (root causes) are transformed through dynamic processes into specifically unsafe conditions and further result in disaster vulnerability (Wisner, Blaikie, Cannon, & Davis 2004). Cutter's (1996) human ecology-oriented hazards-of-place model integrates biophysical vulnerability and social vulnerability into place vulnerability. According to this hazards-of-place model, risk and hazard mitigation interact to produce hazard potential, which is filtered through social fabric and geographic context to produce social vulnerability and biophysical vulnerability, respectively, which collectively create place vulnerability (Cutter, Mitchell, & Scott, 2000).

Influenced by the vulnerability perspective, most, if not all, disaster researchers distinguish between disasters and natural hazards. For example, in the influential and oft-cited book *At Risk: Natural Hazards, People's Vulnerability, and Disasters* (Wisner et al., 2004), the authors emphasize that disaster per se originates in social conditions that may be far removed from 'disaster triggers', such as earthquakes or floods. Specifically, studies focusing on the political economy of disasters have argued that underlying political and economic forces operating at different levels (local, regional, and international) contribute to disaster vulnerability (Tierney, 1989; Wisner et al., 2004). As Tierney states (2007, p. 509), 'disasters are episodic, foreseeable manifestations of the broader forces that shape societies'. Wisner et al. (2004, p. 7) also stress that 'vulnerability is determined by social systems and power, not by natural forces'. Similarly, Oliver-Smith (1996, p. 303) describes disaster as 'a process/event involving the combination of a potentially destructive agent(s) from the natural and/or technological environment and a population in a socially and technologically produced condition of vulnerability'.

Methodologically, vulnerability researchers often measure and characterize vulnerability according to the degree of susceptibility or fragility of a system at risk and its capacity to cope with hazardous conditions (Birkmann et al., 2013). For example, using socioeconomic and demographic data, some scholars construct a social vulnerability

index to identify vulnerable populations and predict disaster impacts (Cutter et al., 2003). Moreover, socioeconomic and demographic indicators (e.g. elderly individuals located in seismic fault zones) are used to identify vulnerable communities. The disaster vulnerability concept has therefore been applied to bridge communication between disaster studies and the classic topics of other traditional disciplines. For example, it has linked the disaster literature with other sociological lenses, such as gender, social constructivism, and social inequality theory (Bradshaw & Fordham, 2015; Tierney, 2007). It has also been used to integrate postcolonial critiques and environmental justice studies with disaster research (Sun & Faas, 2018).

Furthermore, Cutter et al. (2003) has divided the topics of vulnerability studies into three categories: vulnerability as an exposure condition that is subject to disturbance; vulnerability as a social condition that measures societal resilience to hazards; and vulnerability as a place-focused integration of hazard exposure and societal resilience. In recent years, a school of thought has emerged that emphasizes that vulnerability is dynamic (Birkmann et al., 2013; Hansson et al., 2020). In contrast to a social reality, some studies have also argued that vulnerability is a social construct, e.g. a Western discourse (Bankoff, 2001). In particular, those who pay attention to the role of a local cultural belief system in disasters argue that outsiders often apply the 'vulnerability' label to indigenous people to justify western intervention (Bankoff, 2001). In summary, although the connotations vary in the various research orientations of and perspectives on disaster vulnerability, vulnerability can generally be regarded as a socially and historically produced condition of insufficient capability and loss potential (Cutter, 1996; Cutter et al., 2003; Kelman et al., 2016; Marino & Faas, 2020; Rashid, 2013).

2.2. Disaster resilience

The concept of resilience emanates from several theoretical sources (Rose, 2004). As in studies on disaster vulnerability, the resilience concept involves incompatible understandings and ongoing conflicts (Aldunce et al., 2014; Alexander, 2013; Bergstrand et al., 2015; Manyena, 2006). While we only focus on the disaster-related literature, contradictions are also common, for example, when resilience refers to predisaster capacity or postdisaster recovery. However, an inconsistent understanding of resilience has not hindered its popularity in the DRR literature. In the last two decades, especially following the release of *Hyogo Framework for Action 2005-2015: Building the resilience of nations and communities to disasters*, 'resilience' has gradually become a widely used term within disaster and DRR research. Additionally, due to its interconnection with some important international topics, such as climate change (Kelman et al., 2016) and sustainable development (Aldunce et al., 2014; Folke et al., 2002; Kelman et al., 2016; Turner, 2010), and the increasing impact of disasters on global society (Bergstrand et al., 2015), resilience has become an international and transdisciplinary 'hot topic', especially in disaster studies (Manyena, 2006).

It is difficult to identify when resilience theory entered disaster discourse (Alexander, 2013). One argument (e.g. Ji et al., 2021) is that Timmerman (1981) may have been the first to adapt the concept of resilience in disaster research. Some scholars suggest that the entry of the concept of 'resilience' into disaster research denotes the birth of a new disaster study culture (Manyena, 2006) or new research paradigm (Aldunce et al., 2014;

McEntire et al., 2002). In contrast to the vulnerability tradition, which focuses on deficiency, resilience research emphasizes the capacities and resources people possess for coping with disasters (Manyena, 2006; Paton & Johnston, 2001; Twigg, 2007). Cutter et al. (2008), for example, argue that the shift from disaster vulnerability to disaster resilience has entailed a noticeable change in the rhetoric regarding hazards because resilience is a more proactive and positive phenomenon. Indeed, the increasing interest in disaster resilience suggests a self-awareness of capacity and a more positive attitude toward the human–environment relationship.

However, due to these disparate intellectual traditions, there is a lack of consensus on the conceptualization of disaster resilience. Furthermore, it was also argued that the connotation of disaster resilience lacks widely-accepted theoretical basis and is not yet at a mature state (Parker, 2020). In an early study by Timmerman (1981, p. 21), resilience is ‘the measure of a system’s, or part of a system’s, capacity to absorb and recover from the occurrence of a hazardous event’. This is a common conceptualization of resilience. Namely, ‘disaster resilience’ refers to a kind of general capacity to resist and/or recover from hazards (Ainuddin & Routray, 2012; Alexander, 2013; Bruneau et al., 2003; Cohen, Leykin, Lahad, Goldberg, & Aharonson-Daniel, 2013; Cutter, Burton, & Emrich, 2010; Manyena, 2006; see also the definitions summarized by Aldunce et al., 2014). For example, in a review by Adger (2006), resilience is referred to as ‘the magnitude of disturbance that can be absorbed before a system changes to a radically different state as well as the capacity to self-organize and the capacity for adaptation to emerging circumstances’. Moreover, the UN/ISDR (2009) define disaster resilience as the ability of a system, community or society that is exposed to disaster-causing factors to resist, absorb and withstand the impact of disasters in a timely and effective manner and to recover from it. In addition, Rose (2004) explicitly distinguishes resilience into two types—inherent resilience (i.e. ability under normal circumstances) and adaptive resilience (i.e. ability in crisis situations due to ingenuity or extra effort). Furthermore, apart from the traditional notion of ‘*bouncing back*’ in resilience conceptualizations (Aldunce et al., 2014), the notion of ‘*bouncing forward with a disaster improvement system*’ has been valued in recent studies (Manyena, O’Brien, O’Keefe, & Rose, 2011; Sanchez et al., 2018).

Recently, systemic properties (e.g. self-organization and postdisaster learning) and dynamic properties (e.g. rapid recovery) have received increasing scholarly attention (Cariolet, Vuillet, & Diab, 2019). Disaster researchers often explore resilience from a systemic perspective. In their view, disaster resilience results from the interaction of the agents in a system (Cariolet et al., 2019). Resilience theory also emphasizes that different dimensions of disaster resilience (e.g. social and economic) are interdependent (Saja, Teo, Goonetilleke, & Ziyath, 2021). It suggests that the human–environment system is complex and has the inner capacity to self-organize and learn from previous experience (Folke et al., 2002; Turner, 2010).

Concerning the drivers and deterrents of resilience, the conditions of a physical system (e.g. built environment and lifeline engineering), risk perception, social trust, social cohesion and other social construction factors all can foster disaster resilience (Cohen et al., 2013; Leykin, Lahad, Cohen, Goldberg, & Aharonson-Daniel, 2013; Norris, Stevens, Pfefferbaum, Wyche, & Pfefferbaum, 2008). Multidisciplinary approaches have thus contributed to the measurement of disaster resilience. One common approach is the aggregation of direct indicators, such as socioeconomic factors, demographic

indicators, and perception factors, into a composite index (Ainuddin & Routray, 2012; Cutter et al., 2010; Ji et al., 2021; Sajjad, Chan, & Chopra, 2021), specifically, to measure inherent resilience (Cariolet et al., 2019). These indicators are usually developed according to what attributes a resilience system should have (Cariolet et al., 2019), i.e. robustness, redundancy, resourcefulness, and rapidity (Bruneau et al., 2003). Another common approach is to identify the resources that a resilience actor needs and then focus on the attributes of those resources (Zakour & Gillespie, 2013).

Notably, conflict understanding also exist regarding when disaster resilience emerges. Some studies indicate that resilience emerges after a disaster or stressful event (Zakour & Gillespie, 2013). There is also study, however, argues that disaster resilience should be viewed as the intrinsic capacity of a system that is predisposed to a disaster (Manyena et al., 2011). Hence, whether disaster resilience should be regarded as a process or outcome has been contested (Cutter et al., 2008). Despite this theoretical variance, in terms of the resilience–disaster relationship, most of disaster scholars accept that higher resilience means less loss potential and a higher capacity to cope with disaster. Logically, if one refuses to accept this assertion, emphasizing resilience enhancement in disaster management becomes meaningless.

3. Resilience–vulnerability nexus

3.1. Different frames

There is no consensus within the disaster research community on the nexus between vulnerability and resilience. The existing literature thus presents rather confusing statements about this nexus. Nevertheless, our review of the existing articles has allowed us to identify four different relevant frames: opposite, overlap, separate, and inclusion. It should be mentioned that this article mainly infers different conceptual relationships based on the conceptualization of resilience and vulnerability in the existing literature, rather than criticizing those different arguments or joining relevant academic debates. In addition, the literature review method used in this paper is nonsystematic. This may introduce the selection bias problem.

3.1.1. Opposite

Some disaster researchers typically construct the resilience–vulnerability relationship as opposite to the capacity or loss dimension (Figure 1). Namely, resilience is a loose antonym for vulnerability (Adger, 2000; Rashid, 2013). For example, according to Twigg (2007), resilience and vulnerability are opposite sides of the same coin. In this conceptualization, the vulnerability concept mainly focuses on deficiencies, and the resilience concept focuses more on capacity and proactive factors. Notably, Manyena (2006) has identified another resilience–vulnerability nexus where vulnerability and resilience are

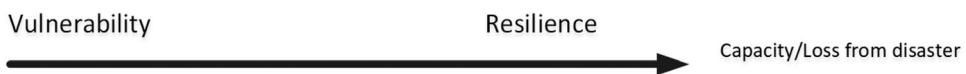


Figure 1 . Vulnerability and resilience are opposite (Note: The direction of the arrow represents the direction of high-capacity or low-loss).

components of each other. In terms of influential factors, Zakour and Gillespie (2013) also suggest that the factors enabling resilience tend to reduce vulnerability and vice versa. However, given that ‘two sets that are subsets of each other are equal’, if we frame vulnerability and resilience as components of each other or produced by the same factors with different directions, we have to accept that resilience is an antonym for vulnerability; otherwise, internal logical contradictions emerge.

3.1.2. *Overlap*

A relationship involving resilience and vulnerability overlap can also be inferred in the recent disaster literature (Figure 2). Compared to the abovementioned opposite relationship, the overlap frame implies that vulnerability and resilience are not completely opposite but have similar aspects or components. For example, Kelman et al. (2016) argue that while resilience and vulnerability have some converse characteristics, aspects of both can exist simultaneously. Birkmann et al. (2013) point out that the resilience concept is based on two core components, coping and adaptation. Birkmann et al. (2013) also argue that coping capacity is part of the formula that determines vulnerability, while adaptation signifies a longer and constantly unfolding process of learning and adjustment that feeds vulnerability. Hence, Birkmann et al.’s (2013) argument indicates that vulnerability and resilience share common components, not that the two concepts are completely opposite in the same dimension.

3.1.3. *Separate*

As Figure 3 shows, the third frame we have inferred from recent disaster discourse holds that while disaster vulnerability and resilience may rely on some similar factors (e.g. socio-economic status), the two concepts, though often linked, are separate and discrete (Cutter et al., 2008; Manyena et al., 2011; Menoni et al., 2012). First, there are arguments that disaster vulnerability and disaster resilience correspond to different phases of disaster management. Usually, vulnerability refers to the predisaster conditions that make systems susceptible to harm, while resilience refers to the postdisaster ability to recover from a hazard (Bergstrand et al., 2015; Zakour & Gillespie, 2013). Furthermore, according to Cutter et al. (2008), vulnerability generally denotes the inherent qualities of a social system that exist before the occurrence of a disaster, while resilience refers to the conditions that enable a system to absorb, address, and adapt to disasters. Second, there are also connotative differences between the two concepts. Manyena et al. (2011) thus suggest that the resilience connotation includes the notion of *bouncing back*, which renders vulnerability and resilience different and separate.

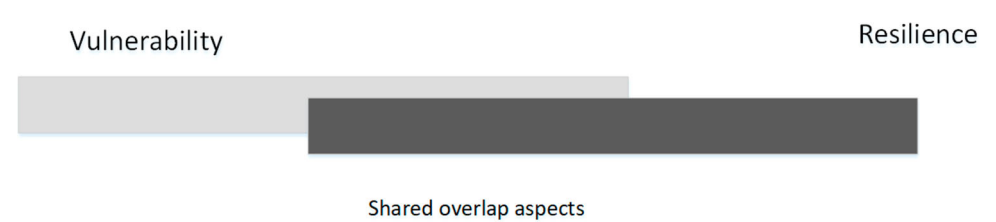


Figure 2 . Vulnerability and resilience overlap.

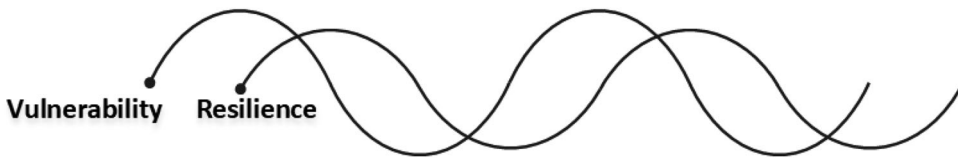


Figure 3 . Vulnerability and resilience are separate but often linked (Note: The intersection of curves means vulnerability and resilience are often linked in some disaster studies).

3.1.4. Inclusion

A frame of inclusion concerning disaster resilience and vulnerability can also be inferred from the extant disaster research. In contrast to the notion that vulnerability and resilience are components of each other, the inclusion frame implies that either resilience is an internal component of vulnerability (Figure 4a) or vulnerability is a component of resilience (Figure 4b).

For example, Timmerman (1981) argues that vulnerability denotes the degree to which a system may react adversely to hazards and that the degree and quality of an adverse reaction partly depends on the system's resilience. In a study by Menoni et al. (2012), disaster vulnerability is a composite outcome of hazard exposure, resilience, and adaptive capacity. Adger (2006) regards vulnerability as the state of susceptibility to harm from exposure to a disturbance via the absence of the capacity to adapt. Similarly, in a conceptual framework proposed by Birkmann et al. (2013), lack of resilience is incorporated as a key factor of vulnerability. McEntire's (2001) model of disaster vulnerability also integrates resilience as a fundamental component. All these arguments therefore illustrate a basic conceptual logic, i.e. disaster resilience is one component of disaster vulnerability.

On the other hand, disaster vulnerability has also been regarded as a component or influential factor of disaster resilience (Figure 4b). For example, Wisner et al. (2004, p. 11) define vulnerability as 'the characteristic of a person or group and their situation that influence their capacity to anticipate, cope with, resist and recover from the impact of a natural hazard'. Obviously, in the conceptualization of Wisner et al. (2004), vulnerability is the most influential factor of resilience.

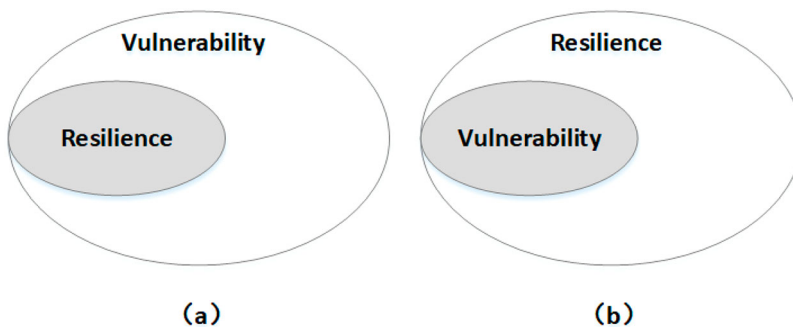


Figure 4 . Inclusion between vulnerability and resilience.

3.2. Shared conceptual understanding

Generally, both vulnerability and resilience research focus on disturbance experience, response, and capacity for adaptive action (Adger, 2006). Miller et al. (2010) suggest that resilience and vulnerability represent different approaches to understanding the response of systems and actors to change. Within the recent disaster literature, resilience and vulnerability scholars share similar theoretical and conceptual understandings of this nexus despite the different frames that we have illustrated above. An awareness of the following shared conceptual understandings can thus spark academic dialog between the resilience and vulnerability research communities:

- Both disaster vulnerability and resilience are multidimensional concepts, although different dimensions, such as the economic, social, cultural, technical, or physical dimensions, have been distinguished by various studies (Ainuddin & Routray, 2012; Bruneau et al., 2003; Manyena, 2006; Menoni et al., 2012; Saja et al., 2021; Zakour & Gillespie, 2013).
- Both concepts can be subjective; whether *things* are viewed as vulnerable or resilient depends on one's perspective (Kelman, Gaillard, & Mercer, 2015).
- Both vulnerability and resilience frames demonstrate the importance of social structure and social processes, including people's decisions and actions, for understanding the adverse consequences of hazardous events (Miller et al., 2010).
- Both resilience and vulnerability reflect the response of units of analysis to hazards and can be used to measure societal coping capacities concerning hazards (Bergstrand et al., 2015; Cutter et al., 2003; Hansson et al., 2020).
- Both resilience and vulnerability contain dynamic properties (Ainuddin & Routray, 2012; Menoni et al., 2012), although they are often measured as static concepts (Cutter et al., 2008).

3.3. Incompatible conceptualization

A further inquiry into the abovementioned different resilience–vulnerability nexus frames indicates that the inconsistent understandings may stem from the following different aspects of the frames: emerging phase, state, driving mechanism, relationship with hazard, and depiction orientation (Table 1).

Emerging phase. In recent studies, resilience implies the pre-event capacity to absorb and withstand disturbance (Adger, 2000), the bounce-back or bounce better capacity of a system after a disaster (Manyena et al., 2011; Rashid, 2013; Sanchez et al., 2018), or both these aspects (Adger, 2006; Bruneau et al., 2003; Cutter et al., 2008; UN/ISDR, 2009). However, vulnerability is often more easily conceptualized as a predisaster

Table 1 . Incompatible conceptualizations of resilience and vulnerability.

Conceptual connotation	Attributes
Emerging phase	Predisaster, during disaster, postdisaster
State	Process and/or outcome
Driving mechanism	Social process, physical factor, political ecology, human ecology, and/or system dynamic
Relationship with hazard	Independent or not
Depiction	Anthropocentric or ecocentric

condition, preexisting characteristic, and predisposition to suffering loss (Rashid, 2013; Wisner et al., 2004).

State. Whether disaster resilience should be conceptualized as a process or an outcome is still contested. However, there is seldom a similar conflict in vulnerability studies. Compared to resilience, vulnerability is more easily conceptualized as a combination of characteristics (Wisner et al., 2004), although there has been an increasing emphasis on its change process and dynamic attributes (McEntire, 2004; Zakour & Gillespie, 2013).

Driving mechanism. In current disaster discourse, the vulnerability concept has more relationships with 'inequality' and 'liability', and has been developed alongside academic inquiry into how disasters happen (McEntire, 2004; Sun & Faas, 2018; Zakour & Gillespie, 2013). Vulnerability studies prioritize exploring the roots of disaster vulnerability in political ecology (e.g. colonial history) and human ecology (e.g. urban development plans) (Wisner et al., 2004; Zakour & Gillespie, 2013). However, disaster resilience tends to imply actors' agency and the structure of a system. Compared to the vulnerability approach, resilience research thus rarely responds to the question of why and how disasters happen. Usually, disaster resilience researchers apply the theoretical arguments of classic disaster studies regarding disaster causes.

Relationship with hazard. In most cases, resilience is regarded as an intrinsic capacity, independent of external hazards. However, hazards have been defined as causes of disaster vulnerability in some studies. That is, disaster vulnerability is conceptualized as a function of internal characteristics and hazard exposure and susceptibility (Cutter et al., 2003; McEntire, 2004).

Depiction. The conceptualization of disaster vulnerability is usually anthropocentric (Rashid, 2013), prioritizing the safety of human life and property. However, a more eco-centric orientation can be seen in how resilience is framed. For example, the concept of social-ecological resilience suggests that human action, social order and structure, and the natural environment are integrated into nature, i.e. there is no distinction between so-called human society and the natural environment (Adger, 2006).

4. Resilience–vulnerability nexus-informed DRR policy design

There is a long accepted notion that disaster and its associated concepts (e.g. vulnerability and resilience) are contextual and subjective—the results of culturally shaped learning (Bankoff, 2004; Kelman et al., 2016; Lewis, 1999). Notably, how vulnerability and resilience are framed and characterized per se is a process of social construction involving the research community (Sun & Faas, 2018). As Manyena (2006) argues, whether vulnerability and resilience are opposite depends on how we define them. Accordingly, in this article, we argue that assembling vulnerability and resilience into a coherent conceptual framework might provide some useful benefits for DRR policy design.

In addition to the opposite frame, as Figure 5 shows, we can identify four kinds of systems in the other three nexus frames (i.e. overlap, separate, and inclusion): Type I—high resilience and high vulnerability system; Type II—low resilience and high vulnerability system; Type III—low resilience and low vulnerability system; and Type IV—high resilience and low vulnerability system. The Type II and Type IV units of analysis are common. Furthermore, transforming a Type II system into a Type IV is an important goal that DRR policies should be pursuing. Type I and Type III systems entail that

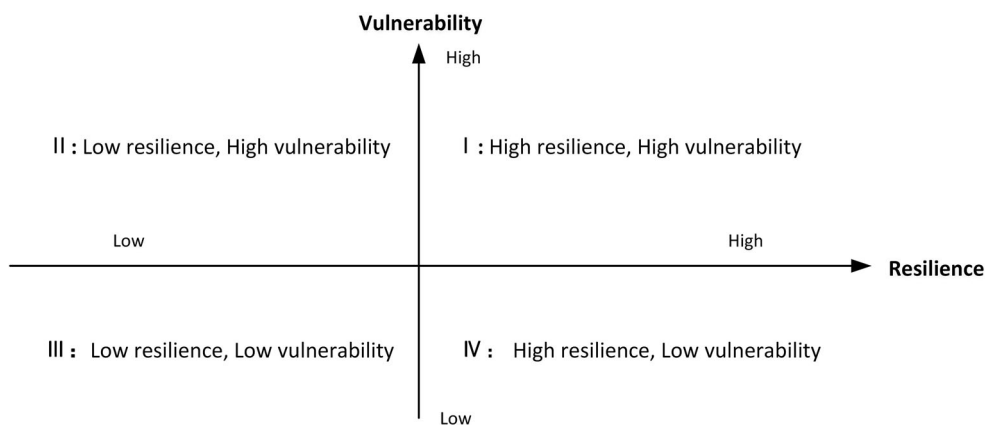


Figure 5 . Four systems in the resilience–vulnerability typology (Note: The direction of the arrow represents the direction of high-resilience or high-vulnerability).

vulnerability and resilience exist simultaneously within the same unit of analysis. According to certain conceptualizations and measurements, this may be theoretically correct. For instance, Bergstrand et al. (2015) empirically evaluate the relationship between community resilience (in the economic development and social capital dimensions) and vulnerability (using variables such as impoverished percentage, median age, and population density) in counties across the United States. They demonstrate that there is a correlation between high levels of vulnerability and low levels of resilience and that some counties are high or low in both vulnerability and resilience.

However, if the disaster research community constructs a resilience–vulnerability nexus in complex ways, this might generate perplexity and confusion at the practice level, which could increase the cost of practitioner–researcher communication. In context of one type of hazard or disaster, it is harder to illustrate a Type I or III system to policy-makers and DRR practitioners than a Type II or IV system. Moreover, in some language systems, there are no unambiguous corresponding words for ‘resilience’ and ‘vulnerability’ (Chmutina, Sadler, von Meding, & Abukhalaf, 2020). However, ‘capacity’ and ‘loss’ are terms that are shared by different languages, cultures, and DRR-related communities (e.g. researchers, policy-makers, and practitioners). When examining disaster-affected actors’ resilience and vulnerability through a capacity or loss lens, ‘increasing resilience’ means reducing vulnerability, decreasing the loss potential, and enhancing capacity. Perhaps this finding will facilitate more dialog between disparate DRR-related communities and stakeholders.

Given the shared conceptual understandings of resilience and vulnerability, we suggest that there is a theoretical possibility to better frame disaster vulnerability and resilience as gradable antonyms, at least in the dimensions of capacity or loss potential. For example, as Figure 6 shows, regarding capacity, resilience means the capacity to cope with disturbance (i.e. resist, absorb and withstand the impact of disturbance), while vulnerability entails a lack of the capacity to cope. At the loss level, resilience means to resist and recover from loss, and vulnerability reflects loss potential. Thus, for a more comprehensive theoretical framework of this gradable antonym nexus, the disambiguation and

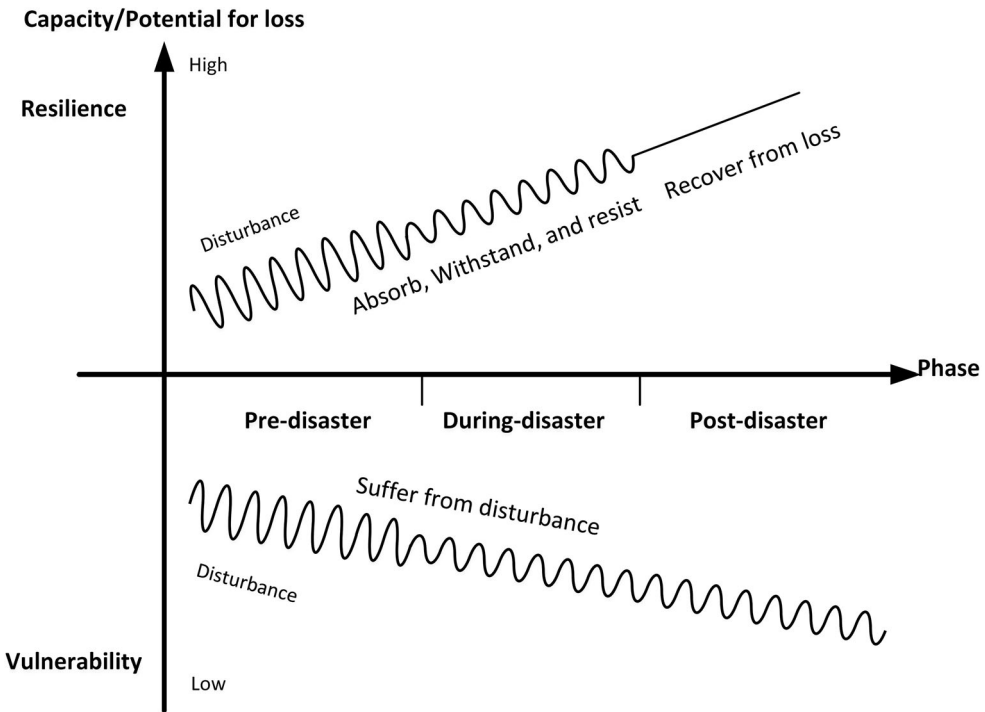


Figure 6 . Conceptualizing resilience as the opposite of vulnerability.

reframing of the incompatible connotations mentioned in subsection 3.3 can be a starting point. Additional research on this topic is critical. Pragmatically, we also argue that framing vulnerability and resilience into one conceptual dimension might be conducive to bridging the gap between academic study and DRR practice. To reiterate, ‘reducing vulnerability’ and ‘building resilience’ are two interlinked sides of a single goal that should be more easily accepted by and become more operational among both policy-makers and DRR practitioners.

5. Conclusion

Vulnerability and resilience are ubiquitous in contemporary disaster discourse. However, there is no consensus within the disaster research community on the nexus between vulnerability and resilience. We note how there has been little theoretical work addressing the resilience–vulnerability nexus within the field of disaster research. Through a nonsystematic literature review combined with authors’ speculative thoughts, we identified four different frames of the disaster resilience–vulnerability nexus: opposite, overlap, separate, and inclusion. It points out that the concepts of disaster resilience and vulnerability share some conceptual underpinnings but have incompatible conceptualizations in their emerging phases, states, diving mechanisms, relationships with hazards, and modes of depiction. Pragmatically, we argue that constantly contributing to the conceptual incompatibility of resilience and vulnerability is unnecessary; it may cause confusion among DRR decision-makers and erect barriers in the disaster theory that informs DRR

policy. Resilience and vulnerability should therefore be conceptualized in a more comprehensive framework. Framing the resilience–vulnerability nexus in the capacity and loss dimensions might thus be a possible research direction. If so, those theoretical basis for vulnerability studies would directly nourish the inquire of disaster resilience. In practice, policy-makers can integrate vulnerability-reduction and resilience-enhancement strategies together to pursue a common policy objective, such as ‘improving capacity to reduce potential losses’. Framing in this direction could thus function as an important pivot for theoretical development in disaster research and attract researchers, policy-makers, and DRR practitioners to participate in theoretical and practical dialog. The arguments presented in this article have the potential to aid disaster researchers and DRR practitioners who might feel confused regarding the relationship between resilience and vulnerability. We hope that this article will stimulate discussion within the disaster resilience and vulnerability research communities about how to further link these two streams of literature.

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