

Disasters

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Glossary

Disaster A state of event (or a “situation”) associated with natural hazards characterized by negative impacts to society in the forms of human and environmental damages.

Disaster risk reduction A systematic effort of concerned stakeholders to reduce new or existing disaster risk and to manage disaster situations and eventually mitigate their negative impacts.

Natural hazard A phenomenon or process associated with the natural environment that has the potential to cause damage to human society.

Disasters, particularly major disasters, often have a tremendous impact on affected localities in terms of human casualties, economic damages, and disruptions of social services and functions of society. Disasters are generally categorized as major and small-scale disasters. Typhoon Haiyan in the Philippines (2013), the Tōhoku earthquake and tsunami in Japan (2011), the earthquake in Haiti (2011), Hurricane Katrina in the United States (2005), and the Indian Ocean Tsunami (2004) are some of the major disaster events in the first two decades of the 21st Century that had enormous impact in terms of the number of human casualties, affected people, and cost of economic damages. According to Emergency Events Database, a database managed by Centre for Research on the Epidemiology of Disasters (CRED-EMDAT) based in Belgium, from 1900 to 2017, the occurrence of at least 14,000 major disasters associated with natural hazards resulted in at least 32 million human casualties, 7 billion people affected, and 3.2 trillion USD of economic damage.

The data on the accumulated impacts of disasters by CRED-EMDAT do not consider the impacts of small-scale disasters that may be equally or even more devastating when compared to major disasters. Small-scale disasters do not meet certain criteria of the accepted global definition of disaster, which is an event characterized by the occurrence of a major hazard that causes devastating impacts on affected communities and societies that are not able to cope with or recover from using their own resources. CRED-EMDAT, for instance, qualifies that disasters must be characterized by 10 or more people reported killed, 100 or more people reported affected, declaration of a state of emergency, or call for international assistance. Localized but frequent landslides that affect villages in the steep Himalayan Mountains in Central Nepal causing human casualties and economic damages that do not meet the criteria of CRED-EMDAT are invisible in its disaster database. Small-scale disasters thus do not receive sufficient attention from different stakeholders (e.g., governments, nongovernment organizations, media, local authorities, and the public) in terms of plans, actions, and policy responses for disaster risk reduction (DRR).

The impacts of both major and small-scale disasters often extend beyond the duration of an event as recorded in any disaster database. The impact on the affected people in the communities are multidimensional and complex (i.e., displacement due to disasters results in fragile health, lack of access to social services, and lesser opportunities for livelihood, among others), and often translate to or contribute to many socioeconomic problems reflected in the daily life of people. Disasters also threaten the achievement of development goals at different geographical scales (from the development efforts established by the international community, such as the Sustainable Development Goals, down to the specific goals of communities and households). To avoid repetition of events, or to reduce the impacts and risks of disasters, many stakeholders who represent government and nongovernment organizations, and civil society organizations, among others, have engaged in disaster risk reduction and management (DRRM). In academic research, the increasing interest in disasters as a field of study for any discipline is justified by the need to reduce the risk of disasters and ensure development and human survival for both present and future generations. Geography as a discipline has greatly contributed to this field in terms of its intellectual and developmental (or practical) contributions.

Concepts and Definitions in Disaster Studies

Disaster is a loose term and no single definition can adequately capture its meaning in a way that is acceptable to all concerned stakeholders. Government and nongovernment organizations, universities and research laboratories, international and national databases, individual authors and scholars, and even dictionaries, among others, offer a definition of disaster that reflects their academic or theoretical position and/or organizational interests. Table 1 presents some of the widely used definitions used by different stakeholders.

Table 1 Definitions of disaster based on several perspectives

<i>Proponent</i>	<i>Classification of proponent</i>	<i>Definition of disaster</i>
United Nations International Strategy for Disaster Reduction (UNISDR)	International government organization	"A serious disruption of the functioning of a community or a society at any scale due to hazardous events interacting with conditions of exposure, vulnerability, and capacity, leading to one or more of the following: human, material, economic, and environmental losses and impacts."
International Federation of Red Cross and Red Crescent Societies (IFRC)	International nongovernment organization	"A disaster is a sudden, calamitous event that seriously disrupts the functioning of a community or society and causes human, material, and economic or environmental losses that exceed the community's or society's ability to cope using its own resources. Though often caused by nature, disasters can have human origins."
Centre for Research on the Epidemiology of Disasters—Emergency Events Database (CRED-EMDAT)	International organization/online database	"Situation or event, which overwhelms local capacity, necessitating a request to national or international level for external assistance." Specifically, disasters are characterized by the following characteristics: • 10 or more people dead • 100 or more people affected • The declaration of a state of emergency • A call for international assistance
Wisner, Gaillard, and Kelman (2012: p. 30)	Individual authors	"A situation involving a natural hazard which has consequences in terms of damage, livelihoods/economic disruption, and/or casualties that are too great for the affected area and people to deal with properly on their own."
Merriam-Webster	Dictionary	"A sudden and terrible event in nature (such as a hurricane, tornado, or flood) that usually results in serious damage and many deaths."

The definitions of disasters in **Table 1** can be described as either all-encompassing and subjective but too loose, or specific and objective but too rigid and exclusive. An example of the latter is the definition by CRED-EMDAT in which indicators and conditions are specified to determine what event counts as a "disaster" event. Defining the concept is a logical step toward understanding disasters and their root causes, more efficient data collection on impacts of disasters, and eventually better formulation of strategies for DRRM. Without proper inquiry on the definition, we might end up asking ourselves: reduce the risk of "what" or prevent "what" from happening?

As a case in point, "natural disaster" as a terminology is traditionally and still commonly used to pertain to disasters triggered or associated with natural hazards (e.g., earthquakes, typhoons, volcanic eruptions). In using this term, however, there is a tendency to consider "natural hazard" and "natural disaster" as two concepts with the same meaning. There are at least two points that must be clarified to differentiate those terms. First, disaster is a much broader term used to describe a state or event ("situation") in which "natural hazard" is only one of the key elements. Second, and in corollary to the first point, the use of the term "natural disaster" is becoming less agreeable to many scholars and stakeholders of DRRM as it tends to neglect other key equally important socio-economic factors that shape disasters and determine their impacts. Disasters are therefore both "natural" and "social."

The definition of disasters draws attention to several concepts, including "exposure to hazards," "vulnerabilities," and "capacities," among others. These are the same concepts that allow us to understand and assess risk or the probability of disaster occurrence based on the level of exposure of people (including their properties and territories) as well as their vulnerabilities and capacities. Disaster is essentially the "materialization" of risk, and thus potential outcomes of disasters can be evaluated through risk assessment. Disaster risk is commonly expressed mnemonically as follows:

Disaster risk = Exposure to hazards X Threatened people (characterized by vulnerabilities and capacities)

Based on the widely used definitions of the United Nations International Strategy for Disaster Reduction (UNISDR), the key concepts in the mnemonic can be defined as follows:

- "Exposure to hazards pertains to the situation of people, infrastructure, housing, production capacities, and other tangible human assets located in hazard-prone areas."
- "Vulnerability is the condition determined by physical, social, economic, and environmental factors or processes which increase the susceptibility of an individual, a community, assets, or systems to the impacts of hazards."
- "Capacity is the combination of all the strengths, attributes, and resources available within an organization, community, or society to manage and reduce disaster risks and strengthen resilience. Capacities can be further categorized as adaptive, coping, and transformative capacities."

The UNISDR terminologies on DRR undergo numerous consultations and intergovernmental negotiations to ensure that concepts and terms are useful and practical for many stakeholders of DRRM, including, but not limited to, academics, government and nongovernment organizations, and many civil society organizations. At least four major revisions were made since the first standardized glossary of DRR terminologies was proposed by the UN International Decade for Natural Disaster Reduction (IDNDR)

in 2002. The latest update on the glossary was made in 2017 to make the concepts and their definitions more consistent with global frameworks such as the Sendai Framework for Disaster Risk Reduction (SFDRR).

Recently, many scholars and practitioners of DRR have emphasized the role of “resilience” of communities and people in determining the outcomes of disasters. Many studies refer to resilience as the positive characteristics of communities and people that can be helpful in preventing a disaster, and reducing or recovering from its impacts. The uniqueness of places in terms of exposure to hazards, and vulnerabilities and capacities of people (or their resilience) explains differential impacts of disasters. In the 1990 7.5 magnitude earthquake that devastated a large part of Central and Northern Luzon (Philippines), the differential impacts to several provinces and cities in terms of loss of lives and economic damages can be attributed to unique social and environmental factors which determine exposure to hazards, and vulnerabilities and capacities of people.

Theoretical Shifts in Disaster Studies

The study of disasters has undergone considerable theoretical shifts as a result of continuing academic discussion and research on the subject, and in response to the evidence gathered from actual disaster. Essentially, each disaster event, both major and small-scale, is an opportunity to reflect on our understanding (or misunderstanding) of disasters and their causes, and eventually on the efficiency of our practice of DRRM. During the Roman Empire, disasters were interpreted as acts of gods. Similarly, disasters were traditionally viewed in medieval Muslim society and reflected in prominent myths in the Pacific Islands as either punishments from god(s) or caused by supernatural events. After the Lisbon Earthquake in 1755, such fatalistic views of disasters were discarded, and disasters were more likely to be explained as natural events (e.g., an earthquake), which can be studied and their impacts mitigated through human actions. Presently, the view of disasters as caused purely by natural process is no longer satisfactory to explain the increasing number and impacts of disasters. Disaster scholars, especially those from the social sciences, have emphasized the influence of human agency and actions, and the role of larger social processes (e.g., structures and dominant ideologies), in determining the vulnerabilities of people and thus their susceptibility to impacts of natural hazards and disasters.

These historical theoretical shifts in studying disasters are reflective of the changing focus of inquiry and conceptual emphasis of scholars and other stakeholders working on DRRM. There are three paradigms that mirror the shifting emphasis in disaster studies: (1) risk and hazard, (2) social-centric or vulnerability (also called political economy/political ecology), and (3) ecological resilience paradigms.

First, the risk and hazard approach emphasizes the extremity of natural hazards as the main determinants of the outcomes of disasters, and the uncertainties of their characteristics owing to the vagaries of nature. Natural hazards refer to biophysical processes (e.g., typhoons, volcanic eruptions, earthquakes) that are harmful to exposed populations and their properties and disrupt many functions and activities in human societies. The risk and hazard approach aligns with the arguments of the hazard-centered and behavioral paradigm, which are best elaborated in the foundational works of the geographer Gilbert White in the 1940s on human adjustment to natural hazards, and later in the works of his prominent students and fellow geographers (Robert Kates and Ian Burton, among others). White and his students argued that the outcomes of disasters are largely determined by how well people adjust to natural hazards. Adjustments to hazards are determined by people’s perception of risk and their corresponding behaviors and actions in response to the perceived risk. The common usage of the term “natural disaster” both in academic and popular publications shows the prevalence of the view that disasters are mainly driven or determined by the magnitude, scope, and frequency of natural hazards.

In the 1970s, the dominance of hazard-centric approach to disaster studies was challenged by an alternative paradigm called social-centric or vulnerability paradigm. The latter argues that disasters and their impacts are attributed to increases in people’s vulnerabilities characterized by growing marginalization of poor people, gender and ethnic minorities, and children and older people, among other marginalized sectors. In this view, people’s vulnerabilities are deemed preexisting characteristics of people as determined by dominant structures in society (e.g., socioeconomic conditions and ideologies). This alternative explanation on the root causes of disaster is largely rooted in structuralist perspectives prominent in the fields of political economy and political ecology. Its argument is best exemplified in the Pressure and Release Model (PAR) that shows how conditions of vulnerabilities progress from specific histories and dominant ideologies in a society to exposure to hazards and unsafe livelihoods. This perspective emphasizes that the vulnerabilities of people are independent of natural hazards and that this explains the unequal impacts of disasters where the most marginalized sectors are often the most affected and at risk. Very recently, the idea of disaster risk creation (DRC) was proposed to point out that efforts for risk reduction are often negated by the faster rate of risk creation. The latter is largely attributed to historically and geographically widespread propagation of processes that make people vulnerable such as environmental degradation, discrimination, and displacement.

Third, and finally, ecological resilience (or simply resilience) has recently emerged mainly from the climate change literature to provide a broader perspective on the question of vulnerability and disaster risk. In this view, vulnerability is a function of external stressors or shocks (e.g., natural hazards), and intrinsic characteristics of people and their properties and territories. The former is best exemplified in many studies suggesting that people and communities are becoming more vulnerable due to greater exposure to natural hazards as a result of global climate change (e.g., stronger typhoons, faster sea-level rise, extreme temperature, and excessive precipitation). The latter pertains to sensitivities and adaptive capacities (or simply capacities) of people and many other elements at risk in the communities that influence the outcomes of disasters. For example, poverty and lack of livelihood opportunities (sensitivity) could partially explain why people live in fragile shelters making them susceptible to impacts of hazards. On the other hand,

people may have access to early warning systems and risk insurance (capacities) that could help them mitigate or avoid hazards, or recover faster from disasters. The vulnerabilities of people, therefore, are determined by the complex interaction of multiple social and environmental factors (e.g., conditions of society and the socioeconomic situations of people, and characteristics of natural hazards due to climate change and major geological events) that exist between nature and society at different geographical and temporal scales. Ecological resilience then suggests that disasters (or disaster risk) cannot be understood in isolation of such mutuality and complexity of human–environment relationships—a point that is not emphasized in the hazard-centric and social-centric paradigm.

Each paradigm in disaster studies proposes a framework of analysis of disasters and their root causes, and offers explanations on the unequal impacts of disasters on people and communities. Questions that are usually asked within the framework of analysis of hazard-centric paradigm may not be asked or less emphasized in social-centric and ecological resilience paradigms, and vice versa. Academic researchers studying the same disaster event may arrive at different explanations on the root causes of such disaster or factors that influence its impacts. The paradigms in disaster studies are reflective of the different ideological positions (e.g., academic or disciplinary focus) or interests (e.g., political, economic, and cultural interests) of the many stakeholders involved in DRRM. Those positions and interests are further reinforced by reflections on evidence gathered from past and recent disasters, and the emergence of issues that are considered to have significant influence on the nature of natural hazards (e.g., climate change) and/or vulnerabilities and capacities of people (e.g., discrimination against poor people, or gender and ethnic minorities).

Geographers have made significant contributions in proliferating different perspectives in disaster studies. The changing focus and conceptual emphasis in disaster studies are reflective of the different standpoints in Geography as a discipline. The risk and hazard approach is essentially based on the conception of geography as human ecology which emphasizes human–environment relationship. The shift of focus of some geographers from purely hazard-focused to vulnerability-centered studies can be related to the prominence of social constructivism or structuralist perspectives in Geography in the 1970s. Last, ecological resilience appears to be a reinvention of the risk and hazard approach but with more emphasis on the overwhelming influence of natural hazards relegating humans as less dominant in human–environment relationships. Nevertheless, regardless of theoretical position and conceptual emphasis, the study of disasters and the many associated concepts requires an understanding of the specific context and situation of people and places which is traditionally the focus of geographical inquiry.

Research Approaches and Methodologies in Disaster Studies

The concepts and theoretical shifts used to approach disasters emphasize the complexity of this field of study. For one, the factors that determine risk (a priori) and the observed causes of disasters (a posteriori) can be analyzed in different ways based on one's theoretical position, conceptual emphasis or organization, and personal interest. Further, the key concepts (e.g., risk, natural hazards, exposure to hazards, vulnerabilities, capacities, and resilience) that allow us to understand a disaster can be defined differently and thus there are multiple meanings of the word "disaster." The examination of actual disaster events involves a wide range of factors, including direct and indirect impacts to affected people and places, long-term effects, and numerous socioeconomic factors that influence at play at different geographical and temporal scales (e.g., globalization, migration, ideologies, among others).

The complexity of disaster events demands that many types of knowledge from different perspectives be used to allow us to understand the multidimensionality of disasters. There is not one but many ways to gather such knowledge based on different research approaches and methodologies present in both academic and citizen-based sciences. Indeed, the wide literature of disaster studies is not just a mine of knowledge on theoretical debates but also on continuous epistemological development. It is important to note that research approaches and methodologies in disaster studies are also commonly applied in many disciplines in the physical and social sciences. Some scholars argue, however, that disaster studies are unique in terms of the contexts (i.e., situations before, during, and after disasters) on which methods and tools are applied, and that their designs, including their implementation, are often modified or adjusted.

In the social sciences, particularly in development studies and poverty research, there are three dominant methodological approaches to which methods and tools can be associated with, including (1) economic reductionism, (2) anthropological particularism, and (3) participatory pluralism. Economic reductionism aims to produce quantitatively measurable and comparable variables and data. In disaster studies, this approach is evident in the methods and tools that are commonly used by physical and social scientists in hazard assessment and risk perception research, respectively. Some of these methods and tools that are commonly used in conducting field studies and survey research include survey questionnaires, simulation and statistical analysis (and similar laboratory experimentation), and cartography of risk and hazards, among others, that often rely on highly technological devices.

Further, anthropological particularism employs methods and tools that are qualitative in nature such as interviews, participant observation, and document analysis, among others. The employment of qualitative methods in disaster studies can be traced back to the sociological study of Samuel Prince of the Halifax Explosion in 1917, a maritime disaster caused by fire explosion that killed approximately 2000 people in Nova Scotia, Canada. Participant observations and interviews were employed in the study to inquire and study the social disorder and individual and group reactions to the disaster. The methods and tools in this approach are particularly useful in producing a rich description that goes beyond the limit of interpretation of disasters through numbers and statistics. Anthropological particularism can provide methodological support to allow scholars informed by social-centric or vulnerability paradigms to question and study the social structures and dominant ideologies that make people vulnerable and produce risk.

Third, participatory pluralism capitalizes on the use of participatory methods and tools to allow concerned stakeholders to participate in research processes, and later in decision-making. In the context of disaster studies and DRRM, participation allows different stakeholders to engage in a dialogue to coproduce and share knowledge to better understand disaster risk and eventually implement effective DRRM strategies. This approach emphasizes the importance of the participation of local stakeholders in many aspects and stages of risk assessment, and planning and actions for DRRM. Some of the most common participatory methods include participatory mapping, seasonal calendars, group discussions, calendar history, Venn diagrams, and problem trees.

The choice of methodological approach is not without bias and is influenced and motivated by certain objectives and interests. Each approach, supported by particular methods and tools, predetermines the role of outsider (e.g., researchers, humanitarian workers) and local stakeholders (e.g., community members), mode of delivery, contribution to knowledge, and outputs. **Table 2** provides a summary of the emphases of each methodological approach in the context of disaster studies.

Economic reductionism and anthropological particularism are conventional and proven methodologies, while participatory pluralism appears to be contemporary but more creative in terms of design and implementation. On the one hand, the former generally refers to quantitative and qualitative approaches and many types of scientific methods and tools that are common in academic research (e.g., economic reductionism and anthropological particularism). On the other hand, methods and tools in anthropological particularism are anchored in the principle of participation of local people, including the marginalized sectors in many aspects of DRRM (e.g., risk analysis and actions for risk reduction). It is important to note, however, that data and information produced by local people and other stakeholders through participatory pluralism should always be qualified to ensure that they are useful knowledge for DRRM.

Because of the multidimensional and multidisciplinary character of disasters, there is a very large diversity of methods and tools associated with each methodological approach. Researchers also have distinct expertise or skills in using methods and tools because of their particular disciplinary focus and professional practice. Some specific methods tend to be associated with certain disciplines; for example, geographers produce hazard and risk maps using different kinds of mapping techniques, anthropologists often undertake ethnographic fieldwork and participant observation that allow them to produce a rich description of disaster events, and geologists and climatologists continue to develop their methods for data collection and laboratory experimentation to better study the dynamics of natural hazards. Particular methods and tools, however, are not exclusive to particular disciplines. Yet, it is clear that disciplinary focus and subject of interests influence one's choice of methods and tools.

By studying disasters with a particular focus on the cartography of risk, geographers have sought and borrowed different methods and tools from many disciplines in the physical and social sciences. The goal has often been to collect relevant data and information and to analyze them to establish spatial patterns that can be useful in risk assessment. The cartography of risk, which remains geographers' key focus, is not a standalone method and often requires data and information that can only be produced using quantitative and qualitative methods and tools. Risk mapping using geographic information systems (GIS) often relies on interviews, survey questionnaires, and field surveys, among other techniques, to build spatial databases. Recently, many creative methods for risk mapping such as Participatory 3-dimensional mapping and other participatory mapping techniques have taken advantage of methods and tools in Participatory Action Research (PAR) that are useful for generating spatial data and information on risk based on local knowledge. PAR is a research approach that highlights the participation of local people and communities in the identification of problems and issues, and actions that can be taken to understand or resolve them. The increasing popularity of

Table 2 A summary of methodological approaches and their emphasis in terms of objectives, methods and tools, roles of outsider, etc.

<i>Emphasis</i>	<i>Economic reductionism</i>	<i>Anthropological particularism</i>	<i>Participatory pluralism</i>
Objectives and interests	Focus on exposure to hazards based on people's perception and behavior, and characteristics of hazards (e.g., hazard-centered and behavioral paradigm)	Focus on vulnerabilities based on socioeconomic factors and people's positions in the society (social-centric or vulnerability paradigm)	Focus on exposure to hazards and condition of vulnerabilities based on the understanding of many actors involved including the vulnerable people themselves
Methods and tools	Quantitative and structured (or semistructured) Usually dependent on technological devices Data collector	Qualitative Recorder, notebook, camera, etc. Participant observer	Participatory Materials and tools that are easily accessible for different actors involved Convener/facilitator
Role of outsider (e.g., researchers, humanitarian workers)			
Role of local actors (e.g., community members)	Respondent	Social actor	Analyst
Mode of delivery	Extractive	Interactive	Self-organizing
Strengths	Noncontextual breadth	Contextual depth	Design for purpose
Contribution to knowledge and practice	Comparable numbers	Social and cultural insights	Practical knowledge that are useful for the local people
Outputs	Tables, graphs, maps	Rich descriptions	Tables, diagrams and charts, maps

Modified after Chamber, 2007, p. 42.

participatory mapping and similar creative methods and tools that do not conform to established traditions in Geography (e.g., scale and precision of Cartesian cartography) shows how versatile geographical approaches can be in terms of research approaches and methodologies.

Disaster Risk Reduction and Management

The effort to understand disasters through research is ultimately aimed at reducing the impact and risk of disasters by reducing the number of casualties and affected people, economic damages, and the many potential negative impacts on both human society and the natural environment. Since the 1970s, many international agencies, government and nongovernment organizations (NGOs), disaster planners and managers, and civil society organizations including local communities have engaged in DRRM. As defined by UNISDR, DRRM is a combined acronym for disaster risk reduction (DRR) and disaster risk management (DRM). It is a vast and complex process involving several aspects and stages. DRR is a concept that describes systematic efforts of concerned stakeholders to reduce new or existing disaster risk and to manage disaster situations and eventually mitigate their negative impacts. It provides a policy framework in which DRM can be applied. DRM, therefore, is the implementation of DRR policies and strategies through programs, projects, and/or activities. Effective DRRM means that people are less exposed to hazards and vulnerable and have sufficient capacities to protect themselves or recover from the impacts of disasters with minimal support from other partners (e.g., government and NGOs).

The early practice of DRRM was based on the idea of civil defense in which the state assumes total responsibility for the safety of its citizens in exchange for its top-down control of DRRM efforts, especially disaster response. The shift from civil defense to civil protection has eventually decentralized some of the responsibilities of the state in terms of the safety of citizens to local government units. Yet, the technocratic and authoritarian designs of plans and actions (e.g., dominant role of state's military especially during and after major disasters) inherited from top-down approaches remain deeply embedded in the policy and operational frameworks of many governments. The practice of DRRM constantly transforms in response mainly to the demands of concerned stakeholders particularly disaster managers (i.e., government and NGOs) and academics, and people who are most affected by disasters. DRRM has shifted from a totally top-down to a more bottom-up oriented process which is mainly attributed to the efforts and advocacies of civil society organizations and support from many governments at different political scales (international down to local government units).

There are several strategies, actions, and plans used to implement top-down and bottom-up approaches for DRRM. First, based on the mnemonic device on risk presented in above, disaster risk is determined by the characteristics of hazards, and exposure of people to them, and vulnerabilities and capacities of people. Plans and actions for reducing risk, therefore, can refer to strategies aimed at hazard prevention and mitigation, vulnerability reduction, and capacity enhancement. The examples of plans and actions for each strategy are not exclusively categorized as such (Table 3). Hazard mapping and monitoring (hazard prevention), for instance, can also be a part of contingency planning (capacity enhancement), and vice versa.

The implementation of DRRM can also be understood based on the "Disaster and Emergency Planning" process or simply emergency management cycle. The emergency management cycle involves four components, namely (1) disaster prevention, (2) preparedness, (3) response, and (4) recovery. Each component comprises of specific activities that are implemented based on the temporal stages or phases of disasters. The emergency management cycle assumes that based on past experiences or projections

Table 3 Strategies for disaster risk reduction and management (DRRM)

<i>Hazard prevention</i>	<i>Vulnerability reduction</i>	<i>Capacity enhancement</i>
Active prevention measures: • Triggering artificial rainfall to avoid drought • Dredging rivers to avoid flooding • Diverting wind to prevent the accumulation of snow and avalanche • Triggering snow avalanches before skiers come Passive prevention measures: • Hazard monitoring • Hazard mapping • Structural measures to control hazards and prevent them to affect local communities (dikes, seawalls, etc.)	Direct mitigation measures: • Warning systems • Information campaigns • Hazard-based land-use planning • Strengthening housing • Strengthening infrastructure • Diversifying livelihoods Indirect mitigation measures: • Poverty alleviation • Controlled urbanization • Sustainable management of natural resources • Sustainable access to land and other resources • Sustainable access to public services and social protection • Respect of human rights	Preparedness measures for personal protection: • Stockpiling of resources • Protection of household goods and resources • Contingency planning, including evacuation, shelter, search and rescue, relief operations, etc. • Emergency drills Preparedness measures at a larger-scale by preventive action and social protection: • Mandatory training for DRRM at the regional or national level • Inclusion of key disaster topics in the education program

of future events, disasters and hazards including their potential impacts can be analyzed and planned for. These four components capitalize on the same set of plans and actions presented in [Table 3](#), but their uses and implementation are based on the temporal stages or phases of a disaster.

Conceptually, each component of emergency management cycle should take place one after the other, which would form into a cycle once disaster recovery is done and affected people or communities are ready to engage in prevention and preparedness. In practice, however, it is difficult to categorically distinguish the divisions without looking at a longer timeframe and considering the wide array of actions and plans being implemented by different stakeholders of DRRM. This is particularly observed after major disasters. In the case of the Philippines, 5 years after the disaster triggered by Typhoon Haiyan (2013), actions and plans being implemented by different stakeholders, particularly government agencies and NGOs, are not clear as to which component of emergency management cycle they are intended for. Following the typhoon, the Philippine Government declared the end of humanitarian phase 7 months after the disaster to give way to the recovery and rehabilitation phase despite ongoing activities for response phase by both government and nongovernment (local and international NGOs). This declaration had also lifted several special policies on price and tax control, accelerated administrative processing for government and nongovernment agencies, and emergency assistances, among others, which made the response phase even more challenging for implementing agencies.

The wide-ranging strategies, actions, and plans for DRRM signify the need for the different stakeholders involved to work together. The stakeholders of DRRM can be loosely identified and categorized as either local or outside stakeholders. The former may refer to authorities, residents, and civil society organizations in a certain local community or political territory while the latter generally pertains to the scientists, central government and NGOs, and private sectors. Stakeholders do not exclusively belong to a certain category as, for instance, scientists and members of the private sector who associate or identify themselves with a certain community or territory are also local stakeholders.

Both local and outside stakeholders can contribute in understanding, coping with hazards and disasters, and reducing risk. Academics and researchers from practically all disciplines could offer theoretical and conceptual frameworks to understand disasters, and useful reflections on the past, present, and future practices of DRRM. Government and NGOs at different geographical scales (i.e., international, national, local) and political spheres promote DRRM through policy, advocacy, and financial support. NGOs, scientists, and government authorities can provide top-down support and facilitate access to sustainable livelihoods and means of protection for local stakeholders. The SFDRR initiated by the UNISDR, for instance, specifies four priorities for actions, including (1) understanding disaster risk, (2) strengthening disaster risk governance to manage disaster risk, (3) investing in DRR for resilience, and (4) enhancing disaster preparedness for effective response and to “Build Back Better” in recovery, rehabilitation, and reconstruction. Further, at the community level, the participation of local people and different sectors, including the private sector, is now evident in many aspects and stages of DRRM (e.g., disaster prevention and mitigation, preparedness, and response and recovery). The importance of local capacities for DRRM is widely recognized in the practice of community-based disaster risk reduction (CBDRR) in many parts of the world.

The integrated DRR framework first proposed by Gaillard and Cadag and later elaborated in several research publications justifies the need for DRRM to be based on the principle of collaboration through a multiactor or multistakeholder approach ([Fig. 1](#)). The framework suggests that effective implementation of DRRM is more likely when knowledge is coproduced and shared among stakeholders. The framework suggests that assessment of risk (i.e., assessment of hazards, vulnerabilities, and capacities) should be based on both local (including traditional) and scientific knowledge.

Combining knowledge, plans, and actions for DRR, however, has proven difficult. On the one hand, outside stakeholders, especially scientists, often underestimate local knowledge as well as the roles and capacities of local stakeholders because of their nonconformity to the established theories and processes of producing scientific knowledge. On the other hand, scientific knowledge, despite its claim to precision, is often disconnected from the needs and experiences of local stakeholders which can be rooted in the imposition of outside stakeholders’ understanding of risk as well as strategies for DRRM. To address the gaps that separate local and outside stakeholders, including their knowledge, the integrative framework for DRR suggests that all stakeholders should engage in dialogue that will ensure that the needs and demands of local stakeholders, especially marginalized groups and sectors, are properly considered in DRRM plans and actions. In return, outside stakeholders are supported by the knowledge and resources of local stakeholders. This process facilitates integration of top-down and bottom-up actions which would ensure effective implementation of DRRM.

Prospects for Geographical Research in Disaster Studies and DRRM

Academically, disasters, like any other historical and contemporary issues such as poverty, globalization, and wars, among others, are events and processes that allow us to understand the world. Disasters, being conceived as the negative results of interaction between the human society and the natural environment, in particular, are attractive to geographers as subjects of inquiry. Geographers have a long history of engagement both in disaster studies and DRRM. The place of disasters in the wide literature of geography, particularly human geography, cannot be situated without looking at the activities and achievements of geographers in the field. The contributions of geographers, as highlighted in the previous section, are wide ranging from theoretical and methodological reflection and formulation (i.e., intellectual contributions) to implementation of research and projects, and policy advocacy (i.e., practical and developmental contributions).

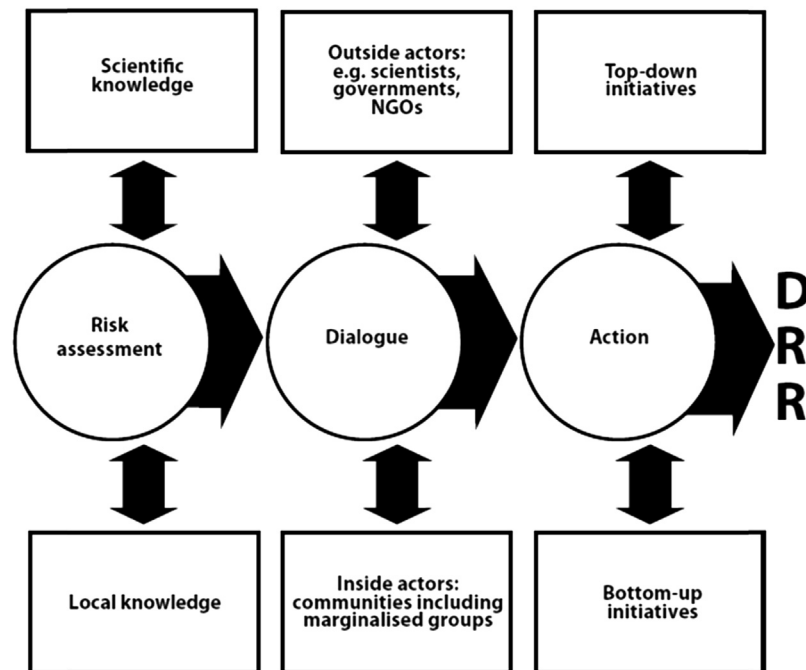


Figure 1 Integrative framework for disaster risk reduction (DRR).

Nevertheless, recent evidence suggesting that impacts and risk of disasters are increasing highlights that there is considerable knowledge needed to better understand disasters and their root causes, and more DRRM activities need to be implemented to effectively reduce risk. This realization opens opportunities for research in geography and many other disciplines in the physical and social sciences. In light of the discussions provided in this article, there are key emerging issues and topics which are potential subjects of inquiry in geography, particularly human geography. First, there is much academic research required to make concepts and definitions in disaster studies more consistent and useful for DRRM. Theoretical and practical gaps prohibit coordinated efforts for DRR, including climate change adaptation, and many other development agendas. Second, geographers should continue to develop methodologies, including methods and tools that are useful both for academic research and practice of DRRM (e.g., participatory methods and tools that encourage dialogue among stakeholders of DRRM). Third, geographical research should aim to understand the influence of major global environmental changes such as climate change on the characteristics of natural hazards, and its implication for exposure to hazards of people, property, and territory. Finally, on the question of vulnerability, geographical research should contribute by understanding how disaster risks are created by many socioeconomic and political factors at different geographical and temporal scales. Rather than failure of DRR, DRC can be an alternative explanation to increasing impacts and risk of disasters and eventually a solid basis of DRRM.

Further Reading

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Relevant Websites

Centre for Research on the Epidemiology of Disasters (CRED) - Emergency Events Database (EM-DAT). http://emdat.be/emdat_db/.

United Nations International Strategy for Disaster Reduction Terminology on disaster risk reduction. <https://www.unisdr.org/we/inform/terminology>.

International Federation of Red Cross and Red Crescent Societies. <http://www.ifrc.org/en/what-we-do/disaster-management/about-disasters/what-is-a-disaster/>.

Meriam-Webster. <https://www.merriam-webster.com>.

Sendai Framework for Disaster Risk Reduction. <https://www.unisdr.org/we/coordinate/sendai-framework>.