

Measuring Community Disaster Resilience: A Review of Current Theories and Practices with Recommendations

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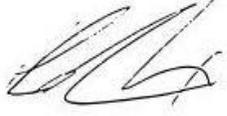
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1. INTRODUCTION AND PURPOSE

1.1 Introduction

The development of this report was supported by the Canadian Safety and Security Program (CSSP) which is led by Defence Research and Development Canada's (DRDC) Centre for Security Science (CSS), in partnership with Public Safety Canada (PS). The CSSP is a federally-funded program to strengthen Canada's ability to anticipate, prevent/mitigate, prepare for, respond to, and recover from natural disasters, serious accidents, crime and terrorism through the convergence of science and technology with policy, operations and intelligence.

DRDC's CSS is providing support to PS to establish a national risk and resilience assessment framework and methodology for use in the National Disaster Mitigation Program. Currently, federal, provincial and territorial (F/P/T) governments are conducting different risk and resilience assessments across Canada; however, the information generated from these assessments is infrequently shared and has not been aggregated nationally for the purposes of emergency management (EM) planning and priority setting. These assessments exist outside of the national context.

1.2 Purpose

The objective of the report is to identify characteristics of resilience that should be considered in future development of a community resilience assessment framework and the resilience indicators and performance metrics that would define those features.

2. BACKGROUND: RESILIENCE IN THE CONTEXT OF DISASTER MANAGEMENT

2.1 General

There is a well-established global policy interest in the concept of disaster resilience. The rising incidence and magnitude of disaster risk and impacts, and the escalating costs of disasters has highlighted the need to not only reduce disaster risks but also increase the ability and capacity of communities to weather and recover from disasters. This shift in focus has resulted in an array of theoretical and applied frameworks focused on understanding and assessing resilience, primarily at the local or community level. Community disaster resilience (CDR) draws on the perspectives of multiple disciplines to help frame an understanding of how human and ecological systems dynamically intersect and influence each other to create vulnerabilities, adaptive capacities, and shared resilience.

2.2 Three analyses of CDR

This report examines the concept of CDR by first detailing some of the key definitions, assumptions, and conceptualizations that are framing the use of this concept in disaster management. This information is based primarily on a review of three meta-analyses of CDR, each of which adopted a different methodological approach to examining the current (i.e., last decade) literature on CDR. These documents are as follows.

2.2.1 Resilience for Public Safety and Security (RPSS) Assessment Report

This growing global interest in community disaster resilience as a concept and a practice is explored in the 2014 *Resilience for Public Safety and Security Assessment* report [1], which was designed to provide a clear and comprehensive picture of what is being researched and published in the domain of community or disaster resilience. The report details the results of a text mining analysis of 2,595 items published between 2003 and 2013, pointing to key topics and concepts that are shaping the public and academic discourse of resilience in the disaster management context. The report highlights the shift in this discourse towards a focus on risk assessments, resilience metrics, critical infrastructure protection and the recovery phase of disasters. This shift is apparent in most disaster management related conferences and policy discussions and reflects a growing recognition of the need to reduce the costs (human, social, and economic) of disasters in the context of climate change and a growing emphasis on inclusive governance practices and community engagement. The picture the review paints is consistent with other meta-reviews [2].

2.2.2 Community Resilience Descriptive Inventory

The Community Resilience Descriptive Inventory [3] was developed by the Canadian Centre for Justice Statistics Branch of Statistics Canada in 2012. As the author states, the inventory “catalogues data sources and variables that currently exist within Statistics Canada’s data holdings that could be used as measures of community resilience.” It includes a set of tables identifying data sources and measures for 26 factors related to

community resilience. These factors were identified through a consultation process involving government and non-government stakeholders. Each of the 26 selected factors was further broken down to indicators and, where available, existing Statistics Canada data sets were identified that would allow for the measurement of each indicator.

2.2.3 Rural Disaster Resilience Index (RRI)

The Rural Disaster Resilience Project was a three-year, community-centered action research project to respond to the global emphasis on increasing the capacity of all communities to meet the growing challenge of disasters, climate change, and other threats. The goals of the project were to produce resilience assessment and planning tools that could be used by communities to generate locally relevant data on their current resilience and be able to monitor and enhance their resilience over time. As part of this project, researchers undertook the development of a resilience assessment index that might be used in a rural community context. The index was generated as part of a larger applied research project. The Rural Resilience Index (RRI), one of a suite of tools produced and field-tested during the project, is designed as a user-friendly, process-based, qualitative resilience assessment tool. It emphasizes the value of widespread citizen engagement in resilience planning and a whole-of-community approach to resilience. The RRI was developed from a systematic analysis of existing resilience assessment and community wellness frameworks and indicators (see Annex A for the full list), and further informed by a rigorous analysis of data collected through interviews with rural end users and key informants. The RRI gathers together a set of qualitative indicators under categories and factors of community resilience that address such things as the quality and availability of local resources, expertise, skills and services; governance issues; economic and employment issues; culture; disaster preparedness; and emergency management planning.

Although the three reports' approaches to analyzing key factors and dimensions of resilience were different, all share some common findings. These findings help frame the concept of CDR and its dominant application in the field of disaster management.

2.3 Community disaster resilience: definitions

Theorists have extended the dictionary definition of resilience -- *the quality or fact of being able to recover quickly or easily from, or resist being affected by, a misfortune, shock, illness, etc.; robustness; adaptability* [4] -- to describe not just individuals but systems. However, the RPSS report highlights the lack of clarity regarding key terms used in the discussions of resilience in the disaster context, pointing to multiple definitions and conceptualizations of the term *resilience* as well as corollary terms such as adaptation and vulnerability. This lack of definitional clarity is a frequent criticism of resilience theorizing, an issue that originates in the multiple disciplines and applied contexts (e.g., engineering, disaster management, psychology, and urban planning) with an interest in resilience.

As this and other comprehensive literature reviews of resilience have indicated [5], the definitions of resilience share some common ground but vary widely depending on the discipline in which they have been constructed. To date, no standard definition of disaster resilience has emerged, as evidenced by the following examples:

- Community seismic resilience is defined as the ability of social units to mitigate hazards, contain the effects of disasters when they occur, and carry out recovery activities in ways that minimize social disruption and mitigate the effects of future earthquakes [6];
- Social resilience is the ability of groups or communities to cope with external stresses and disturbances as a result of social, political, and environmental change ... ability of communities to withstand external shocks to their social infrastructure [7];
- The capacity of a system, community or society potentially exposed to hazards to adapt, by resisting or changing in order to reach and maintain an acceptable level of functioning and structure[8];
- The capacity of an individual, community or system to adapt in order to sustain an acceptable level of function, structure, and identity[9];
- ...the amount of disturbance a system can absorb and still remain within the same state...the degree to which the system is capable of self-organization ...the degree to which the system can build and increase the capacity for learning and adaptation[10]; [10] and,
- ...resilience as both an individual capacity to identify and access resources (e.g., psychological, social, cultural) in order to ensure health and wellness, and the individual and collective ability to ensure the equitable and culturally-relevant provision of and access to these resources [11].

- Community-focused definitions of resilience shift our understanding of the concept from an individual, to a more relational understanding of well-being embedded in a social-ecological framework[12]. This view of resilience includes or implies a broad range of interconnected social, psychological, cultural, and structural factors that influence local capacity to anticipate, adapt to, and weather shocks that include disasters and other catastrophic changes[13].

- It is also important to define the concept of *community* in the context of disaster management and community resilience. Cutter et al. provide the following useful definition that synthesizes the multiplicity of possible meanings: we view communities as the totality of social system interactions within a defined geographic space such as a neighborhood, census tract, city, or county. We recognize that there are many different communities within such geographically defined spaces [14].

- The UK lexicon of civil protection terminology, established to ensure all partners in disaster management are using a shared language, succinctly defines *community resilience* as “communities and individuals harnessing local resources and expertise to help themselves in an emergency, in a way that complements the response of the emergency services[15].” This definition highlights a number of important principles used in various approaches to community disaster management including the primacy of the local, the complementary roles of community and emergency services, and the understanding that existing community resilience is a resource that can be harnessed to mitigate and respond to the impacts of disasters.

In essence, *community disaster resilience* refers to the ability of a community (viewed as a system) to adapt to change using its own inherent strengths and characteristics to

absorb the impact of an event and to participate in post-event processes that support the system in reorganizing, changing, and learning from the event[16].

Finally, it is also important to define social vulnerability in the context of disasters and community disaster resilience. Resilience in disasters is often framed in opposition to vulnerability, a term like *resilience* that has many different definitions. Social vulnerability commonly refers to the “characteristics and circumstances of a community, system or asset that make it susceptible to the damaging effects of a hazard [17].” In other words, social vulnerability results from social conditions and circumstances (present day and historic) that are related to individual characteristics (e.g., health, income, gender, ability, class, developmental stage and age, education, race, and ethnicity) but it is not these individual characteristics in and of themselves that create vulnerability. It is, rather, the ways in which society and/or a community recognize and respond to these characteristics and generate social-structural vulnerabilities.

Social vulnerability is partially the product of social inequalities—those social factors that influence or shape the susceptibility of various groups to harm and that also govern their ability to respond. However, it also includes place inequalities—those characteristics of communities and the built environment, such as the level of urbanization, growth rates, and economic vitality, that contribute to the social vulnerability of places [18].

Social vulnerability and resilience are understood to be socially-constructed, reflecting the differential distribution of resources and the ways in which individual characteristics (e.g., gender, age, ability, ethnicity) intersect with structural vulnerabilities (e.g. poverty, land use decisions) to create variable patterns of vulnerability and resilience across populations. Well-being is influenced greatly by the context of the larger freedoms within which people live. People may innately have greater or lesser strengths and abilities, but disaster resilience, as with disaster vulnerability, is largely related to individual and group factors such as gender, age, ability, ethnicity, social and economic status, and policy and planning decisions [19].

Social vulnerability is often challenging to measure and is most frequently described by the aforementioned individual characteristics (i.e., age, gender, race, ethnicity, ability) but it is a mistake to infer that these characteristics alone produce vulnerability. As with resilience, vulnerability can vary over time, context, and conditions. These constructs both describe processes and outcomes that are embedded in social relations, shaped by specific contexts and hazards, and mutable [20]. It is equally important to recognize that any individual can experience vulnerability and resilience simultaneously; neither vulnerability nor resilience are absolutes.

2.4 Disaster resilient communities

Given the multiple definitions of resilience and community resilience, a definition of disaster resilient communities may best be approached descriptively, through the characteristics or features of a disaster resilient community. In the UK’s *Strategic National Framework on Community Resilience*, the following descriptions describe the profile of a resilient community:

- People in resilient communities use their existing skills, knowledge and resources

- to prepare for, and deal with, the consequences of emergencies or major incidents.
- They adapt their everyday skills and use them in extraordinary circumstances.
 - People in resilient communities are aware of the risks that may affect them. They understand the links between risks assessed at a national level and those that exist in their local area, and how this might make them vulnerable. This helps them to take action to prepare for the consequences of emergencies.
 - The resilient community has a champion, someone who communicates the benefits of community resilience to the wider community. Community resilience champions use their skills and enthusiasm to motivate and encourage others to get involved and stay involved and are recognized as trusted figures by the community.
 - Resilient communities work in partnership with the emergency services, their local authority and other relevant organizations before, during and after an emergency. These relationships ensure that community resilience activities complement the work of the emergency services and can be undertaken safely.
 - Resilient communities consist of resilient individuals who have taken steps to make their homes and families more resilient. Resilient individuals are aware of their skills, experience and resources and how to deploy these to best effect during an emergency.
 - Members of resilient communities are actively involved in influencing and making decisions affecting them. They take an interest in their environment and act in the interest of the community to protect assets and facilities [21].

2.5 Resilience-based approaches to disaster management and disaster risk reduction

The focus on resilience in disaster management and disaster risk reduction represents an intentional shift away from a traditional top-down approach and an almost-exclusive emphasis on risks and vulnerabilities. Resilience is a so-called *strengths-based* construct, focusing on capacities and assets and how these can be mobilized and/or enhanced in order to reduce vulnerability and risk [22]. As noted earlier, resilience is based on the principle that people have the ability to overcome adversity and to succeed in the face of difficult circumstances. At the core of this shift, however, is another equally important change that recognizes the importance and centrality of community engagement to resilience building. CDR is generated from the ground up and resilience enhancement plans, activities and policies, if they are to be successful, must be participatory and respond to the specific cultural and social context. At its heart, CDR is driven by community-defined priorities and practices [23].

In this essential way, CDR requires the transformation of the role of citizens from that of stakeholders who are positioned to advise governments, to full equity partners and co-designers of solutions. This represents a significant shift in power relations. It also means that building resilience is a function that must be distributed across society. As Geoff O'Brien of the Disaster and Development Centre at Northumbria University in the U.K. suggests, "resilience should be a societal characteristic, not just of the emergency management function [24]." In a related paper, O'Brien et al. observe that resilience "should underpin holistic risk management, which includes hazard mitigation, sustainable development, and adaption to climate change [25]."

Marius Grinius, Canadian Ambassador to the United Nations, delivered a statement to the 2009 International Strategy on Disaster Resilience meeting during which he said:

[I]t is clear that we must adopt a comprehensive approach. Disaster risk reduction must be integrated into long-term development planning, including sustainable development and poverty reduction strategies.... Canada also recognizes the close linkages between climate change and disaster risk reduction [26].

Cork also argues that approaching risks from the perspective of resilience involves a more holistic approach:

[I]t encourages us to look at the dynamics of the whole system at multiple scales. Not just the focal scale of primary interest, but the scales above and below, in time and space, to understand how the system at the focal scale might be able to deal with perturbations and how that capacity can be enhanced and/or maintained[27].

However, it is important to note that resilience is not a variation of risk management, but “a proactive approach to the complex and uncertain policy context facing us today [28].”

2.6 Sustainability and resilience

Another important evolution in the conceptualizing of resilience in disaster management relates to sustainability science and the theoretical and practical intersection of resilience and sustainable development. In the 2009 *Brighter Prospects: Enhancing the Resilience of Australia*, Steve Cork has argued that:

...the focus on resilience includes, but has broadened, the view of “sustainability” towards identifying and then avoiding states that are clearly not sustainable, and then increasing the ability of environmental and social systems to respond to change while still retaining their essential functions [29].

A sustainable community sustains not just economic growth and development but “the entire web of life on which our long-term survival depends.” A sustainable community in this sense means one where “ways of life, businesses, economy, physical structures, and technologies do not interfere with nature’s inherent ability to sustain life [30].” Conversely, we know that unsustainable environmental practices increase vulnerability to a range of hazards and reduce the disaster resistance, thereby resilience of communities [31].

Further exploring the relationship between resilience and sustainability, Karen Howard concludes that “resilience does not imply returning to an unsustainable state [32].” If a system was not functioning well prior to a challenging event, then the system may need to be changed. In the disaster recovery context this implies both the possibility of building back better and of the possibility of *emergence*, the self-organizing capability of systems in response to stress.

This perspective, commonly referred to as a complex adaptive system perspective, suggests that changes in socio-ecological systems are inevitable, sometimes unpredictable, and can be either adaptive or destructive or both. Resilience in this

context demands a willingness to embrace change and complexity and be responsive, flexible, agile, and innovative [33]. It also suggests that change can include not only adaptation but also transformation and emergence [34]. Popa, Guillerin and Dedeurwaerdere [35] suggest that resilience theorizing is a necessary shift in thinking, necessary for addressing the kinds of complex sustainability problems that are characteristic of the 21st Century.

Cutter concurs, arguing that community resilience is inseparable from the condition of the environment and the treatment of its resources making the “concept of sustainability...central to studies of resilience [36].” In this way, resilience thinking provides a conceptual bridge that links disaster risk, climate change, and sustainability. As Steve Cork has observed, resilience is “the result of complex interactions within systems such as between a society and an ecological system,” and thus unable to be understood “without considering whole systems going beyond the immediate system of interest [37].”

A whole system, or in this case, a whole of community approach to resilience, suggests that any assessment of resilience requires a broad and inclusive survey of factors across intersecting systems (e.g., political, social, cultural, structural, natural). Enhancing resilience calls for fewer restrictions on the exercise of agency -- the freedom to act -- and thus empowers citizens to contribute to setting priorities for action and participating and contributing to those actions. It also requires strong social and state institutions that can support people’s efforts to cope with adverse events and that recognizes the inherent right of people to have input into the development and administration of their society [38].

2.7 Population health and well-being

Further informing resilience in disaster management are population health approaches that emphasize the links between CDR and health. Population health highlights the intersecting social, economic, and environmental factors that determine the health of populations. These factors are known as “health determinants” in Canada. The following 12 key determinants have been articulated by the Public Health Agency of Canada and are in use throughout Canada:

- healthy child development;
- education and literacy;
- employment and working conditions;
- income and social status;
- social environments;
- physical environments;
- social support networks;
- personal health practices and coping skills;
- biology and genetic endowment;
- gender;
- culture; and,
- health services[39].

As these and other health determinants contribute to natural, social, human, and economic capital and combine to produce a healthy or unhealthy population -- which in

turn contributes to the risk of hazards becoming disasters -- so too do they describe potential indicators of CDR. The Ontario Healthy Communities Coalition makes this link explicit: "In times of need, a resilient community will draw upon all of the resources that make it a healthy community [40]." A health determinant approach to resilience takes a multiple systems view of wellbeing.

John Lindsay of the Disaster Management Branch of Manitoba Health argues that health determinants are identical to the factors associated with disaster vulnerability and notes that "[r]ecognizing that these same concepts are being applied in both the health and disaster management contexts presents an opportunity to also achieve a shared objective of reducing vulnerability within a population [41]." Simone Powell of the Centre for Health Promotion at the Public Health Agency of Canada echoes this thinking and notes that the factors that increase resilience to disasters significantly overlap with the agency's definitions of the determinants of health [42].

People who are struggling with chronic or acute health conditions may experience greater vulnerability in disasters because of the limitations illness can place on mobility, independence, and coping. In addition, disasters may cause or exacerbate limitations on the availability and access to formal (e.g., nurses, counsellors, social workers) and informal (e.g., friends, family) health and social supports limiting assistance during and following a disaster. Those with functional disabilities (visual, aural, physical and cognitive) may similarly experience greater vulnerability. Other health determinants such as gender, age, aboriginal status, food insecurity, income, education, housing, race, social exclusion and social safety networks are also factors in disaster vulnerability [30].

Decades of research on the social determinants of health have produced a clear evidence base for the role that social factors and inequities play in health [43]. Given the complexity of CDR and of generating a useful assessment tool to measure CDR, and given the relatively limited research detailing the application of CDR assessment, it may be prudent to consider this evidence and the indicators on which it is based.

2.8 Community action

Community action and participation are considered to be vital to enhancing community resilience. In the literature, this "bottom-up" approach emphasizes that, although community members need to be educated about aspects of disasters, ultimately they must decide which factors are relevant to their community, and how strategies to increase or reduce these factors should be implemented. Resilience thinking is inherently participatory; creative adaptation requires that citizens feel a sense of ownership in and empowerment to influence their environments and the policies and practices that impact and shape those environments [44].

Krewski et al. note that community action has traditionally provided the basis for social change and that community action is a necessary factor in enhancing community disaster resilience:

Community action is a term used to describe the involvement of community members in setting priorities, making decisions, planning, and implementing health-related initiatives. Engaging community members in this process involves a process of empowering communities, and building their sense of ownership and

control over decisions and programs that affect their lives and their communities. Community action involves mobilizing existing community resources, increasing meaningful public participation, sharing and increasing access to information, and building skills. Strengthening community action increases a sense of common purpose and identity, strengthens partnerships and social networks, builds commitment to group action and in the longer-term, commitment to strategic action [45].

The emphasis on communities is noted in the RPSS report which also observes that “[c]ommunities – especially as defined by their social elements – are also seen as key to emergency management, planning, and continuity [46].” Recently, a stronger focus among analysts on “bottom-up” approaches to community resilience is aimed at empowering communities to develop their own approaches to resilience, sustainability, and climate change. In the UK, O’Brien argues that while building disaster resilience requires both top-down and bottom-up approaches, “local authorities are the vehicle most appropriate for developing local level adaptation responses” because they know more about local vulnerabilities and assets, particularly the strengths and needs of residents and the impact of disasters on their environment and the sustainability of the community[47].

O’Brien et al. note that there is an urgent need for communities to develop the capacity to evaluate climate change risks, including local conditions, their potential impact, vulnerabilities, and capacities to avoid or respond to disasters [25]. This will require communities that are educated in the issues and are self-sufficient and organized. In other words, O’Brien et al. note, building or enhancing community disaster resilience “is about helping people to help themselves [30].”

Adger et al. argue that the nature of the relationships between community members and their access to and participation in decision-making is critical for adaptive capacity/resilience:

A series of studies has shown that successful community-based resource management, for example, can potentially enhance the resilience of communities as well as maintain ecosystem services and ecosystem resilience.... There are many examples where social capital, social networks, values, perceptions, customs, traditions and levels of cognition affect the capability of communities to adapt to risks related to climate change[48].

It has also been recognized that Indigenous and local peoples have very specific ways of indicating and assessing change in the health of their systems as well as their own well being. According to Helen Hambly, there have been some initiatives internationally to develop grassroots indicators based on Indigenous knowledge [49]. While it may not be possible to introduce grassroots indicators into a community disaster resilience indicator set, it may be that acknowledging the importance of local knowledge and grassroots indicators based on direct experience and observation may lead to their inclusion in future efforts to measure community resilience.

2.9 Discussion

Community disaster resilience provides a conceptual framework for accommodating the complex interactions between human agency, social structure, and the environment. CDR plays particular attention to the social dimension of living (e.g., creating and sustaining relationships and networks of relationships; communication; information sharing), social inequalities, and the structural barriers and opportunities that are generated as a result of power relations. Central to any understanding of CDR (and disaster related vulnerability) is a recognition of the complex web of social relations, social-structural factors, context and hazard specific characteristics, and temporal and other conditions that influence an individual or groups capacity to anticipate, mitigate, manage, and recover from a disaster.

A CDR approach to disaster management emphasizes the importance of attending to the complete life-cycle of disasters (e.g., mitigation, prevention, preparedness, response, and recovery) and planning in ways that capitalize on community assets and resources while also recognizing and mitigating vulnerabilities. To do this requires acknowledging and addressing the unequal patterns of distribution of both vulnerability and resilience across any given population, and harnessing the political will and resources to address the underlying conditions and dynamic pressures that generate and sustain vulnerability. Understanding that CDR is a context driven process, any assessment or plans will need to incorporate an analysis of the ways in which specific hazards and risks may influence the geographic and social landscape of vulnerability and capacity. An effective attempt to assess and sustain community resilience must:

- take a trans-disciplinary approach and involve multi-sector collaboration;
- be integrated into the fabric of a community or society;
- incorporate a social inclusion framing that addresses the ways in which poverty, race, class, gender, ability and other factors will variably shape and influence resilience;
- promote the cooperation of formal and informal institutions and systems to protect, promote, and sustain the health and well-being of individuals, families, and groups; and,
- be based on an understanding that building community resilience is a dynamic process in response to natural cycles of routine (persistent) and transformative changes (crises) that occur in intersecting systems[50].

CDR represents the composite capacity of a community at a moment in time and place and its ability to anticipate, respond effectively to, and manage critical transitions by absorbing and creatively adapting to the losses and changes incurred as a result of disasters/adversity. This understanding conceptually guides an approach to disaster risk reduction and management that includes the need to reorient to environments (social, environmental, political, etc.) that are continually in flux and that, at specific times undergo dramatic changes. These changes may be positive or negative and their value as such will differ for differing people; building resilience for some may cause greater vulnerability for others. Whereas the focus of most disaster planning is on continuity of functions, identity and system integrity, CDR invites a consideration of adaption and emergence, a perspective more consistent with much of the thinking being done in relationship to climate change. CDR offers a way forward for the two disciplines and

areas of practice — disaster and emergency management and climate change science — to begin working more closely together. The increase in extreme weather events and natural disasters associated with climate change suggest this is an imperative and an opportunity.

Articulating a conceptual approach is the foundation for and first step in developing a framework to guide efforts to enhance community disaster resilience. The following section identifies and briefly describes some key themes and concepts that attempt to provide unified frameworks to guide practitioners who seek to build or enhance community disaster resilience.

3. THEMES FROM RESILIENCE CONSTRUCTS AND FRAMEWORKS

In the context of this discussion, the term *framework* means a theoretical construct that is developed to guide action. Frameworks are constructed on a base of knowledge, research, and best practice and may include guiding principles, desired outcomes, policy assumptions, and roles. In essence, developing a framework is the first step in determining how to address a problem.

A resilience planning and assessment framework is intended as a tool to support effective planning, providing users with both the big picture of resilience planning and a guide to help shape their understanding of where they are, where they want to go and how to measure progress towards those goals. A framework is also an essential precursor to developing indicators that can adequately measure disaster resilience. As Mayunga et al. surmise, “without a conceptual framework in which indicators can both be defined and measured, [the concept of resilience] will not be useful for disaster risk reduction strategies, nor will it sufficiently inform our disaster risk reduction policies [51].”

A resilience assessment requires delimiting the scope and focus of the assessment (which systems?), the temporal focus (resilience when? how stable?), and the goals (what outcomes are desirable? what outcomes are we trying to avoid?). This means that any framework that is developed needs to be comprehensive but flexible, adaptable, and responsive to different circumstances and desired outcomes.

Resilience assessments can contribute to developing a baseline measure of resilience in a community, developing a community portrait of vulnerability and capacity, identifying indicators for other related outcomes based planning frameworks, and for monitoring and evaluation of projects and/or for a comparative evaluation of projects [52].

A wide range of existing measures and models assessing CDR and related constructs (e.g., community wellbeing, sustainability) already exist. These frameworks reflect the diverse disciplinary backgrounds and planning contexts in which and for which these frameworks have been developed including:

- disaster and emergency management;
- sociology;
- psychology;
- ecology and environmental science;
- community economic development;
- international development; and,
- public health.

The diversity of foci and the differing scales of analysis makes producing a single CDR assessment framework challenging. This is further complicated by the fact that communities of differing sizes and capabilities may need different types of assessment tools and processes. Given that any community, large or small, includes a constellation of sub-communities or groups, it also requires that a CDR framework pose and help assessors explore questions such as: “Resilience of what? Resilience to what? and Resilience for whom?”

What is clear from a review of extant CDR frameworks and models, and from related indices (e.g., health determinants) however, is that there is no need to reinvent the wheel. Although the descriptive language used may vary, most of these models share a similar understanding of the constituent dimensions of resilience. Cutter et al [53] call for “a candidate set of variables for measuring resilience” drawn from climate change, hazards, political ecology, ecosystems and planning literatures and focusing both on “antecedent conditions in social and natural systems and the built environment.” Norris et al [54] focus on adaptive capacities across various networked domains – economic development (e.g., diversity of resources, equity), social capital (e.g., social support, attachment to place), information and communication (e.g., skills and infrastructure, trusted sources of information), and community competence (e.g., community action, flexibility and creativity).

3.1 Principles of CDR Assessment

In their summary report on research examining the links between health status and resilience in rural environments, Kulig, Edge, and Guernsey [55] describe resilience as a process influenced by such factors as community leadership, community engagement, and collective problem-solving processes. Like Cutter et al. [14], Kulig et al. also emphasize the role of a sense of belonging and community cohesion as necessary precursors to effective, proactive community action and problem solving and hence, community resilience.

This depiction of resilience as strongly influenced by individual and social capital creates a vision for a disaster resilient community that is consistent with the basic characteristics of resilient communities identified in the UK’s *Strategic National Framework on Community Resilience* (see section 2.4). A systematic analysis of the CDR literature by Cox and Perry elaborates some basic principles that can be used to guide the development of CDR assessment tools to support communities working to build resilience [57] .

- Focused measures are needed that incorporate a range of quantitative and qualitative methodological approaches in order to meet the need for specificity and flexibility and be able to apply measures in different contexts;
- Secondary data sets will likely enhance the ability to measure CDR (as outlined in the Statistics Canada index). Community Profiles can contribute to providing this data where not available through national surveys;
- CDR assessment will benefit from a diversity of approaches (quantitative and qualitative) and methodologies allowing for adaptation in different contexts. This includes a range of indicators that allow for ‘expert’ assessment and those that are simple enough to allow a range of stakeholders to assess (e.g., Likert scales that allow for quantifying subjective assessments), and proven tools such as community mapping;
- Ideally, the development and application of CDR assessments would be an iterative process, wherein a basic framework could be adopted and adapted to reflect specific community needs, considerations and capacities;
- As the NOAA Coastal Service Centre emphasizes, “indicators may make more sense than an index” [58];

- CDR assessment frameworks should be attuned to and attempt to address the various social, cultural, geographic and economic constraints that may influence the assessment process (including the decision to prioritize CDR);
- Perceptions, needs, and capacities will change over time and resilience outcomes should be monitored, evaluated, and revised accordingly;
- Effective CDR assessment processes will adopt a participatory, collaborative approach that encourages broad engagement and a whole-of-community approach; and,
- Communities may require incentives when it comes to implementing CDR processes (assessment and resilience building measures). Case studies can help communities understand the relevance, the process, and the potential benefits and increase their willingness to utilize these measures.

3.2 Core domains and dimensions of community resilience

In the development of the RRI, Cox and Perry used community capitals to organize a range of dimensions, or features of resilience. The notion of community capitals refers to the assets or resources that exist in a community. The Community Capitals Framework [59] articulates seven capitals: natural, cultural, human, social, political, financial/economic, and built capitals. Many of the commonly used disaster and community resilience frameworks draw on this Capitals-based approach. To these seven identified by Emery and Flora, Cox and Perry [57] added an additional category focused specifically on dimensions of a community related to disaster planning and preparedness. These core domains are described below drawing on Emery and Flora's descriptions and the work associated with the RRI:

- Human Capital – constitutes the individual capacities, skills, training, education, and knowledge and leadership of community members. Human capital is necessary for developing and mobilizing community resources;
- Built Capital – constitutes the community's infrastructure including key community buildings, homes, business/office buildings, schools, roads, transportation systems, sanitation/sewage systems, telecommunications, water systems and, energy systems;
- Social Capital – constitutes the shared norms, the breadth, depth, and quality of social networks and bonds in a community, and mutuality and trust. Social capital is about relationships and the ways in which these relationships support collaboration towards shared goals, and cohesion;
- Cultural Capital – constitutes the values, customs, traditions and, languages within a community. Cultural capital can also include the ways in which creative processes and capabilities are practiced and shared in the community formally or informally;
- Economic Capital – constitutes the economic vitality and diversity within a community/region, the financial resources available, employment and livelihood resources, wealth and, alternative economic practices that can be used to offset economic inequalities;
- Natural Capital – constitutes the natural resources and natural resource management, energy production and supply, geographic attributes, weather, proximity, and utilization of local food and water sources, environmental status, and ecological/natural systems exposure;

- Governance (political) Capital – constitutes both the ways in which community members are included, engaged by, and are able contribute to or have a voice in the governance and decision making in a community. It also includes the nature and quality of formal and informal governance structures, systems and processes (e.g., transparency and reliability of government communication, trust, the community’s ability to access resources and support from other levels of government) and, the local government investments in disaster planning and resilience;
- Preparedness Capital – constitutes the investments a community makes into disaster planning, preparedness, mitigation, response, and recovery. This includes plans and planning processes, activities undertaken to prevent/mitigate/prepare for disasters, safety and security (e.g., police), formal emergency response capabilities (e.g., fire, ambulance, emergency response services), medical care facilities and staffing, emergency management staff and resources, informal/community response capabilities (e.g., volunteer base, skills specific to disaster response and recovery), and presence of community shelters; and,
- Risk Assessment – assessment and analysis of local/regional hazard risks, social vulnerability and capacity assessment and analysis.

3.3 Dimensions from Resilience for Public Safety and Security Report

The RPSS has also analyzed a range of official resilience frameworks and inventories of the “characteristics, components or drivers of resilience” [1] in order to identify most commonly cited concepts which they frame as “features of resilience.” This exercise identifies the frequency of occurrence of concepts in the frameworks and inventories. Some of these concepts would map to a Capitals-based organization such as “education,” “risk assessment/management,” and “community engagement.” Others, such as “climate change” or “floods” are more descriptive of concerns/hazards that resilience frameworks may be addressing, approaches to working with resilience, such as “Hyogo Framework for Action” or, highlight potential players in resilience building such as “NGOs” or “Government role.”

Other themes emerge from this report that are relevant when considering domains of resilience. This includes the identification of several areas of emphasis or “key thematic areas” (or clusters) of focus in the overarching review of the 2,595 documents. These clusters of attention in the frequency analysis include dimensions of resilience that would be important to consider in the construction of a framework, namely:

- mental health effects of disasters;
 - public health care planning;
 - psychosocial support;
 - critical infrastructure (including supply chains) and public works;
 - risk assessments;
 - decision-making and governance; and,
 - issues related to the intersection of disaster risk – reduction and climate change.
- [30]

The latter, while not necessarily a dimension of communities and therefore of community resilience, points to the need to include in a resilience framework the links between climate change and disasters, and some of the skills/knowledge, practices, etc. that may need to be heightened in a community to meet the challenges associated with the uncertainty, unpredictability and increased disaster risks (e.g., extreme weather, land loss, ice loss) associated with climate change.

3.4 Indicators

Indicators are used to measure something by providing information or pointing to information that can be of direct use to decision makers. An effective indicator or index (a set of related indicators) must be suited to its purpose. Indicators are most frequently determined by identifying those processes and outcomes measured quantitatively (e.g., volunteer hours) but that can also, in some way, inform the assessment of a more abstract and/or complex construct such as citizen engagement that can not, in and of itself, be measured. Because of this, one of the potential challenges in adopting an indicator approach to measuring resilience is the tendency to focus only on those indicators that lend themselves to being measured while ignoring those that, although no less relevant or valid, do not lend themselves to measurement[60]. Indicators are not

apolitical. Inherent in any given indicator are the political biases and historical uses that have shaped the legitimacy (or illegitimacy) of that indicator.

Successful resilience assessment and planning activities depend upon their being grounded in the context of citizens' everyday concerns and providing ways and means that are flexible, accessible, and realistic within the financial and/or technical constraints that are characteristic of many communities. At the same time, many of the constructs indicators are designed to measure are complex. Forms of vulnerability related to such things as poverty, or racism, cannot be reduced simply to income, or ethnicity. As King suggests when discussing the use of indicators to measure vulnerability, "[c]ommunities and their populations are too complex to be reduced meaningfully to indicators or generalised to absolute classifications of vulnerability[61]." For an index to be useful and relevant, the blend of indicators needs to somehow address this tension between usability, complexity, and relevance.

This suggests that successful resilience assessment frameworks will include a blend of quantitative and qualitative measures to better reflect and value the subjective perspectives and priorities of local actors [62] while also including so called hard or quantitative measures where those are available and relevant. The goal of the assessment may also, in part, determine the specific choice of dimensions and indicators and will need to balance tensions between the need for local relevance and for regional/national comparisons[63]. The use of Likert style measures (e.g., scales one to five) can provide descriptive quantitative data based on subjective assessments and afford a broader spectrum of stakeholder involvement in CDR assessment. As outlined in the Statistics Canada report[64], quantitative indicators may be available for certain dimensions of CDR but their availability will vary depending on the type of communities (e.g., incorporated, unincorporated) and the focus of commonly available survey data (e.g., census data), and the nature of the dimension. Such indicators typically involve census data, enumerations, and administrative records, while qualitative indicators tend to involve interviews, participant observation, and self-assessments. Both types of indicators are important, and used together, can provide greater validity and reliability for the overall assessment. Furthermore, resilience indicators are not simply tools for assessing, but also tools for supporting dialogue and empowering communities and their citizens to become engaged in resilience building activities, an approach that is congruent with current demands for more democratic and participatory forms of decision making and governance[65].

3.5 Organizing indicators

One of the ways of organizing indicators of resilience is to identify core categories, domains or features of a community that would influence resilience. As with the analysis of community resilience frameworks, a detailed analysis of resilience indicators suggests some common themes for these categories that can help identify and organize the choice of indicators to be included in a framework. The relative importance and relevance of any indicator in a given context will vary, and as stated previously, there will always be a need to customize indicators to meet the specific needs, goals, and capacities of each community or region. Given the challenges of working with indicators, some agencies and groups have suggested that it is more realistic in many communities to use qualitative indicators that focus on an assessment of community characteristics based on local knowledge and judgments [30]. Providing at least two options for how to

measure a specific dimension of resilience (one quantitative, one qualitative) and preferably several options allows for customization. It is important not to overwhelm both the measurement process and communities involved in it.

Based on best practices, it is generally recommended that the communities themselves make the final determination about which indicators to use. These decisions will inevitably be based on their own priorities, the social, cultural, and economic context, and the specific hazard risks, vulnerabilities, and community assets with which they are working. The Bellagio Principles of indicator development and communication emphasize the need for widespread and inclusive participation that includes grassroots, professional, technical and social groups, with particular attention to those groups that tend to be marginalized in decision making processes (e.g., youth, women and indigenous people). This participation ensures that the resilience assessment reflects the diverse and changing values within a community, and that the process establishes the social legitimacy of the proposed changes those solutions entail [66].

Table 1, which follows, outlines some suggested domains (categories) and dimensions (features) of CDR. Some of the indicators are suggested by the Statistics Canada Resilience Index report but not all of those would have corresponding data available whereas others are suggested by the RRI and other of the frameworks surveyed for this report. As suggested previously, a blend of indicators (qualitative and quantitative) is preferable and would include Likert-type questions that would prompt subjective assessments. The list of dimensions and indicators is comprehensive but not exhaustive. Depending on the level of analysis (e.g., community-wide, neighbourhood) some of the indicators may be more or less applicable.

Table 1: Suggest Dimensions and Potential Indicators of CDR

Domain	Dimensions	Potential Indicators
Human Capital	Socio-demographics	Education Age structure Population density Gender Visible minorities Aboriginal status Religion Household composition and family structure Languages Official language proficiency Crime and social disorder
	Population Density and Distribution	Community maps Population density
	Population stability	In and out migration Tourists, seasonal and migrant worker populations
	Knowledge and Skills	Adult literacy and competencies Skills & Knowledge inventories Traditional skills and knowledge Intergenerational transmission of skills and knowledge
	Health Status of community	Self-rated health and well-being Prevalence of mental health issues Prevalence of obesity Prevalence of chronic health issues Smoking rates Alcohol, illicit drug use, gambling Self-rated levels of physical activity Life Expectancy Suicide rates Food Security
	Health Resources	Access to primary health care (i.e., family physicians, health clinics) Access to acute health care (i.e., hospital) Numbers, types and staffing of health care facilities Medical professionals Culturally specific health care options Senior care services
	Mental Health & Social Service Resources	Psychosocial and mental health providers Rates, use, and accessibility of social support services and programs Rates, use, and accessibility of addiction services Domestic violence/child abuse services and shelters

Domain	Dimensions	Potential Indicators
	Functional disabilities	Activity limitation and degree of assistance required
Social Capital	Relationships	Sense of belonging Trust in neighbours Willingness to help neighbours Self-reliance Social equity and inclusivity Mutual aid Sense of safety (Self-reported or Crime Rates) Openness to new comers
	Civic Engagement	Involvement in local events, community activities Volunteering – rates/breadth/diversity Resourcefulness Ability to problem solve Ability to manage, adapt to change
	Social Resources and Networks	Proximity to and frequency of contact with family and friends Membership and/or participation in religious, cultural, social, or recreational groups
	Social Support	Availability, access diversity Formal and informal Religious ties and cooperation Non-governmental supports (e.g., food bank, women's shelter, advocacy groups)
	Availability of social, civic, and religious organizations	Number of volunteer/non-profit organizations per capita Community sports, recreation, and arts centres Community centres, resource centres, and libraries Religious organizations
	Generalized Trust	Trust in strangers Openness to newcomers
	Social connectivity (bridging capital)	Links to other/neighboring communities Links to outside resources Intra-community mutual aid

Domain	Dimensions	Potential Indicators
Built Capital	Telecommunications	Access, availability, and reliability of landlines Cellular phone coverage, access, and reliability Alternative communication options Presence of HAM radios/radio operators Satellite phones
	Internet	Access, usage, coverage, and reliability
	Communication	Local/regional television access, usage, coverage, and reliability Local/regional radio access, usage, coverage, and reliability Local/regional print media access, usage, coverage, and reliability Alternative forms of community communication (e.g., newsletters, twitter, texting, blogs, other social media)
	Transportation and evacuation capacity	Driver's licenses Private vehicles (including cars, ATV, and snowmobiles) Public transit availability, usage, and reliability Reliance on others for transportation Commuting – numbers, distances Transportation alternative (e.g., bike routes and paths, snowmobile/ATV routes)
	Critical Infrastructure (Availability, reliability, breadth of coverage, access, and redundant systems)	Water Sewer/Sanitation Power Transportation Telecommunications
Cultural Capital	Housing	Private home ownership Rental Accommodation Housing affordability
	Creative capacity	Numbers of artists (visual, music, theatre, media, etc) Cultural events Arts events Festivals Innovation
	Cultural vitality	Cultural events and activities Trans-generational transmission of culture and language and traditions Traditional knowledge and skills

Domain	Dimensions	Potential Indicators
Economic Capital	Economic health	Employment Income Low income and Income Inequalities Wealth, assets, access to financial resources Economic development and diversity
	Economic vitality	Local businesses Local Services (e.g., grocery store(s), pharmacy, gas, mechanics) Short and Long Term planning
Natural Capital	Natural resources and resource management	Stocks (fish, wildlife) Forest resources Energy sources Policies and plans Community engagement in planning and management strategies Technical and financial investments in management
	Environmental Status	Beach/shell fishing closures Well contamination Air quality Acidification Pollution by Agents of Release Industries with the potential for significant pollution/disruption (Pulp and Paper Mills, Mining, and Fracking)
	Geographic Attributes	Remoteness Weather and climate Topography
	Ecological Exposure (Loss, Protection, and Rehabilitation)	Soil Flooding Wetlands Coastal areas Forests
Governance	Political Engagement	Voter turnouts Citizen involvement in decision making processes Sense of Civic empowerment and self-efficacy Generalized Trust
	Leadership (formal and informal)	Trust Transparency Accountability Communication Sustainability Planning Resources for Resilience planning

Domain	Dimensions	Potential Indicators
Preparedness Capital	Risk Management	Hazards, Capacity, and Vulnerability Analysis and Mapping History of Hazard Occurrence Regular review and updating of assessments All Hazards Plans Civic awareness of hazards and risks Integrated risk-land use planning Risk Mitigation Activities and Strategies
	Resources	Community disaster reception/shelter Local food options Local Gas/Fuel options Generators Heavy equipment/machinery and operators Farming, construction and other equipment that could be used in search, rescue, and recover
	Disaster and Emergency Plans and Planning processes	Comprehensive Community Emergency Plan (short and long term) Community Awareness Education Training Resources to support planning, updates, and practicing of plan Business Continuity plans for local businesses Multilingual Information Resources & Communication Prevention, Mitigation and, Risk Reduction Actions
	First Response Capacity	Police services Fire, ambulance, and emergency response services Search and Rescue Medical professionals Emergency management program and staff (and alternates) Up-to-date inventories of equipment, personnel, contacts, and call out lists Early warning systems
	Community Response Capacity	Community Shelters Emergency Social Services Disaster Non-governmental organizations and volunteer groups Psychosocial and mental health providers Up-to-date Inventories of equipment, personnel, and contacts First Aid Capacity Automated External Defibrillators Up-to-date Inventories of equipment, personnel, contacts and call out lists

	Medical Response Capacity	Physicians Nurse Practitioners Nurses Paramedics Ambulance First Aid Practitioners Clinics/Hospitals
	Food Security	Food security and affordability Food banks Local farming and food production

4. RECOMMENDATIONS

As evidenced in the analysis presented in this report, effective CDR assessment requires a whole-of-community approach that assesses factors and processes touching on all aspects of the community. As the table of dimensions in the previous section indicates, this could involve assessing a large number of dimensions and a wide range of indicators. However, best practices for the use of indicators suggests that a much more limited set is probably more likely to be used. This is supported by experience working with communities and by the fact that despite there being a good number of extant CDR frameworks, relatively few communities have undertaken such an assessment.

Diversity across and within communities, including cultural diversity, development patterns, size, and geographies, demands that whatever policies and tools are developed, they must have built in flexibility that allows communities to adapt them to meet their needs, priorities, and capacities. These mechanisms should be guided by common principles of participation and engagement, inclusivity, accountability through monitoring and evaluation processes, multi-hazard focused, ease of use, and relevance. Supports (e.g., guidance documents, resources) should be provided to communities in order that they can adapt tools in ways that ensure they are still asking the right questions but able to adapt those questions to their specific context.

The following recommendations are made for the consideration of the development of a CDR framework:

- **Build upon what has already been developed.** As this report suggests, extensive research has already been conducted on the construct of CDR and an assortment of tools, models and frameworks already exist that can be drawn on to generate a comprehensive Canadian CDR assessment framework. That said, the Canadian geographic, political, and cultural context presents specific unique factors and these should be accounted for in any national CDR framework. Most community disaster resilience measures have been developed in other national contexts and do not address, or address well, issues and concerns related to rural and remote communities, Arctic/Northern communities, First Nations reserve communities (including differences in governance and culture), specific challenges, and opportunities;
- **Keep it simple.** Checklists and Likert type scales are useful and easy to use and if presented properly can spark dialogue and a consideration of a range of factors in ways that are accessible and familiar. The potential danger in checklists is a superficial analysis; the potential benefit is the involvement of a wider range of community stakeholders in the process. This may be particularly relevant in smaller communities where the formal capacity for undertaking a CDR assessment may be limited. However, the principle remains the same regardless of the size and capacity of the community.

The further benefit of simple inventories and checklists is that some of these can be used as aide memoirs during a disaster when stress, fear, and fatigue may otherwise interfere with cognitive functioning;

- **Flexibility and Relevance.** An indicator framework should be developed that is flexible, easy to use, and that provides communities with options. As stated previously, this means including options for either quantitative or qualitative (or semi-quantitative – Likert style) indicators. It may also be beneficial to consider developing a framework that is guided by a set of relevant questions, communities should consider and then links those questions to a range of indicators that can be used to explore the answer. As suggested previously, a set of indicators may be more beneficial than a structured index. Communities need to be able to select indicators that help them analyse relevant and important dimensions while also being relevant to their community and their everyday needs, priorities and processes;
- **Secondary data.** Improving the availability and access to secondary data sets can improve the quality of resilience assessments and enhance the capacity of communities, particularly smaller rural and remote communities, to engage in CDR. Regional information can be useful but fails to address the diversity (e.g., geographic, cultural, climatic) encompasses by many large regional boundaries. Detailed community profiles can be resource intensive but can provide more detailed information for CDR assessments;
- **Process orientation.** The process of engaging in CDR is an opportunity to generate community awareness and contribute to community members working together towards a shared goal (i.e., building social capital). CDR assessments can contribute to resilience as part of the assessment through building awareness, increasing social capital, and providing a shared community vision. In this way, CDR can contribute as much or more to the goal of achieving emergency preparedness and resilience as the plans and activities that emerge from the process. Such outcomes can empower citizens and decision makers and become the catalyst for action. A CDR framework should encourage the involvement of a broad range of stakeholders in the process. Activities such as community mapping have been used successfully to engage communities and quickly, dramatically gather and convey relevant information about the community's capacities, vulnerabilities, and resources.

The process also needs to reflect the creativity, spontaneity, and emergence that contribute to resilience. As Tierney suggested in 2009, "Flexibility, adaptability, and improvisation among responding entities make their own distinctive contributions to resilience. Organizational expansion, extension, and emergence are key bases of resilient disaster responses" [67];

- **Make it relevant.** Finding ways to frame CDR within existing community and/or planning processes may increase the uptake and stakeholder engagement. Providing incentives may be helpful, but it may also require framing and presenting CDR in ways that suggest its relevance to the everyday quality of life in a community, not only as an instrument of preparing for disasters. Despite decades of disaster preparedness campaigns and efforts, the reality is that these ideas do not resonate for most people unless they are somehow linked to their realities in the everyday;

Outcome measures should include indicators that can measure the benefit and value to individuals (households), partnering organizations, and the community as a whole while ensuring that the diversity of cultural, ethnic, religious, business and other groups can *see themselves* in those outcomes. These outcomes can also include measuring the ways in which the process may be benefiting the

- quality of the relationships amongst the involved partners and within the community (i.e., bonding capital); and,
- **Sustainability.** CDR is a process and, as stated previously, the resilience it measures will change over time, in response to a changing hazard risk landscape, and as the community changes and develops. For a CDR process to be effective it requires a long-term vision that allows for ongoing assessment and monitoring and revisions. It also requires attention to the ways in which conflict, partnership fatigue, shifts in personnel, and changes in resources and funding contribute to what is often a start-and-stop process, or a one-off mentality in many disaster risk reduction programs. Customizing the process will help in some measure with this, but it is likely also to require engaging community champions – those people in the community, who because of their position and their relationships, encourage greater buy-in, can mobilize other partners and stakeholders, and who understand the dynamics of a community in order to encourage ongoing and widespread involvement. Identifying, creatively communicating, and celebrating meaningful tangible outcomes and successes keeps people engaged and motivated.

5. CONCLUSION

There is little question that new, more proactive approaches are needed to address the growing challenges of climate change, sustainability, and disaster risk reduction. The national and global focus on community disaster resilience is responding to a shared recognition of the need to re-envision our shared approach to disaster management. A new approach is needed that acknowledges disaster management's distributed function and the need for multi-sector and civil society engagement and participation in risk reduction and resilience building. A cultural shift is needed in which CDR is understood as everyone's responsibility but a responsibility that is resourced (financially and technically) by government policy and action.

A community-centered approach to disaster management and risk reduction is recognized as an optimal way of building capacity, integrating unique local needs and resource contexts, and addressing the limitations of top-down management strategies [68]. The public and private sectors will need to work collaboratively to manage risks more effectively and engage proactively in practices that reduce those risks (e.g., integration of hazard risk and land use planning) and build resilience. Broad-based resilience enhancement efforts and partnerships or coalitions at all levels, but particularly at the local and regional levels, will support the comprehensive assessment of resilience and vulnerabilities and allow for the development and implementation of more effective plans and practices to reduce risks and foster resilience across all parts of society. This, in turn, requires strong and capable leadership, a proactive policy environment, and opportunities and incentives that engage citizens, including and especially, those who are marginalized or disenfranchised through poverty, disability, age, or ethnicity.

To accomplish the goal of developing resilient communities and a resilient society will require an approach that includes, but is not limited to CDR planning and assessment. CDR is a critical component of risk reduction and sustainability but it will need to be tied to other opportunities that address more effectively the underlying dynamics of social vulnerability. For CDR initiatives to be successful they will need to support innovation and the generation of creative and possibly unexpected solutions to the resilience challenge communities and society face. These solutions will need to be tailored to the local context but also shared in ways that allow for them to be adapted to other contexts. Scaling up resilience solutions may be important, but scaling across is as well.

Addressing complex social challenges such as CDR requires a willingness to explore innovative ideas and opportunities. Innovation, however, should not imply as it often does, that the solutions are highly technical or expensive. As has already been stated, much of what supports community resilience is what supports healthy communities more generally and what has been identified in previous movements (e.g., community wellness, community development, population health). Governments have a prominent role to play in developing a culture of CDR, and their commitment through policies and resources is essential if this transformation is to occur. This role, however, may require stepping away from traditional approaches and adopting participatory governance models that engage communities as equal partners and encourage innovation and greater ownership at the local level. CDR is more than a simple tweak to existing approaches to disaster management policy and practice; it represents a more fundamental shift in thinking that requires addressing underlying, systemic factors of

social and structural vulnerability, normalizing and institutionalizing the concept of CDR across sectors and groups, and promoting innovation in 'niche' spaces.

Resilience is too broad a concept and too complex to address with one policy or within one department. CDR must be recognized and embraced as a distributed function across society. Disaster risk will never be eliminated completely, but CDR provides a way forward to managing more effectively and reducing those risks, and building healthier, stronger communities. It requires the contributions of all citizens (and the valuing of those contributions) towards a shared national vision for resilience in which all citizens can see themselves reflected.

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ANNEX A. FRAMEWORKS ANALYSED FOR THE RRI

Table 2: Table of frameworks analysed for the RRI

Name	Author/Developer
Characteristics of a Disaster Resilient Community	John Twigg (2007)
Capital Approaches to Community Disaster Resilience	Joseph Mayunga (2007)
Community Vulnerability Management Paradigm	David McEntire (2002)
Disaster Ecology Approach	James Schultz, Zelde Espinel, Sandro Galea, and Dori Reissman (2007)
National Community Resilience Enhancement Approach	United Nations International Strategy for Disaster Reduction (2005)
Resilience as a Critique of Risk	International Federation of Red Cross and Red Crescent Societies (2004)
Resilience as a Metaphor, Theory, Set of Capacities, and Strategy for Disaster Readiness	Fran H. Norris, Susan P. Stevens, Betty Pfefferbaum, Karen F. Wyche and Rose L. Pfefferbaum (2008)
Disaster Resilient Eco-community Approach	Akhilesh Kumar Surjan and Rajib Shaw (2008)
Life-line Systems Approach to Community Disaster Resilience	Stephanie E. Chang and Christopher Chamberlin (2004)
A Framework to Quantitatively Assess and Enhance the Seismic Resilience of Communities	Michel Bruneau, Stephanie E. Chang, Ronald T. Eguchi, George C. Lee, Thomas D. O'Rourke, Andrei M. Reinhorn, Masanobu Shinozuka, Kathleen Tierney, William A. Wallace and Detlof vonWinterfeldti (2003)
Sustainability and Community	G. Tobin (1999)

Disaster Resilience Approach	
Name	Author/Developer
Multidisciplinary Engineering Perspective of Resilience to Disaster	Multidisciplinary Center for Earthquake Engineering Research (MCEER) (2006)
Organizational Resilience Approach to Community Disaster Resilience	Erica Seville (2009)
Community Psychology Approach to Community Disaster Resilience	Douglas Paton and David Johnston (2001)
“Preparing to Recover” Approach to Community Disaster Resilience	Southeastern Region Research Initiative (SERRI) and Regional Community Resilience Institute (CARRI) (2009)
Disaster Resilient Communities: Principles and Practices	William M. Matthews (2008)
Disaster Resilience of Place Model (DROP)	Susan L. Cutter, Lindsey Barnes, Melissa Berry, Christopher Burton, Elijah Evans, Eric Tate and Jennifer Webb (2008)
Coastal Resilience Index: A Community Self-Assessment - A Guide to Examining How Prepared Your Community is for a Disaster	Rod Emmer, Louisiana Sea Grant, LaDon Swann, Melissa Schneider, Stephen Sempier and Tracie Sempier, Mississippi-Alabama Sea Grant Consortium, Tina Sanchez, National Oceanic and Atmospheric Administration (NOAA) Gulf Coast Services Center (2008)
How Resilient is Your Community? A Guide for Evaluating Coastal Resilience to Tsunamis and Other Hazards	US Indian Ocean Tsunami Warning System (US IOTWS) Program (2007)

Name	Author/Developer
Community Owned Vulnerability and Capacity Assessment Tool	World Vision (2007)
Community Assessment of Resilience Tool (CART)	Kathleen Tierney (2008)
Disaster Response: Research Findings and Their Implications for Resilience Measures	Kathleen Tierney (2009)
Community Disaster Resilience: Context and Preliminary Indicators from a Genuine Progress Perspective	Karen Hayward (2009)
“Strawman” Disaster Resilience Standard for Community and Faith-Based Organizations	Fritz Institute (2009)
Discerning Community Resilience in Disadvantaged Communities in the Context of Violence and Injury Prevention	R. Ahmed, M. Seedat, A. van Niekerk and S. Bulbulia (2004)
Climate Disaster Resilience: Focus on Urban Cities in Asia	Rajib Shaw and the International Environment and Disaster Management Laboratory (IEDM), Japan (2009)
Galveston Futures	Tanveerul Islam, William Merrell and William Seitz (2010)
Assessing Community Resilience in the Context of Disaster and Emergency	Robin Cox (2008)

Management	
Name	Author/Developer
Community Resilience Handbook	Rick Hutchins and Paula Speevak Sladowski (2008)
Building Community Resilience for Children and Families	R.H. Gurwitch, B. Pfefferbaum, J.M. Montgomery, R.W. Klomp, R. D.B. Reissman
Community Based Disaster Risk Reduction	Krishna Suryanot Pribadi and Aria Mariany (2007)
Building Disaster Resilient Communities: Good Practices and Lessons Learned	United Nations (2007)
Community Disaster Resilience Fund: Operational Guidelines	Community Disaster Resilience Fund (2009)