Practices that Integrate Climate Change Adaptation and Disaster Risk Reduction

A Global Scoping Review

The Resilience Institute, 2025

THE RESILIENCE INSTITUTE

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Executive Summary

As climate change-related hazards intensify globally, the integration of climate change adaptation (CCA) and disaster risk reduction (DRR) is increasingly recognized as a critical approach for strengthening resilience across sectors and scales. Global policy frameworks such as the Paris Agreement (UNFCCC, 2015), Sendai Framework for Disaster Risk Reduction (UNDRR, 2015), and 2030 Agenda for Sustainable Development (UNGA, 2015) emphasize the need for integration, yet questions remain regarding how integration is advancing in practice, the conditions that enable progress, and the barriers that persist. This gap between recognition and implementation underscores the importance of analyzing practical examples of integration drawn from both academic and applied contexts.

As such, this global summary brings together two complementary strands of research to advance the understanding of the practical integration of CCA and DRR. First, The Resilience Institute developed an annotated bibliography of 30 high-quality and diverse sources focused on CCA-DRR integration, including peer-reviewed academic journal articles, policy guidance documents, government reports, conceptual frameworks, and case studies. Each source was systematically reviewed to identify key insights, good practices, enabling conditions, and barriers. In parallel, graduate students from the University of Waterloo's Master of Climate Change program conducted a global literature review of applied case studies of CCA-DRR integration, examining how integration has been advanced across six world regions, including Asia, the Pacific, Europe, the Arab States, Africa, and the Americas & Caribbean, and assessing their relevance and applicability to the Canadian context.

The synthesis of these two research efforts highlights several recurring good practices for advancing CCA-DRR integration at the global level. Common approaches include establishing integrated frameworks and governance mechanisms, enacting legal mandates and regulations, implementing participatory and community-led planning processes, promoting cross-sectoral policy coherence, adopting nature-based solutions, conducting comprehensive risk assessments, building multi-actor partnerships, and deploying multi-hazard early warning systems.

Importantly, these global lessons have direct relevance for Canada, where small, rural, and Indigenous communities are on the frontlines of climate change and disaster risks.

Strengthening institutional and technical capacity, as well as experimenting with innovative financing models that link CCA and DRR funding, also emerge as critical entry points for integration. These practices are noted to be supported by enabling conditions such as strong political will, clear legal and regulatory mandates, interagency collaboration, trusted relationships with communities, and access to timely and usable climate risk data.

At the same time, persistent barriers continue to undermine integration. This includes institutional silos, fragmented mandates, and competing policy agendas that often impede CCA-DRR integration, misaligned, inflexible, and short-term funding streams are indicated to limit local capacity, and the undervaluing of Indigenous and local knowledge further constrain progress and make integration difficult at the local level. These challenges highlight the need for systemic reform that address CCA and DRR governance structures, financing mechanisms, and knowledge-sharing processes to create an environment where integration can be implemented and scaled from local to global levels.

Importantly, these global lessons have direct relevance for Canada, where small, rural, and Indigenous communities are on the frontlines of climate change and disaster risks. Approaches such as community-led adaptation, flexible financing models, and cross-sectoral governance can inform risk reduction and resilience-building strategies in Canada, while barriers such as fragmented funding streams and the undervaluing of Indigenous and local knowledge mirror domestic challenges seen in other fields. This Global Scope Summary therefore aims to provides a strong evidence base for Canadian policymakers, practitioners, and communities to adapt global good practices to their own contexts.

Insights from this report will also directly inform the Roots for Resilience program, which is a partnership between The Resilience Institute and the Canadian Red Cross that aims to strengthen the resilience of small, rural, and Indigenous communities across Canada to climate change. It is also hoped that the report will serve as a valuable resource for other organizations seeking to advance integration in their own contexts.

1 | Introduction

The convergence of climate change and disasters is generating increasingly complex and compounding challenges for communities, ecosystems, and institutions across the globe. As the frequency, severity, and unpredictability of climate-related hazards intensify, social and economic vulnerabilities continue to deepen. This context highlights the urgency of shifting away from fragmented, siloed responses toward more integrated, holistic approaches to risk management (UNDRR, 2020). Without such integration, efforts to advance climate change adaptation (CCA) and disaster risk reduction (DRR) chance duplication, resource inefficiency, and lost opportunities to build resilience effectively in the face of escalating, and often compounding, risks.

Although CCA and DRR share similar goals (Figure 1), including reducing vulnerability, mitigating risk, and strengthening resilience, they have historically evolved separately, shaped by different policy domains, institutional structures, and technical communities. As a result, to date, integration has been more aspirational than operational, even though global policy frameworks such as the Paris Agreement (UNFCCC, 2015), Sendai Framework for Disaster Risk Reduction (UNDRR, 2015), and 2030 Agenda for Sustainable Development (UNGA, 2015) all call for stronger linkages, coherence, and mutually reinforcing action. Yet, substantial gaps remain between acknowledging the need for integration and achieving it in practice.

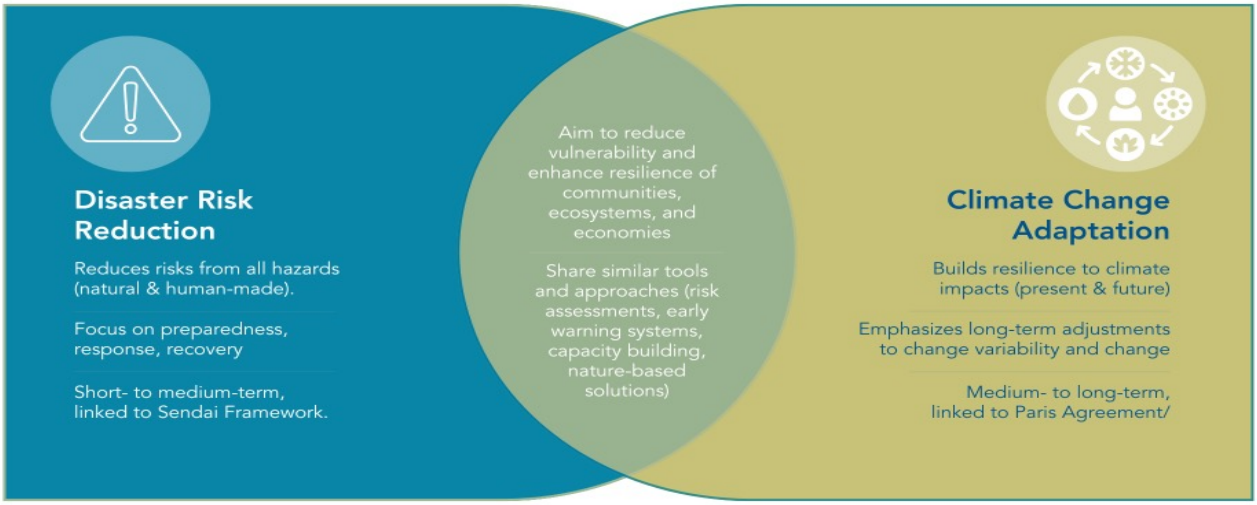

Figure 1: Linkages between Disaster Risk Reduction (DRR) and Climate Change Adaptation (CCA)

In response, The Resilience Institute undertook this global scope summary to better understand the extent of integration in theory and practice globally, the approaches that are effective, and the contextual factors that enable or constrain success. This effort is part of a broader commitment to advance interconnected resilience building in small, rural, and Indigenous communities across Canada that combine DRR's emphasis on managing immediate risks with CCA's focus on long-term adaptation to climate change impacts, which is being advanced through the Roots for Resilience program, a partnership between the Canadian Red Cross and The Resilience Institute. This pan-Canadian program promotes adaptive and risk-reduction actions while elevating diverse voices to highlight the meaning of resilience, agency, and responsibility in the CCA and DRR space.

This report is grounded in a dual methodological approach. First, The Resilience Institute conducted an annotated bibliography of 30 diverse, high-quality sources, capturing key findings, good practices, enabling conditions, and barriers to integration. Second, graduate students from the University of Waterloo's Master of Climate Change program produced a global literature review of applied case studies, synthesizing how integration has been advanced across six global regions, including Asia, the Pacific, Europe, the Arab States, Africa, and the Americas & Caribbean. Together, these complementary research efforts provide both conceptual and policy-oriented insights, as well as applied, practice-based lessons with specific relevance to the Canadian context.

The structure of this report is as follows:
Section 2 describes the methodology used across both research components, Section 3 synthesizes key themes of good practices, enabling conditions, and barriers emerging from the analysis, and Section 4 offers concluding reflections that situate these findings within broader commitments to advance CCA-DRR integration in Canada. Supporting materials are provided in Appendix A, which contains the full annotated bibliography developed by The Resilience Institute, and Appendix B, which presents the Master of Climate Change graduate student report in full. Together, these components provide insight into the state of CCA–DRR integration globally and lay the groundwork for advancing more holistic resilience strategies in Canada.

2 | Methodology

This report was developed through a dual methodological approach designed to capture both conceptual depth and applied breadth in understanding the integration of CCA and DRR. First, The Resilience Institute conducted an annotated bibliography of 30 diverse sources to identify recurring good practices, enabling conditions, and barriers for CCA-DRR integration (Section 2.1). In parallel, graduate students from the University of Waterloo's Master of Climate Change program conducted a global literature review, synthesizing applied examples and case studies from six global regions (Section 2.2). Together, these complementary approaches offer a summary on how CCA-DRR integration is being framed, tested, and implemented in theory and practice on a global scale.

2.1. Annotated Bibliography

This research initiative was designed to build a foundational understanding of existing literature at the intersection of CCA and DRR. The process followed a modified PRISMA-ScR (Preferred Reporting Items for Systematic Reviews and Meta-Analyses Extension for Scoping Reviews) approach to ensure consistency and clear parameters in identifying relevant sources (Page et al., 2021).

2.1.1. Search Strategy

An exploratory literature search was conducted using Google Scholar and Advanced Google Search. A Boolean search string was designed and applied to capture the overlap between climate adaptation and disaster risk reduction in the search process:

("climate adaptation" **OR** "climate change adaptation" **OR** "climate resilience" **OR** "climate change resilience")

AND

("disaster risk reduction" **OR** "disaster risk management" **OR** "disaster preparedness" **OR** "whole hazard approach" **OR** "all-hazard approach" **OR** "comprehensive hazard approach" **OR** "comprehensive risk management")

Search results were screened for diversity in geographic scope, document type, and institutional origin. References were stored in EndNote, and full documentation was maintained on search strings, platforms, and search dates to ensure transparency and reproducibility

2.1.2. Inclusion Criteria

A total of 30 diverse and high-quality sources were selected to represent a broad range of perspectives and forms of knowledge on CCA-DRR integration (see Appendix A). These included peer-reviewed journal articles, policy guidance documents, international and government policy frameworks, reports by multilateral organizations, and conceptual frameworks. The inclusion criteria are listed below:

- The source explicitly discussed or demonstrated the integration of CCA and DRR;
- The source was published in English;
- The source was accessible in full text through academic databases or open access repositories;
- The source included practical, policy, or conceptual insights relevant to CCA–DRR integration;

2.1.3. Document Analysis and Annotation

Each document was reviewed and annotated using a standardized tracking sheet. Annotations captured the full APA citation, document type, a summary of key insights, good practices related to integration, enabling conditions, barriers, and relevant notes to inform a document analysis (Morgan, 2022). This structured approach ensured that each annotation provided both descriptive summaries and critical reflections drawn from each unique document.

2.1.4. Synthesis and Reporting

The annotated bibliography was synthesized into this report using a document analysis process (Morgan, 2022) to distill preliminary themes including recurring strategies and areas of convergence across the reviewed documents. The detailed tracking sheet and individual annotations were reviewed to identify preliminary themes, good practices, enabling conditions, and persistent barriers using a thematic analysis process in Microsoft Excel (Bree & Gallagher, 2016; Naeem et al., 2023). Annotations are presented in full in Appendix A.

Together, these complementary approaches offer a summary on how CCA-DRR integration is being framed, tested, and implemented in theory and practice on a global scale.

2.2. Global Literature Review

As a complement to the annotated bibliography, The Resilience Institute partnered with graduate students from the University of Waterloo's Master of Climate Change program to conduct a global literature review of CCA-DRR integration. This review was designed to extend the annotated bibliography beyond conceptual and policy-focused literature by incorporating applied examples and regional case studies, specifically focusing on their applicability in a Canadian context. Adopting a regional approach, the review synthesized practices from six global regions: Asia, the Pacific, Europe, the Arab States, Africa, and the Americas & Caribbean.

2.2.1. Search Strategy

The University of Waterloo's Master of Climate Change graduate student team conducted a structured scoping methodology to identify relevant literature across peer-reviewed, policy, and grey sources. Searches were conducted using academic databases (e.g., Google Scholar, Scopus) and targeted organizational repositories (e.g., UNDRR, UNDP, Red Cross/Red Crescent). Search strings combined terms related to climate change adaptation and disaster risk reduction with regional identifiers (e.g., "DRR + CCA + ASIA").

2.2.2. Inclusion Criteria

Sources were screened and selected against the criteria as outlined in Table 1.

Table 1: Inclusion Criteria for Global Literature Review

Criteria	Inclusion	Exclusion
Integration Focus	Explicitly discussed the integration of climate adaptation and disaster risk reduction, focusing on practical approaches, frameworks, or strategies.	Focused solely on either climate adaptation or disaster risk reduction without integration.
Content Relevance	Focused on conceptual models, practices, programs, or policies that include empirical evidence, case studies, or documented impacts.	Theoretical studies without practical applications or empirical evidence.
Geographic Scope	Global, national, or regional in scope, provided regional studies offer transferable insights applicable to broader contexts.	Regional or local in scope that does not have the potential to inspire broader integration discussions.
Source Credibility	Published in peer-reviewed journals or credible grey literature, such as reports from reputable organizations (e.g., UN, NGOs, governments).	Non-credible sources, including blogs, opinion pieces, or unverified grey literature.
Language Accessibility	Available in English or translated into English with verified accuracy.	Not available in English or without a translation.

The final dataset included 65 sources that reflected a balance of academic, policy, and practice-based perspectives (Appendix B).

2.2.3. Synthesis and Reporting

Each source was reviewed using a standardized template that recorded bibliographic details, type of document, thematic focus, and region, as well as summarized through an annotated bibliography. Graduate students then extracted insights on good practices for integration, enabling conditions, barriers, and lessons learned from each annotation, with particular attention to the duplication of findings across regions and their potential relevance for Canada. Regional syntheses were then prepared to highlight distinctive approaches emerging in different geographic and political contexts.

The review was them compiled into a global synthesis report organized by the six global regions (Asia, the Pacific, Europe, Arab States, Africa, Americas & the Caribbean). Each section presents an overview of good practices, enabling conditions, barriers, and contextual insights relevant to integration, with particular emphasis on relevance to the Canadian context. This review complements the annotated bibliography by grounding theoretical and policy-oriented insights in real-world implementation examples, thereby strengthening the evidence base for applied strategies to integrate CCA and DRR. The report is presented in full in Appendix B.

2.3. Integration of Research Efforts

The annotated bibliography and the global literature review were reviewed collectively to identify areas of convergence and divergence. Annotated bibliographies and thematic analyses from both strands were compared to distill common good practices, enabling conditions, and barriers, while also noting unique regional or conceptual insights. This process ensured that findings were cross validated across diverse document types and geographic contexts.

Through this comparative review, the annotated bibliography provided conceptual and policy-oriented depth, while the Waterloo global literature review contributed applied examples from six regions. Together, these complementary approaches generated a consolidated evidence base that links theoretical frameworks with real-world practice, forming the foundation for the synthesis presented in Section 3.

3 | Overview of Good Practices, Enabling Conditions, and Barriers

This section presents a synthesis of findings from two complementary research efforts: (1) the annotated bibliography of 30 diverse sources compiled by The Resilience Institute, and (2) the global literature review of 65 sources conducted by graduate students from the University of Waterloo's Master of Climate Change program. Together, these bodies of work examined scholarly literature, government reports, applied case studies, conceptual frameworks, and policy analyses.

The combined insights highlight recurring good practices, common enabling conditions, and persistent barriers that shape the integration of CCA and DRR, synthesized in Table 2 and elaborated upon in the subsequent paragraphs. By moving beyond individual case studies to identify shared patterns across geographical scales and contexts, this synthesis provides a comprehensive overview of how integration is advancing globally, what factors lead to success, and the barriers that continue to constrain implementation.

Table 2: Integration Mechanisms for DRR–CCA

Mechanism	Why It Matters	Example of Good Practices	Enabling Conditions	Barriers
3.1 Governance Structures	Provides the foundation to align policies, institutions, and resources across sectors; reduces duplication and enhances coherence	Embedding DRR–CCA in national development strategies; creating joint institutional mechanisms; establishing regional coordination platforms	Strong political will; legislation mandating integration; centralized coordination; donor/financial support; technical capacity	Ministries working in isolation; integration limited to projects without institutionalization; lack of vertical integration across scales
3.2 Conceptual and Analytical Frameworks	Provide structured approaches to decision-making, bridge silos, and guide the design of integration strategies	Multi-level governance models; simulation-based approaches; systems-thinking and resilience frameworks	Interdisciplinary collaboration; strong academic–policy linkages; investment in evidence-based decision making	Complexity & lack of standardization; difficulty in local application; weak monitoring and evaluation systems
3.3 Legal and Regulatory Mandates	Institutionalize integration through enforceable rules and long-term accountability	Incorporating DRR–CCA into building codes, zoning, and municipal plans; explicit national legal mandates	Political will to legislate integration; effective enforcement mechanisms; updated regulations reflecting climate risks	Few binding frameworks; weak enforcement capacity; disconnect between national and local implementation

Integration Mechanisms for DRR–CCA (continued)

Mechanism	Why It Matters	Example of Good Practices	Enabling Conditions	Barriers
3.4 Community-Led & Participatory Approaches	Ground integration in local knowledge, legitimacy, and ownership	Women-led initiatives; Indigenous and local knowledge inclusion; participatory governance structures	Trust between governments and communities; adequate funding; gender-responsive and inclusive planning	Tokenistic participation; undervaluing Indigenous and local knowledge; short-term/project-based funding
3.5 Multi-Actor Partnerships	Pool complementary strengths across government, NGOs, civil society, academia, and private sector	Formalized partnerships; regional/multi-stakeholder platforms; joint technical and financial support mechanisms	Clear coordination structures; sustained donor financing; formalized agreements	Unequal power dynamics; weak private-sector engagement; lack of institutionalization beyond donor cycles
3.6 Cross-Sectoral Policy Coherence	Aligns CCA, DRR, and development goals; reduces inefficiencies, redundancy, and institutional conflict	Linking CCA-DRR objectives in legal mechanisms; integrated land use and urban planning policies	Cross-ministerial committees; shared data systems; joint indicators	Misaligned mandates; competing agendas; fragmented budgets; inconsistent terminology
3.7 Nature-Based Solutions	Harness natural systems and processes to reduce hazards and strengthen long-term resilience	Ecosystem-based management; biodiversity conservation; weaving western scientific and traditional ecological knowledge	Political recognition of co-benefits; integration into planning frameworks; technical capacity for implementation	Underfunding; lack of prioritization; land tenure conflicts; limited scaling capacity
3.8 Comprehensive Risk Assessments & Early Warning Systems	Anticipates risks and enables timely action, while strengthening cross-sector coordination	Multi-hazard assessments; integrated early warning systems; combining local, Indigenous, and scientific forecasting	Strong collaboration across sectors; reliable and accessible data; adequate technical expertise	Gaps in real-time data; weak links to planning; insufficient capacity at local levels

Integration Mechanisms for DRR–CCA (continued)

Mechanism	Why It Matters	Example of Good Practices	Enabling Conditions	Barriers
3.9 Institutional Capacity	Sustains integration by building skills, resources, and adaptive governance systems	Training and professional development; cross-sector knowledge exchange; centralized information platforms; strong monitoring and evaluation frameworks	Long-term investments in training; stable staffing; professional development linking CAA and DRR fields	High staff turnover; reliance on external consultants; weak institutionalization; limited technical expertise.
3.10 Financial Alignment	Strengthens coherence by overcoming fragmented funding streams and ensuring sustained resourcing for resilience	Integrated budget lines; pooled funding mechanisms; innovative finance (resilience bonds, insurance)	Flexible donor requirements; dedicated national budget lines; incentives for innovation in the private and civic sectors	Siloed funding streams; reliance on short donor cycles; weak institutional readiness to manage climate finance; limited financial autonomy at local levels

3.1. Governance Structures

Governance reform is frequently highlighted as a critical area of focus for advancing integration, as it provides the structural foundation to align policies, institutions, and resources across sectors and scales. By embedding CCA and DRR considerations into governance systems, countries can create more coherent strategies, reduce redundancy, and enhance overall resilience-building and risk reduction strategies.

Good practices include embedding DRR and CCA within national development strategies and sectoral policies, such as Vietnam's disaster prevention program integrating climate resilience objectives (Nguyen & Shaw, 2010) and Bangladesh's alignment of disaster management and climate planning (Chakrabarti, 2010). At the institutional level, countries like Zimbabwe and Malawi have created joint funding and programmatic mechanisms to reduce duplication and promote coherence (UNDRR, 2020). Regional coordination bodies such as the South Asian Association for Regional Cooperation (Shaw et al., 2010) and the Africa Multi-Hazard Early Warning and Early Action System (AUC, 2022) further illustrate how intergovernmental platforms can help smaller states pool resources and expertise.

Scholarship also emphasizes adaptive and collaborative governance frameworks that explicitly integrate DRR and CCA (Djalante et al., 2013; Forino et al., 2015). These models highlight how shared responsibilities across state, market, and civil society actors can strengthen institutional flexibility and foster integration. Comparative work in Canada and Australia has further shown that fragmented governance structures remain a major barrier to implementation, pointing

to the importance of institutional reform, cross-sectoral coordination, and engagement with Indigenous and local communities (Raikes et al., 2022). Practical guidance such as the Towards Resilience framework (Turnbull et al., 2013) and UNDP's mainstreaming tools (UNDP, 2020) identify decentralization, inclusive participation, and coherent policy alignment as key enablers for strengthening governance mechanisms. Meanwhile IBC (2021) similarly highlight the importance of improving governance and institutional capacity to ensure integration at national scales.

Enabling conditions include strong political will, legislation mandating integration, and centralized coordination bodies bridging ministerial silos (UNDRR, 2020). Donor support and technical assistance, often channelled through multilateral organizations, further strengthen governance and institutional coherence (Uchiyama et al., 2014).

Barriers remain entrenched in many contexts, particularly where ministries for environment, public safety, disaster management, and planning work in isolation (McCommon et al., 2021). Further, CAA-DRR integration often occurs only at the project level rather than being institutionalized in many national systems, resulting in continued fragmentation and redundancy that trickles down to the local level (Dias et al., 2021; Olhoff, 2011).

3.2. Conceptual and Strategic Frameworks

Conceptual and strategic frameworks are essential for advancing integration, as they provide structured approaches for decision-making, help bridge disciplinary silos, and create shared reference points for different actors. These frameworks can guide policymakers and practitioners in aligning short- and long-term priorities, coordinating across scales, and anticipating emerging risks.

Good practices include the use of systems-thinking frameworks, resilience models, impact chains, and multi-scalar approaches that link adaptation and risk reduction objectives (UNDRR, 2021). For example, in Asia, the Decentralized Climate Hazard and Disaster Integration model promotes multi-level governance and coordination across scales (Chaiya et al., 2022). In Europe, simulation-based approaches test cross-border disaster scenarios, enhancing collaboration and preparedness (Booth et al., 2020). Broader systems-thinking and resilience frameworks also offer important insights for aligning adaptation and risk reduction objectives (Begum et al., 2014; Burns & Johansson, 2017). Further, the European Union has integrated DRR and CCA into their planning frameworks around the theoretical concept of resilience, which adopts an all-hazards and whole-of-society approach (UNDRR, 2025).

Scholars have argued that integration is supported by frameworks that explicitly bridge knowledge systems, disciplines, and sectors. For example, Bendito & Barrios (2016) propose transdisciplinary approaches that embed ecological knowledge into planning and education, while Lei & Wang (2014) emphasize multi-scalar and multi-temporal models for aligning DRR and CCA. Similarly, Serrao-Neumann et al. (2015) highlight synergies between DRR and CCA within planning arenas such as spatial planning, social and community processes, and long-term strategic decision-making. Paterson & Guida (2022) further suggest that climate change risk assessments themselves can act as an integration space, linking DRR and CCA theory and practice.

Enabling conditions include interdisciplinary collaboration, strong academic–policy linkages and collaborations, and investment in decision-support tools such as climate models and risk mapping platforms (Islam et al., 2020).

Barriers stem from complex and non-standardized frameworks, which are often difficult to operationalize at local levels. Weak monitoring and evaluation systems further limit their utility, with inadequate indicators to assess whether integration is being achieved, and how successful integration strategies are at building resilience (Setiadi et al., 2010; Soares et al., 2023).

3.3. Legal and Regulatory Mandates

Legal and regulatory instruments play a critical role in institutionalizing integration, as they provide enforceable mechanisms to embed climate and disaster risk considerations into governance systems. By establishing clear mandates and standards, these instruments help ensure continuity, accountability, and long-term commitment beyond individual projects or political cycles.

Good practices include incorporating DRR–CCA linkages into building codes, zoning laws, and municipal plans, as well as explicit mandates in national legislation (Cubie & Natoli, 2022). For example, South Africa has advanced integration by aligning disaster management and climate legislation, while Morocco and Tunisia link DRR measures with adaptation targets in their National Adaptation Plans and Nationally Determined Contributions (UNDP, 2018; Zembe et al., 2022). Practitioner-oriented guidelines also recommend integrating climate and disaster risk considerations into sector-specific regulatory frameworks such as education, health, and child protection (Save the Children, 2013).

Broader legal analyses emphasize the importance of aligning national legal mandates with international frameworks, such as the Sendai Framework, Paris Agreement, and the Sustainable Development Goals (UNDRR, 2021). Cubie & Natoli (2022) argue that systemic coherence, vertical alignment, and horizontal integration across scales are essential for legal frameworks to enable integration. Meanwhile, case studies from Red Cross and Red Crescent societies in Asia show how organizational guidelines can act as quasi-legal mechanisms for promoting integration at operational levels (Keweloh, 2015).

Enabling conditions include political will to legislate and regulate CCA–DRR integration, effective enforcement mechanisms, and updated regulatory frameworks reflecting evolving climate risks (Forino et al., 2015).

Barriers are widespread, with few countries possessing binding legal frameworks mandating integration (UNDRR, 2021). Even where laws and regulations exist, enforcement capacity is often weak and disconnects between national legislation and local implementation persist (Dias et al., 2021; Mashi et al., 2019).

3.4. Community-Led and Participatory Approaches

Community-driven processes are widely recognized as being essential for effective integration, as they ground CCA and DRR efforts in local knowledge, capacities, and priorities. Such approaches strengthen legitimacy, ensure cultural relevance, and foster community ownership, which are all critical for long-term resilience (McCommon et al., 2021).

Good practices include embedding local and Indigenous knowledge into planning, adopting a gender-inclusive lens to risk analyses, and creating participatory governance structures that ensure community voices shape decision-making (UNDRR, 2020, 2021). For example, in Nepal and Bangladesh, women-led initiatives have enhanced disaster preparedness while integrating adaptation into local practices (Leitner et al., 2010). In Kenya, Indigenous forecasting combined with western science methods has improved food security and early warning systems (Songok et al., 2011). In Fiji, traditional governance structures such as chiefs and women's committees have facilitated hazard mapping and ecosystem restoration (Charan et al., 2016). The Towards Resilience guide also emphasizes rights-based and inclusive approaches as central to effective DRR–CCA practice (Turnbull et al., 2013).

Enabling conditions include trusted relationships between governments and communities, adequate funding for participatory processes, and methodologies that draw on local expertise (Shaw et al., 2010). Gender- and age-responsive planning further enhances inclusion and equity (Leitner et al., 2010).

Barriers include tokenistic participation that sidelines communities from decision-making, the undervaluing of Indigenous and local knowledge in national frameworks, and short-term or project-based funding for grassroots initiatives (Gero et al., 2010; Navab, 2024; Piggott-McKellar et al., 2019). These challenges highlight the need to move beyond symbolic engagement toward deeper co-production of resilience strategies across scales.

3.5. Multi-Actor Partnerships

Collaborative partnerships are widely acknowledged as vital enablers of integration, as they bring together the complementary strengths of governments, NGOs, civil society, academia, and the private sector. By pooling knowledge, resources, expertise, and capacities, partnerships can address gaps that no single sector could manage alone, enabling more coherent, multi-level responses.

Good practices include establishing formalized partnerships and regional platforms that provide technical and financial support for integration (UNDRR, 2020, 2021). For example, the African Union's Africa Multi-Hazard Early Warning and Early Action System links meteorological data with disaster management systems (AUC, 2022), while in the Pacific region, partnerships coordinated by the South Pacific Commission and the Pacific Regional Island Program have enhanced institutional capacity and coherence (UNISDR & UNDP, 2012). National-level partnerships in Nigeria demonstrate how migration, environment, and climate factors can be jointly addressed through integrated DRR–CCA programming (IOM Nigeria, 2023). Field guidance also emphasizes the importance of multi-stakeholder networks and community-based alliances that build on shared ownership of resilience strategies (IBC, 2021; Turnbull et al., 2013).

Enabling conditions include clear coordination structures, sustained donor financing, and formalized partnership agreements that clarify roles, responsibilities, and accountability mechanisms (IOM Nigeria, 2023).

Barriers include power dynamics between partners, limited private-sector engagement, and the absence of institutionalized mechanisms to sustain partnerships beyond donor cycles (Olhoff, 2011; UNDRR, 2020). Without durable frameworks and equitable collaboration, partnerships risk becoming ad hoc or donor-driven rather than long-term and systemic enablers of integration.

3.6. Cross-Sectoral Policy Coherence

Cross-sectoral policy coherence is a key mechanism for advancing integration, as it ensures that adaptation, disaster risk management, and development objectives are mutually reinforcing rather than redundant (UNDRR, 2021). By reducing inefficiencies, aligning funding streams, and harmonizing institutional mandates, policy coherence enables more systemic and sustainable approaches to resilience.

Good practices include integrating DRR and CCA objectives into overarching legal and planning frameworks, as well as ensuring that land use, infrastructure, and urban policies reflect cross-sectoral linkages. For example, Kenya's Climate Change Act links CCA and DRR under a common legislative framework (Nduku, 2021). In Europe, the PLACARD project has emphasized coherence through shared language, coordinated financing, and alignment of monitoring and evaluation systems (Mysiak et al., 2018). Urban planning initiatives that explicitly integrate climate and disaster risk assessments into development planning have also proven effective (Paterson & Guida, 2022). Multi-sectoral frameworks, such as those trialed in Queensland, Australia, illustrate how planning across spatial, community, and strategic domains can maximize synergies (Serrao-Neumann et al., 2015). Further, at the national level, authorities could establish formal mechanisms requiring DRR and CCA to coordinate in the development of comprehensive and integrated risk assessments within climate planning processes (e.g., National Adaptation Plans, National Contribution Agreements, etc.) (UNDRR, 2025).

Enabling conditions include the establishment of cross-ministerial committees, shared data systems, and joint indicators that enable vertical and horizontal policy coordination (Mysiak et al., 2018; Nalau et al., 2016). Policy guidance has also underscored the value of whole-of-government approaches and sustained knowledge platforms that bring together DRR, CCA, and sustainable development communities (IBC, 2021).

Barriers include misaligned mandates across ministries, competing policy agendas, fragmented budget cycles, and inconsistent terminology that hampers communication and collaboration across scales and sectors (Kelman, 2015). These challenges often result in siloed policies that undermine rather than reinforce integration.

3.7. Nature-Based Solutions

Nature-based solutions (NbS) are increasingly recognized as a powerful convergence point for CCA and DRR, as they harness ecosystem functions to reduce risks while providing co-benefits for biodiversity conservations, livelihood security, and human health and well-being (UNDRR, 2020, 2023; UNDRR & UNU-EHS, 2024). By integrating ecological processes into risk management, NbS can simultaneously address immediate hazards and strengthen long-term resilience.

Good practices include watershed management, coastal restoration, mangrove rehabilitation, and reforestation projects that reduce exposure to hazards while improving ecosystem services and health. For example, UNEP's review of ecosystem-based projects highlights how mangrove restoration and agroforestry in Asia and Africa both reduced disaster risks and supported community livelihoods (Doswald & Estrella, 2015). In Rwanda, biodiversity conservation and land-use programs have integrated CCA and DRR goals, while in Fiji, traditional ecological knowledge has been combined with western science to guide ecosystem restoration and hazard mapping (Charan et al., 2016). Systems perspectives also emphasize how NbS can be embedded in broader sustainable development pathways (Burns & Johansson, 2017), while regional reports from the Pacific highlight NbS as critical entry points for integration in small island states (McCommon et al., 2021).

Enabling conditions include political recognition of NbS co-benefits, integration of ecological approaches into planning frameworks, inclusive governance, adequate technical capacity, integration into national plans, and supportive institutional arrangements (Burns & Johansson, 2017; Doswald & Estrella, 2015; UNDRR, 2023; UNDRR & UNU-EHS, 2024).

Barriers include underfunding and lack of prioritization of NbS, land tenure conflicts that limit community access to ecosystems and limited technical experience in scaling NbS approaches across diverse contexts (Soares et al., 2023). These constraints highlight the need for stronger investment and policy commitments to move NbS from pilot projects to being mainstream resilience strategies.

3.8. Comprehensive Risk Assessments and Early Warning Systems

Comprehensive risk assessments and early warning systems are widely recognized as critical tools for advancing integration, as they bring together data, institutions, and communities to anticipate risks and enable timely action (UNDRR, 2021, 2025). By combining multiple sources of information and fostering cross-sectoral collaboration, these mechanisms improve preparedness and coordination across scales.

Good practices include developing multi-hazard, comprehensive risk assessments (UNDRR, 2021), integrating local and Indigenous knowledge into forecasting, and utilizing climate information systems in disaster management institutions. For example, the Africa Multi-Hazard Early Warning and Early Action System connects meteorological, hydrological, and disaster agencies to deliver integrated early warnings (AUC, 2022). In the Pacific, climate information systems have been used to map vulnerabilities and guide proactive planning (McCommon et al., 2021). In Kenya, Indigenous forecasting combined with western science has enhanced food

security and resilience (Songok et al., 2011). Guidance such as the Towards Resilience framework also underscores the importance of risk-informed approaches that integrate local knowledge into assessment and warning processes (Turnbull et al., 2013).

Enabling conditions include strong cross-sectoral collaboration, reliable and accessible data, technical expertise, and participatory processes that build trust between communities and institutions (UNISDR & UNDP, 2012).

Barriers include gaps in real-time data, weak institutional links between early warnings systems and proactive planning and risk assessment processes, and insufficient capacity at local levels to assess risk and to act on warnings (Gero et al., 2010; McCommon et al., 2021).

3.9. Institutional Capacity

Institutional and technical capacity is a cornerstone of sustaining integration, as it equips actors with the skills, resources, and governance systems needed to implement and adapt strategies over time. Strong capacity enhances coordination across sectors, supports technical expertise, and enables adaptive governance approaches that can respond to evolving risks.

Good practices include investing in training and professional development for government officials, supporting cross-sectoral knowledge exchange, and developing centralized platforms for information sharing. For example, systematic reviews highlight how targeted training programs and decision-support tools improve institutional readiness for integration (Islam et al., 2020). Capacity development efforts in South and Southeast Asia also show how collaborative training and monitoring frameworks can build long-term institutional strength (Setiadi et al., 2010). Recent approaches emphasize the importance of strong monitoring and evaluation systems that foster iterative learning and adaptation (Naeem et al., 2023). Higher education institutions are also emerging as key actors by embedding DRR–CCA integration into postgraduate training, online learning, and professional networks (Scolobig & Balsiger, 2024). Field-oriented guidance stresses that building institutional capacity must also center inclusive participation and the structural drivers of vulnerability (Turnbull et al., 2013).

Enabling conditions include long-term investments in training and education, stable staffing structures that reduce turnover, professional development opportunities that link CCA and DRR expertise, and accessible platforms for cross-sectoral knowledge exchange (Islam et al., 2020; Scolobig & Balsiger, 2024).

Barriers include high staff turnover, reliance on external consultants, weak institutionalization of knowledge, and limited technical expertise, which collectively undermine sustained integration (Naeem et al., 2023; Setiadi et al., 2010). Without deliberate investment in building institutional capacity, integration efforts often remain fragmented and short-lived.

3.10. Financial Alignment

Financial alignment is widely recognized as one of the most persistent challenges for integration, as fragmented funding streams often reinforce silos and limit long-term scalability. Strengthening financial coherence is essential to scaling integrated approaches and ensuring adequate and sustained resourcing for adaptation and risk reduction efforts.

Good practices include developing integrated budget lines, pooled funding mechanisms, and innovative financial instruments that incentivize aligned DRR and CCA actions, including capitalizing upon opportunities for through international climate finance architecture (UNDRR, 2025). For example, Malawi and Benin have advanced integrated budget structures, Zimbabwe has implemented pooled financing mechanisms, and Nigeria has piloted donor-financed integration through migration and climate initiatives (IOM Nigeria, 2023; UNDRR, 2020). Emerging tools such as resilience bonds, insurance mechanisms, subsidies, grants, taxes, and multi-criteria analyses also demonstrate potential to link CCA and DRR priorities (Botzen et al., 2015; UNDRR, 2021). For example, the InsuResilience Global Partnership advocates for strong collaboration with the reinsurance industry to incorporate expertise on risk analytics for developing countries for the scale-up of climate and disaster risk finance and insurance (UNDRR, 2021). Guidance documents also stress the importance of embedding climate and disaster finance within broader development planning (IBC, 2021; UNDP, 2020, 2021).

Enabling conditions include flexible donor requirements, dedicated national budget lines, government-led financial alignment, and private-sector incentives for cross-sectoral innovation (UNDP, 2020; UNDRR, 2020).

Barriers include siloed funding streams, reliance on short donor cycles, weak institutional readiness to manage climate finance, and limited financial autonomy at local levels (Olhoff, 2011; UNDRR, 2020). These barriers underscore the need for systemic reform in financing structures to support integrated resilience-building at scale.

The evidence across these ten themes demonstrate that integration is both feasible and increasingly practiced globally. Successful examples consistently share enabling conditions such as political will, clear mandates, trusted relationships, sustained financing, strong technical expertise, involvement of local communities, and access to effective climate data. Yet systemic barriers, including institutional silos, governance challenges, fragmented mandates, weak monitoring and enforcement mechanisms, and misaligned funding streams, continue to constrain implementation.

4 | Conclusion

As climate change-related hazards intensify and intersect with other systemic global risks, the need to bridge CCA and DRR is becoming increasingly important. While international frameworks such as the Paris Agreement (UNFCCC, 2015), Sendai Framework for Disaster Risk Reduction (UNDRR, 2015), and 2030 Agenda for Sustainable Development (UNGA, 2015) call for integration, practical implementation remains fragmented and inconsistent across regions and sectors. This global scope summary addresses this gap by synthesizing insights from 30 high-quality sources and a complementary global review of scholarly literature and case studies by University of Waterloo Master of Climate Change students. It offers an evidence base on how integration is being conceptualized, operationalized, and advanced in theory and practice.

The findings of this global scope summary underscore that integration is possible and already underway in many contexts. Good practices include integrated governance frameworks, legal mandates, participatory and community-led approaches, cross-sectoral policy coherence, nature-based solutions, comprehensive risk assessments, multi-actor partnerships, multi-hazard early warning systems, strengthened institutional and technical capacity, and innovative financing models that link climate and disaster funding. These good practices are supported and realized by enabling conditions such as political will, interagency collaboration, trusted community relationships, and access to relevant risk information. Yet persistent barriers, including institutional silos, fragmented mandates, inflexible funding streams, and the undervaluing of Indigenous and local knowledge, continue to undermine progress. Overcoming these challenges will require systemic reform, long-term investment, and a commitment to inclusivity and equity in resilience-building strategies.

These insights hold relevance for Canadian communities, particularly for small, rural, and Indigenous communities on the frontlines of climate change. Strengthening Canada's resilience to escalating climate and disaster risks will require adapting these practices to domestic contexts and addressing systemic barriers that continue to limit integration. Advancing CCA-DRR integration is thus not only a technical or institutional necessity but also a moral and strategic imperative critical for protecting lives and livelihoods today while enabling the transformative resilience needed to navigate an increasingly uncertain future for future generations.

This report, Practices that Integrate Climate Change Adaptation and Disaster Risk Reduction Global Scoping Review, helps to advance the goals under the Roots for Resilience program.

an initiative by

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Appendices

Appendix A | Annotated Bibliography

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This academic article offers a foundational conceptual framework for understanding the integration of DRR and CCA, based on a comprehensive literature review. It identifies both direct and indirect linkages between DRR and CCA, including non-structural measures, political interest, resilience building, and multi-stakeholder engagement. The framework emphasized the need for the inclusion of vulnerable sectors, institutional capacity building, effective fund allocation, education and awareness programmes, stakeholder involvement, coordination among institutions, policies, and programmes, political will, and an integrated approach to policy for effective integration of DRR and CAA. Key practices which were highlighted include strengthening local governments, engaging NGOs and the business sector, and decentralized fund disbursement.

Bendito, A., & Barrios, E. (2016). Convergent Agency: Encouraging Transdisciplinary Approaches for Effective Climate Change Adaptation and Disaster Risk Reduction. *International Journal of Disaster Risk Science, 7*(4), 430-435. https://doi.org/10.1007/s13753-016-0102-9

This academic article proposes a conceptual framework for a transdisciplinary strategy that integrates the knowledge systems, disciplines, and approaches of CCA and DRR. It emphasizes the importance of strategically combining DRR and CCA during future development planning, with building codes identified as a key entry point for reducing risk, illustrated through the comparative impacts of earthquakes in Haiti, Chile, and Japan. The authors advocate for climate- and risk-smart education and awareness as core components of integration efforts and call for reforms in university education, including incorporating ecological knowledge into engineering curricula. The Eco-DRR/CCA approach is presented as a promising effort to support this convergence of knowledge by fostering holistic thinking.

Booth, L., Fleming, K., *Abad*, J., Schueller, L. A., Leone, M., Scolobig, A., & Baills, A. (2020). Simulating synergies between Climate Change Adaptation and Disaster Risk Reduction stakeholders to improve management of transboundary disasters in Europe. *International Journal of Disaster Risk Reduction, 49*, Article 101668. https://doi.org/10.1016/j.ijdrr.2020.101668

This academic article uses the ESPREssO Project's participatory approach to explore synergies between CCA and DRR stakeholders in managing transboundary disasters in Europe. Through stakeholder interviews, questionnaires, thinktank discussions, and the RAMSETE II serious game, the authors simulate coordinated decision-making in disaster scenarios. The game creates a conceptual space to reveal governance gaps, informal practices, and fragmentation in disaster planning. Key findings emphasize the need for proactive planning, overcoming language and cultural barriers, and strengthening coordination through underutilized actors like NGOs. The study highlights the value of promoting two-way integration of local and global perspectives and fostering shared ownership of risk to build resilience.

Botzen, W. W. J., Bouwer, L. M., Scussolini, P., Kuik, O., Haasnoot, M., Lawrence, J., & Aerts, J. C. J. H. (2015). Integrated Disaster Risk Management and Adaptation. In R. Mechler, T. Schinko, & J. Linnerooth (Eds.) *Loss and Damage from Climate Change: Concepts, Methods, and Policy Options*. SpringerOpen.

This chapter presents real-world case studies demonstrating the integration of disaster risk management (DRM) and CCA. It underscores the use of economic tools such as cost-benefit and multi-criteria analyses in determining optimal long-term adaptation strategies in cities like Ho Chi Minh and the Netherlands, concluding that economic efficiency is an important aspect of disaster risk management and adaptation. Other key practices include integrating zoning and building codes to reduce urban climate risk, linking insurance mechanisms with incentives for risk reduction, and designing adaptation pathways with policymakers. The chapter emphasizes that economic efficiency, behavioural factors, and flexible policy and planning mechanisms are essential for effective DRM-CCA integration.

Burns, T., & Johansson, D. M. N. (2017). Disaster Risk Reduction and Climate Change Adaptation - A Sustainable Development Systems Perspective. Sustainability, 9(2), 293. https://doi.org/10.3390/su9020293

This conceptual paper presents a systems theory perspective to analyze the relationship between CCA and DRR, and sustainable development. It argues that DRR and CCA are partial subsystems that must be embedded within a broader, multi-functional societal system to be effective and sustainable. The authors support this argument through illustrative case studies, including food and chemical safety reforms and adaptation efforts in Gotland and Gothenburg, Sweden. Key good practices include the use of multi-level governance, infrastructure-based adaptation, stakeholder coordination, and discourse shifts from technical risk control to public goods and sustainability planning. This article offers a theoretical framing that highlights the need for systemic integration of DRR and CCA through a sustainability lens.

Cubie, D., & Natoli, T. (2022). Coherence, Alignment and Integration: Understanding the Legal Relationship Between Sustainable Development, Climate Change Adaptation and Disaster Risk Reduction. In S. Flood, Y. Jerez Columbié, M. Le Tissier, & B. O'Dwyer (Eds.) *Creating Resilient Futures Integrating Disaster Risk Reduction, Sustainable Development Goals and Climate Change Adaptation Agendas* (pp. 45-64). Palgrave Macmillan. https://doi.org/https://doi.org/10.1007/978-3-030-80791-7

This chapter examines the legal coherence, alignment, and integration of international frameworks addressing sustainable development, CCA, and DRR. Focusing on the Sendai Framework, Paris Agreement, and United Nations Sustainable Development Goals, the authors present an hourglass model to conceptualize interactions across scales and sectors. Key dimensions include systemic coherence at the international level, vertical alignment across international, national, regional, and local levels, and horizontal integration at the domestic level. Systemic coherence ensures the effective coexistence between the three global frameworks aligning the logic and principles. Vertical alignment allows for two-way flow of knowledge, experience, and norms between national and international levels helping in the exchange of legal principles and operation experience. Horizontal integration can recue the duplication of efforts and optimise the use of limited resources across sectors and ministries.

Djalante, R., Holley, C., Thomalla, F., & Carnegie, M. (2013). Pathways for adaptive and integrated disaster resilience. *Natural Hazards, 69*(3), 2105-2135. https://doi.org/10.1007/s11069-013-0797-5

This academic article draws on existing academic and grey literature in the fields of DRR, CCA, adaptive governance, and resilience to inform the development of a conceptual framework for adaptive and integrated disaster resilience (AIDR). The integration of these fields is directional, with CCA being framed as a subset of effective DRR. They propose seven pathways, or strategies, to support scientists and practitioners in developing more integrated and adaptive approaches to DRR. These seven pathways include: (1) integrating DRR, CCA, and development strategies, (2) strengthening polycentric governance architecture for DRR, (3) increasing and coordinating cross-sector and multi-stakeholder collaborations, (4) improving knowledge and information through comprehensive and systematic assessments of hazards, risks, vulnerability and impacts, (5) facilitating institutional learning from implemented policies and experiences, (6) encouraging and nurturing self-organization and networking, and (7) developing comprehensive disaster risk finance and insurance using a broad set of private and public instruments. Finally, the authors apply their framework to Indonesia, outlining policy and practice implications to advance integrated and adaptive DRR.

Doswald, N., & Estrella, M. (2015). *Promoting ecosystems for disaster risk reduction and climate change adaptation*. United Nations Environment Programme. https://www.unep.org/resources/report/promoting-ecosystems-disaster-risk-reduction-and-climate-change-adaptation

This UNEP report synthesizes lessons from 38 ecosystem-based projects that integrate CCA and DRR globally. It identifies five key dimensions of integration, including shared project aims, joint risk and vulnerability assessments, implementation using nature-based and hybrid green-grey infrastructure, integrated monitoring and evaluation, and policy/institutional alignment. Case studies highlight how mangrove restoration, agroforestry, and wetland rehabilitation can reduce climate and disaster risks while supporting biodiversity and livelihoods. The report emphasizes participatory governance and local knowledge as essential to effective implementation and sustainability. It provides concrete examples, identifies institutional and methodological enablers, and highlights common challenges, such as funding silos, fragmented governance, and capacity gaps, that should be addressed in future integration efforts. Its practical focus and attention to socio-political dimensions make it a strong foundation for informing integrated resilience programming.

Forino, G., von Meding, J., & Brewer, G. J. (2015). A Conceptual Governance Framework for Climate Change Adaptation and Disaster Risk Reduction Integration. *International Journal of Disaster Risk Science, 6*(4), 372-384. https://doi.org/10.1007/s13753-015-0076-z

This academic article presents a conceptual framework for understanding how CCA and DRR can be integrated through governance processes. The authors build on adaptive and collaborative governance theory to propose a model in which integration is shaped by the dynamic relationships among three core actor groups: national and subnational governments (state actors' domain), private sector (market actors' domain), and communities (social actors' domain). Their framework shows these actors engaging in mutual interactions to co-produce DRR–CCA integration. The authors argue that integration must be context-specific, adaptive to local institutional arrangements, and oriented around shared responsibilities rather than centralized authority. The model is grounded in the Australian planning context but intended for broader application. This article contributes a governance-centered conceptual model that focuses on actor roles, interactions, and institutional flexibility as central enabling factors to DRR–CCA integration.

***Issue-Based Coalition on Environment and Climate Change (IBC). (2021). Review of Good Practices: Integrating Disaster Risk Reduction and Climate Change Adaptation for Risk-informed and Climate-smart Development.* Issue-Based Coalition on Environment and Climate Change. https://www.preventionweb.net/news/integrating-disaster-risk-reduction-and-climate-change-adaptation-risk-informed-and-climate**

This NGO report provides a review of good practices for linking DRR and CCA through the lenses of policy, innovation, and practice. The purpose is to provide guidance for policy development at national scales that reflects this integration. The authors identify good practices of CCA-DRR integration within five areas: (1) governance and institutional capability to coordinate responses to disaster and climate risks and foster innovative and forward-thinking solutions; (2) assessment of disaster and climate risks, vulnerabilities, and coping capabilities, which consider systemic interlinkages and dependences; (3) nature-based solutions which provide cost-effective ways of reducing risks and provide additional ecological, social and economic benefits; (4) disaster and climate finance embedded within comprehensive financial protection strategies and contributing to building resilience to financial impacts of climate and disaster risks; and (5) monitoring, reporting, and evaluation or learning to trace progress made in reducing risks and building resilience, assess what has been accomplished, and communicate the processes and outcomes. It also includes examples and case studies demonstrating application of CCA-DRR integration across the five areas.

Islam, S., Chu, C., Smart, J. C. R., & Liew, L. (2020). Integrating disaster risk reduction and climate change adaptation: A systematic literature review. *Climate and Development, 12*(3), 255-267. https://doi.org/10.1080/17565529.2019.1613217

This academic article presents a systematic literature review of 37 peer-reviewed studies on the integration of CCA and DRR, following PRISMA guidelines. It identifies major challenges, including lack of capacity among actors and institutions, policy gaps, mandate mismatches, governance failure, lack of coordination, fund-shortages, and obstructive influence from the influential decision makers. These challenges were noted to be underpinned by the political economy, including the roles of influential actors and their interests in funding mechanisms related to DRR and CCA. The review highlights the limited availability of concrete strategies for integration, emphasizing the need for further research on political, social, and cultural dynamics, community involvement, and funding coordination. The article highlights that international and national agreements, protocols, and policies on climate change are key to facilitate the mainstreaming of CCA into DRR policy.

Kelman, I. (2015). Climate Change and the Sendai Framework for Disaster Risk Reduction. *International Journal of Disaster Risk Science, 6*(2), 117-127. https://doi.org/10.1007/s13753-015-0046-5

This academic article examines the Sendai Framework for Disaster Risk Reduction 2015–2030 (SFDRR), focusing on how it frames and refers to climate change in the context of DRR. The authors problematize the choice to separate DRR, sustainable development, and climate change action, including adaptation and mitigation, at the international level, which is illustrated by three separate international agreements established in 2015. The authors suggest alternative framings for international policy that would better integrate DRR and CCA as opposed to reinforcing the separation between these policy areas. The main argument made in this paper is that an all-vulnerabilities or all-hazards approach should be taken to combat siloing in international organizations across DRR, climate change, and sustainable development policy areas. The article also provides a thorough overview of the current state of environmental and sustainable development decision-making at international levels and the current challenges around siloing in this space.

Keweloh, R. (2015). Integrating Disaster Risk Reduction and Climate Change Adaptation in Theory and Practice: A Case Study of the Red Cross and Red Crescent Movement in Asia. SSRN. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4150738

This working paper uses a case study approach to examine Red Cross and Red Crescent organizations in Bangladesh, Pakistan, the Philippines, Tajikistan, and Vietnam, to assess policy coherence in guidelines and practice that supports DRR and CCA. The study was conducted in two parts. First, a literature review was used to identify criteria for determining integration levels of DRR and CCA. Second, a case study analysis was used to understand how and to what degree the countries of focus integrate DRR and CCA in practice within the Red Cross and Red Crescent organizational structure. Methods used in the case study analysis included expert interviews, document analysis, and participant observation. The report provides recommendations for the International Federation of Red Cross and Red Crescent Societies as well as for National Societies in each of the countries on how to better integrate DRR and CCA in practice in both disaster relief and sustainable development contexts, and to improve alignment between policy and practice in organizations at international and national scales.

Lei, Y., & Wang, J. A. (2014). A preliminary discussion on the opportunities and challenges of linking climate change adaptation with disaster risk reduction. *Natural Hazards, 71*(3), 1587-1597. https://doi.org/10.1007/s11069-013-0966-6

This academic journal article reviews the CCA and DRR scholarship to distill differences between them, as well as opportunities for their theoretical integration. The authors frame their analysis around the observation that neither the CCA or DRR framework focus solely on addressing risk, but both fundamentally respond to and engage with the social context within which disasters and climate change occur. Thus, they identify building resilience and adaptive capacity as shared goals between the literatures, while they identify spatial and temporal scale as the primary differentiating features. The article provisions a three-dimensional model linking CCA and DRR, with axes for time scale (pre-, mid-, post-disaster, and next/future disasters), spatial scale (individual, community, local, national, and global), and adaptive strategies (educational, ecological, technological, and political). The authors draw on this model to offer recommendations for integration.

McCommon, J., Lees, J., Hoebreck, C., & Vaike, L. (2021). Beyond Barriers: Integrating disaster risk reduction and climate change adaptation in the Pacific. *Humanitarian Advisory Group*. https://humanitarianadvisorygroup.org/insight/beyond-barriers-integrating-disaster-risk-reduction-and-climate-change-adaptation-in-the-pacific/

This literature review is the first output of a multi-year research initiative led by World Vision Australia and the Humanitarian Advisory Group to understand how CCA and DRR can be integrated at the community level across the Pacific. Grounded in the region's leadership under the Framework for Resilient Development in the Pacific, the paper argues that communities experience risks holistically, making the traditional DRR/CCA divide artificial. It synthesizes theory, policy, and practice to define where the fields converge (risk concepts, resilience goals) and why integration matters, including reduced duplication, better use of resources and knowledge, and improved outcomes for at-risk populations. Using examples and regional policy milestones, the authors identify barriers, including siloed funding and institutions, inconsistent inclusion practices, methodological and theoretical confusion, coordination gaps, and limited access to usable risk information. They further map opportunities for integration, including aligning finance with integrated frameworks, strengthening vertical linkages, prioritizing inclusive participation (including people with disabilities), building new partnerships (e.g., private sector, risk transfer), improving data accessibility, and sharing good practices. The paper proposes a working definition of integration and sets a research agenda to test and refine good practices through country studies, with the goal of informing resilient, community-led programming.

Mysiak, J., Castellari, S., Kurnik, B., Swart, R., Pringle, P., Schwarze, R., Wolters, H., Jeuken, A., & van der Linden, P. (2018). Brief communication: Strengthening coherence between climate change adaptation and disaster risk reduction. *Natural Hazards and Earth System Sciences, 18*(11), 3137-3143. https://doi.org/10.5194/nhess-18-3137-2018

This policy-oriented paper distills how Europe can make CCA and DRR more mutually reinforcing. Framed by the SDGs, Sendai Framework, and Paris Agreement, the authors argue that policy coherence, not just parallel progress, is essential as climate extremes intensify. Drawing on the European Environment Agency's assessment, they identify characteristics of good integration practices, including clear legislative mandates and roles, coordinated multi-level governance, sound risk and adaptation finance, and evidence-based risk analysis that combines short- and long-term hazards, exposure, vulnerability, and learning. Six illustrative examples are highlighted, including long-term adaptive

planning, public–private insurance partnerships, local risk governance, national risk assessments incorporating CCA and DRR, city networks for urban resilience, and financing nature-based solutions. Looking ahead, they see opportunities in better climate-risk assessment and modelling (including cascading impacts), stronger climate services and knowledge portals, multi-stakeholder platforms that link data with decisions, coherent funding across EU instruments, and aligned monitoring, reporting, and evaluation systems across CCA/DRR/SDGs. Overall, the paper makes a pragmatic case for systematic knowledge sharing, collaboration, and investment to close the CCA–DRR implementation gap.

Paterson, S. K., & Guida, K. (2022). Bridging Gaps: Connecting Climate Change Risk Assessments with Disaster Risk Reduction and Climate Change Adaptation Agendas. In S. Flood, Y. Jerez Columbié, M. Le Tissier, & B. O'Dwyer (Eds.), ***Creating Resilient Futures Integrating Disaster Risk Reduction, Sustainable Development Goals and Climate Change Adaptation Agendas*** **(pp. 65-80). Palgrave Macmillan.**

The focus of this book chapter is on a conceptual bridging of DRR, CCA, and climate change risk assessment (CCRA) literature from a policy perspective. The authors frame CCRA as an integration space for bringing together DRR and CCA theory and practice. The authors argue that integration requires long-term socio-technological approaches that improve urban planning, access to health care, sustainable investing, and participatory planning processes. The authors also call for a public and large-scale reframing of the concept of "disaster" to something that is socially constructed and produced by the presence of marginalization, discrimination, and inequity. They suggest that integrating CCA and DRR requires shifting our focus to mitigating these underlying problems that produce and reinforce vulnerability. They advocate for co-produced and participatory approaches to CCA at local scales but emphasize that this must be complemented by strong DRR at larger (e.g., national) scales.

Raikes, J., Smith, F. T., Baldwin, C., & Henstra, D. (2022). Disaster risk reduction and climate policy implementation challenges in Canada and Australia. ***Climate Policy, 22*****(4), 534-548. https://doi.org/10.1080/14693062.2022.2048784**

This academic article examines the integration of CCA and DRR in multi-level governance systems across Canada and Australia, focusing on flood and drought planning. Using document analysis, Delphi surveys, and practitioner interviews, the authors identify a growing policy discourse that promotes whole-of-society, risk-informed, and vulnerability-sensitive approaches. The authors note that implementation is hindered by fragmented governance structures, limited cross-sectoral coordination, and conceptual and institutional disconnects between DRR and CCA. The study highlights the need for governance reform, improved risk knowledge, and deeper engagement with marginalized populations, particularly Indigenous communities. It provides critical insights into policy challenges and offers directions for strengthening DRR–CCA integration through institutional transformation and inclusive policymaking. It highlights themes such as policy fragmentation, the need for governance reform, cross-sectoral coordination, and engagement with vulnerable and marginalized communities, offering practical directions for institutional transformation and inclusive policymaking frameworks.

Save the Children. (2013). Practitioner Guidelines on the Integration of Disaster Risk Reduction and Climate Change Adaptation into Sector-Based Programs. Save the Children. https://resourcecentre.savethechildren.net/document/practitioner-guidelines-integration-disaster-risk-reduction-and-climate-change-adaptation

This manual is designed for field practitioners, sector leads, and program managers seeking to integrate CCA and DRR within education and child protection programs. It explains why integration matters (i.e., avoiding loss of development gains, addressing children's disproportionate risk), defines core concepts (risk, vulnerability, resilience), and situates the work within global frameworks (Hyogo Framework for Action and Sustainable Development Goals). The guidance is organized around five activity areas, including early warning systems, preparedness, mitigation, resilience, and adaptation, each with risks, context-specific interventions, enablers, and common blockers. A major organizing device is the Comprehensive School Safety framework's three pillars: (1) Safe Learning Facilities, (2) School Disaster Management, and (3) Risk Reduction & Resilience Education, with concrete responsibilities for ministries, local authorities, schools, and communities. Cross-cutting emphasis is placed on child rights, meaningful participation, and inclusion (gender, disability, out-of-school learners), plus multi-level capacity building and policy/advocacy linkages to advance integration at scale. Detailed tables provide step-by-step program options, while case studies (including those in Laos, Cambodia, Pakistan, Vanuatu, Philippines, the Solomon Islands, Thailand, Bangladesh) illustrate practical application. Overall, the manual functions as a field-ready catalogue of integration practices to design, implement, and scale child-centred DRR–CCA programs.

Scolobig, A., & Balsiger, J. (2024). Emerging trends in disaster risk reduction and climate change adaptation higher education. *International Journal of Disaster Risk Reduction, 105*, Article 104383. https://doi.org/10.1016/j.ijdrr.2024.104383

This literature review explores higher education practices in CCA and DRR, covering a range of educational formats including master's programs, postgraduate diplomas and certificates, standalone training courses, online course materials, and transnational academic networks. The study identifies emerging trends in DRR and CCA higher education, such as the integration of big data analytics, a focus on the social dimensions of risk, multi-risk assessment approaches, the development of synergies between CCA and DRR, and deeper connections between disaster risk, sustainability, and development. The review highlights the importance of faculty collaboration, departmental coordination, and robust institutional cooperation for the successful implementation of higher education programs that merge CCA and DRR. It also finds that universities hosting disaster-focused research centers often provide extensive training opportunities and play a significant role in shaping national policy and legal reforms. The paper concludes that higher education institutions are increasingly recognized as essential actors in building a culture of disaster prevention, cultivating risk awareness, and supporting research and policy development across sectors.

Serrao-Neumann, S., Crick, F., Harman, B., Schuch, G., & Choy, L. D. (2015). Maximising synergies between disaster risk reduction and climate change adaptation: Potential enablers for improved planning outcomes. *Environmental Science & Policy, 50*, 46-61. https://doi.org/10.1016/j.envsci.2015.01.017

In this academic article, the authors draw learnings from a case study: a multi-sectoral adaptation research initiative in southeast Queensland, Australia that involved 30 interviews with stakeholders involved in urban planning, coastal management, health, emergency management, and infrastructure at the various levels of government, as well as NGOs. The authors propose a framework for maximizing synergies between DRR and CCA within multi-sectoral and multi-scalar planning processes. It brings together four planning arenas (spatial, cross-sectoral, social/community, and strategic/long-term) and identifies key activities and action areas under each that are relevant to supporting DRR and CCA integration. The novelty put forth in this article is the authors' identification of emergent concepts of "betterment" and "post-disaster planning in the pre-disaster phase" as areas of synergy between DRR and CCA. They also put forth enablers for integration within planning processes within the four above-identified planning arenas. These include land use and reconstruction measures, improved cross-sectoral communication and capacity building, community engagement and risk awareness, and the embedding of adaptation into long-term governance and recovery planning.

Turnbull, M., Sterret, C. L., & Hilleboe, A. (2013). Towards Resilience: A Guide to Disaster Risk Reduction and Climate Change Adaptation. *ECB, Emergency Capacity Building Project*.

Toward Resilience is a foundational guide for development and humanitarian practitioners working to integrate CCA and DRR using a rights-based, participatory, and inclusive approach. Developed through multi-agency collaboration and field consultation, the guide outlines 10 principles for integrated DRR–CCA practice, including: (1) increasing understanding of the hazard and climate change context, (2) increasing understanding of exposure, vulnerability, and capacity, (3) recognizing rights and responsibilities, (4) strengthen participation of, and action by, the population at risk, (5) promoting systemic engagement and change, (6) fostering synergy between multiple levels, (7) drawing on and building diverse sources of knowledge, (8) instilling flexibility and responsiveness, (9) addressing different timescales, and (10) doing no harm. It emphasizes program cycle management, highlighting how continuous analysis, participatory design, responsive implementation, and adaptive learning must all center the voices of at-risk populations. Key enablers identified include strong, accountable governance, decentralized decision-making, inclusive participation (particularly of women, children, Indigenous peoples, and persons with disabilities), robust advocacy strategies, knowledge co-generation, and the ability to adapt to emerging risks. The guide applies these concepts across key sectors (e.g., health, natural resource management, food security, education) and provides case studies, tools, and sector-specific guidelines. It stresses that true resilience-building requires addressing the structural drivers of vulnerability, especially during post-crisis recovery, by embedding long-term, equitable, and climate-informed solutions into all aspects of development and humanitarian work.

United Nations Development Programme (UNDP). (2020). A Strategy Tool for Integrating Disaster Risk Reduction and Climate Change Adaptation into Development. United Nations Development Programme. https://www.undp.org/publications/risk-informed-development-strategy-tool-integrating-disaster-risk-reduction-and-climate-change-adaptation-development

This UNDP strategy tool provides practical guidance on mainstreaming DRR and CCA into development through five interconnected spheres of action: knowledge, policy, finance, organization, and stakeholders. In the knowledge sphere, mainstreaming focuses on enhancing access to research and local knowledge, integrating DRR/CCA into education, conducting policy risk assessments, and promoting compliance and reporting. The policy sphere emphasizes leadership, legal frameworks, integrated planning, and the development of standards to support risk-informed development. The finance sphere is critical for implementation and includes budgeting, resource mobilization, disaster risk financing, and cost-benefit analyses for investments. The organizational sphere involves clarifying coordination roles, building institutional capacity, developing operational tools, and implementing supportive projects. The stakeholder sphere ensures inclusive participation from government, civil society, the private sector, and networks to support and scale mainstreaming efforts. Through case studies, the report emphasizes that successful integration depends on country-specific starting points and policy triggers, and it recognizes that mainstreaming can occur at multiple governance levels. While financial integration remains a common challenge, the report identifies key strategies such as identifying champions within government, building awareness, developing financial expertise, and performing expenditure analyses.

United Nations Office for Disaster Risk Reduction (UNDRR). (2020). *Integrating Disaster Risk Reduction and Climate Change Adaptation in the UN Sustainable Development Cooperation Framework*. United Nations Office for Disaster Risk Reduction. https://unsdg.un.org/resources/integrating-disaster-risk-reduction-and-climate-change-adaptation-un-sustainable

This guidance note supports the United Nations Resident Coordinators and United Nations Country Teams to integrate climate and disaster risk management throughout the United Nations Sustainable Development Cooperation Framework. It frames DRR–CCA coherence as essential to achieving the Sustainable Development Goals and the United Nations Prevention Agenda and situates risk within the humanitarian–development–peace nexus and "Leave No One Behind" commitments. The document provides plain-language definitions (risk, resilience, drivers, capacities) and a practical checklist for every cooperation framework phase. It recommends sex-, age-, disability- and geography-disaggregated indicators, alignment with Sendai Framework, Paris Agreement, National Adaptation Plans, and Nationally Determined Contributions, and links to global data platforms (e.g., Sendai Monitor, Global Risk Assessment Framework). A menu of "levers of change" are offered that aim to translate coherence into action, including risk information systems and climate services, awareness and capacity development, risk-sensitive governance and budgeting, social protection and risk transfer, risk-proofing infrastructure with engineered and nature-based solutions, and community and private-sector resilience.

United Nations Office for Disaster Risk Reduction (UNDRR). (2021). *Promoting Synergy and Alignment: Between Climate Change Adaptation and Disaster Risk Reduction in the Context of National Adaptation Plans*. United Nations Office for Disaster Risk Reduction. https://unfccc.int/sites/default/files/resource/UNDRR_Promoting_Synergy_and_Alignment_between_CCA_and_DRR.pdf

This UNDRR technical guidance document synthesizes experiences from National Adaptation Plan processes to identify concrete opportunities for promoting synergy and alignment between CCA and DRR. Drawing on comparative policy analysis and global case examples, the report outlines six "pathways to coherence" to support national-level integration. These include: (1) strengthening capacities for developing and implementing coherent national policies, with an emphasis on institutional leadership and sharing of good practices; (2) applying comprehensive risk management approaches that address the full spectrum of disaster and climate risks, including both rapid- and slow-onset events; (3) understanding how climate change drives disaster risk, and how disasters influence adaptive capacity, to ensure adaptation strategies and DRR efforts are mutually reinforcing; (4) developing strategies to finance coherence by blending climate, DRR, and development funding to support integrated action; (5) selecting and implementing measures that deliver co-benefits, ensuring actions are inclusive, sustainable, and contextually relevant; and (6) strengthening data systems for integrated risk analysis, implementation, and monitoring, including the use of shared data platforms and coordinated monitoring and evaluation. The report also includes a practical checklist for embedding DRR approaches within National Adaptation Plans, organized around the four elements of the UNFCCC Technical Guidelines. Overall, the guidance promotes policy coherence, improved resource efficiency, and integrated risk governance, positioning CCA-DRR alignment as a foundation for climate-resilient development.

United Nations Office for Disaster Risk Reduction (UNDRR). (2023). *Technical Guidance on Comprehensive Risk Assessment and Planning in the Context of Climate Change*. United Nations Office for Disaster Risk Reduction. https://www.undrr.org/publication/technical-guidance-comprehensive-risk-assessment-and-planning-context-climate-change

This technical document provides guidance on how risks in the context of climate change can be comprehensively and systemically addressed through risk assessment through 10 key principles. These principles include placing risks to both human and ecological systems at the centre of the risk assessment recognizing the interactions among hazards, vulnerabilities, exposures, and risk drivers (1), fully accounting for climate change as a risk driver and its influence on current and future hazards and vulnerabilities (2), recognizing the complex, systemic, and cascading nature of risks (3), applying inclusive risk governance through wide engagement (4), using multidisciplinary methods and diverse knowledge sources to identify measures (5), evaluating risks through the lens of risk tolerance to guide action (6), leveraging nature-based solutions to address and minimize risk while enhancing ecosystem services (7), integrating risk considerations across sectors and levels of governance (8), strengthening risk communication using scientific, local, and Indigenous knowledge tailored to end users (9), and using iterative, adaptive processes supported by monitoring, evaluation, and learning frameworks (10). While primarily structured around these principles, the document also implicitly reinforces the need for resource efficiency, policy coherence, and cross-sectoral alignment, notably between CCA and DRR via integrated national plans.

United Nations Office for Disaster Risk Reduction (UNDRR). (2025). *Disaster Risk Reduction and Climate Change Adaptation: Coherence Pathways in Europe and Central Asia*. United Nations Office for Disaster Risk Reduction. https://www.undrr.org/publication/disaster-risk-reduction-and-climate-change-adaptation-coherence-pathways-europe-and

This report assesses the coherence between DRR, CAA, and sustainable development goals (SDGs) across 16 countries in Europe and Central Asia using the Coherence Pathway Tool (CPT). The CPT evaluates coherence in four domains, conceptual, institutional, operational, and financial. For conceptual coherence, the study recommends joint risk reduction strategies with synchronized timelines and greater stakeholder involvement across DRR and climate governance. Institutional coherence can be strengthened through clarifying institutional responsibilities, enhancing the effectiveness of DRR platforms, broadening the scope climate/sustainable development platforms to include DRR stakeholders, and leverage global and regional strategies to coordinate broad implementation and learning. Operational coherence can be strengthened through joint implementation teams, capacity assessments, cross-training programs, and shared methodologies. Financial coherence was indicated to be enhanced through the creation of joint funding mechanisms, mainstreaming risk reduction into national budgets, and private sector engagement. The report also highlights the growing momentum around early warning systems, the urgency of climate-adaptive agriculture through improved irrigation, crop diversity, and technology, and the critical need to strengthen infrastructure resilience, beginning with energy, followed by transport, water, and healthcare systems. Nature-based solutions are emphasized as a bridge across DRR, climate mitigation, pollution control, and biodiversity protection, providing a holistic path for coherent climate risk governance. This report offers comprehensive policy guidance for aligning DRR and CCA through both theoretical framing and practical examples.

United Nations Office for Disaster Risk Reduction (UNDRR), & United Nations University - Institute for Environment and Human Security (UNU-EHS). (2024). *Nature-Based Solutions for Comprehensive Disaster and Climate Risk Management - Toolkit for Integrated Planning and Implementation of Disaster Risk Reduction and Climate Change Adaptation*. United Nations Office for Disaster Risk Reduction. https://www.undrr.org/publication/nature-based-solutions-comprehensive-disaster-and-climate-risk-management-toolkit#downloads

This toolkit published by the United Nations focuses on practice-based integration of DRR and CCA using nature-based solutions. It adopts the framing of "comprehensive disaster and climate risk management" to describe the combined objectives of DRR and CCA. The toolkit supports national-level planning and implementation by offering five practical tools: (1) a stocktaking process to assess environmental, climate, and risk data; (2) a review of existing policies to evaluate current integration of nature-based solutions; (3) guidance for selecting context-appropriate nature-based solutions interventions; (4) strategies for inclusive stakeholder engagement and governance; and (5) approaches to embed nature-based solutions into national planning frameworks across sectors and scales. These tools are designed to help national organizations and governments embed nature-based solutions into policy and programming to strengthen integrated disaster and climate risk management.

Wang, L., Gong, Z., Shi, L., Hu, Z., & Shah, A. A. (2021). Knowledge mapping analysis of research progress and frontiers in integrated disaster risk management in a changing climate. *Natural Hazards, 107*(3), 2033-2052. https://doi.org/10.1007/s11069-020-04465-z

This article uses bibliometric and knowledge mapping techniques to analyze 488 academic publications on integrated disaster risk management (IDRM) in the context of climate change from 2008 to 2020. The study identifies five thematic clusters in the literature: (1) theoretical disaster studies (including cascading and secondary disasters), (2) construction of disaster databases, (3) research on vulnerability, risk, and resilience, (4) development of integrated risk frameworks and models, and (5) assessments of human-nature interactions in disaster governance. The research identifies three development stages in IDRM: (1) early exploration (2008–2010), (2) expansion and clarification (2011–2015), and (3) systematization and integration (2016–2020). This article maps the knowledge landscape of IDRM-CCA integration and identifies emerging research frontiers, such as social-ecological resilience, risk modeling, and inter-organizational collaboration. It also suggests key goals for integration, including enhanced institutional coordination, societal engagement in disaster governance, and sustainable development framing for risk mitigation.

Wen, J., Wan, C., Ye, Q., Yan, J., & Li, W. (2023). Disaster Risk Reduction, Climate Change Adaptation and Their Linkages with Sustainable Development over the Past 30 Years: A Review. *International Journal of Disaster Risk Science, 14*(1), 1-13. https://doi.org/10.1007/s13753-023-00472-3

This review article delineates the trajectory of discourse on DRR, CCA, and sustainable development at international scales. The authors propose a framework to support the integration of both CCA and DRR into resilience building via sustainable development. They link CCA and DRR into a single concept and goal of "climate risk management", which they argue should be a pillar of sustainable development planning and policy and result in the development of an "integrated risk governance solution" at national levels. The authors spend more time critiquing existing framings and identifying barriers to integration than they do putting forth recommendations or good practices. Interestingly, however, the authors question the framing put forth by others in the field (and other documents included in this review) that CCA should be understood as a subset of DRR. Instead, they argue that both should be incorporated equally into frameworks under the umbrella of sustainable development.

Appendix B | Good Practices Review by Waterloo University Students

Good Practices that Integrate Climate Adaptation and Disaster Risk Reduction

A Global Scope Review

April 11, 2025

Theo Dan & Ayah Medlej

For The Resilience Institute & The University of Waterloo

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Introduction

The purpose of this report is to outline the methods and results of the work which was conducted to synthesize pre-existing knowledge regarding the integration of climate change adaptation (CCA) and disaster risk reduction (DRR) good practices. To assemble the existing information on this topic, the research effort took the form of a scoping review at the global scale. This work was done to provide The Resilience Institute (TRI) with a combination of knowledge that contributes to DRR and CCA integration, good practice findings transferable to Canada.

Climate change can be defined as an observable long-term change in average weather patterns across the world (Amaratunga, 2017). However, as weather patterns around the globe are transforming, the frequency and intensity of natural disasters that stem from the aforementioned weather changes are increasing (National Aeronautics and Space Administration, n.d.). To combat these issues, DRR is used as a method to achieve reduced disaster impacts and to prevent or lessen future natural hazard risks (Schiermeier, 2021). As for CCA, this is used as a means for implementing actions that reduce vulnerability to current or expected impacts of a changing climate (UNDRR, n.d.). TRI aims to use the combined strength of DRR's focus on risk management with CCA's focus on long-term adaptation to address climate change challenges by preventing the creation of new risks while simultaneously reducing existing ones. This led to a global scoping review regarding this combined DRR and CCA approach. This assessment first consisted of general research about this field, which was categorically divided into six zones by global geographic region, following the framework of the United Nations Office for Disaster Risk Reduction (UNDP, 2022). Information extracted from this research was then rigorously screened to ensure maximum contribution to the scoping review by omitting irrelevant

knowledge through a categorical approach. The remaining articles or media were then each analyzed in the form of an annotated bibliography framework that extracted several categories of results regarding the integration of DRR and CCA. The results of this research effort vary across regions and with this variation follows the demonstration of the distinctions between how integration good practices and the barriers associated vary within a subset of the region they make up.

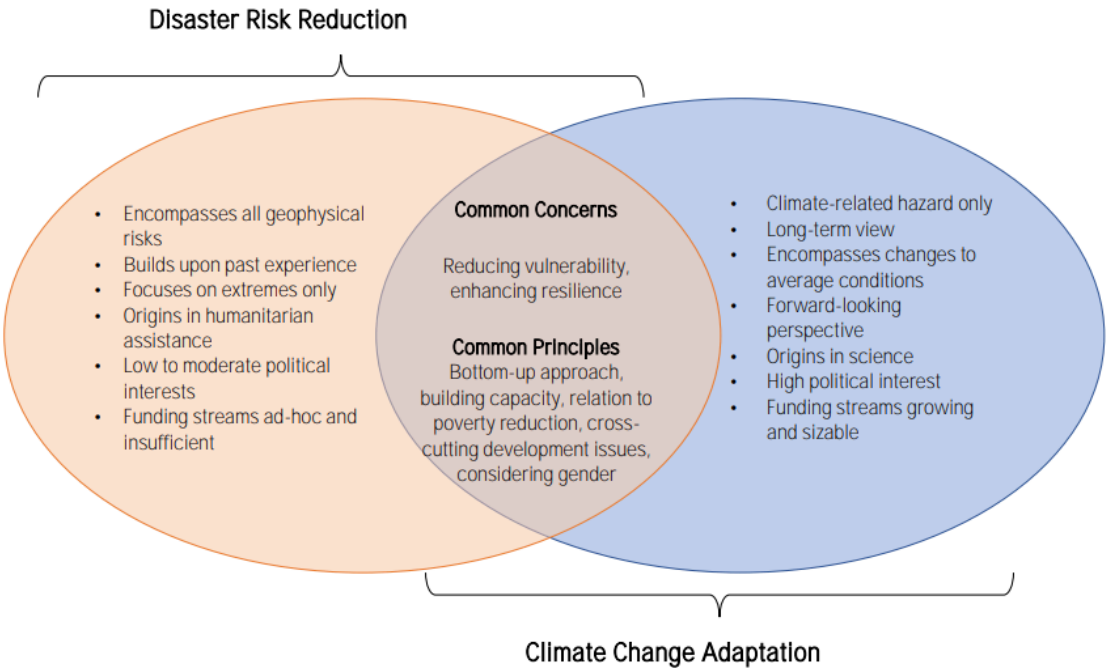


Figure 1: Similarities and Differences Between DRR and CCA (ESCWA,2017)

Methods

This global scope review process began with an organizational step carried out by dividing the world into six regions based on their geographic location. These six regions were selected as a foundational way of supporting greater precision regarding DRR and CCA integration good practice research because it follows a structure proposed by a credible author, the United Nations Office for Disaster Risk Reduction (UNDRR). These regions, each assessed

individually, consist of the following areas: Asia, the Pacific, Europe, Arab States, Africa, Americas & the Caribbean (UNDRR, n.d.). Following this organizational stride, the first major step of the review was then carried out by beginning general research of DRR and CCA integration and good practice knowledge through peer-reviewed articles, grey literature, and case studies. The goal was to amass approximately 20 sources of information in total per each UNDRR division region (subject to change due to region limitations). Of these 20 sources, 10 sources were peer-reviewed articles and the remaining 10 were divided equally among grey literature and case studies. During the research process, sources were identified by using the Google Scholar search engine and search strings such as “DRR + CCA + ASIA” where only the third string (region e.g. Asia) is variable depending on the region of interest. Once a satisfactory amount of information was collected, each source was put through a document screening process that assesses its contribution potential to the scoping review. Provided by TRI, the document screening method took the form of an excel file consisting of a rigorous structure that determined

Figure 1. Document Screening Criteria

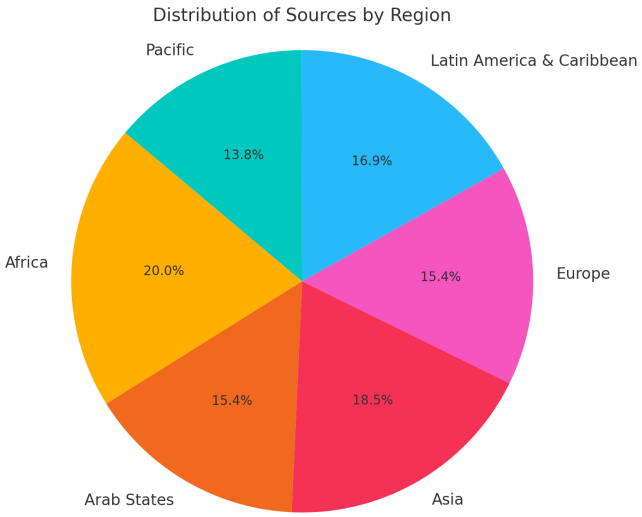
Criteria	Inclusion	Exclusion
Integration Focus	Documents explicitly discussing the integration of climate adaptation and disaster risk reduction, focusing on practical approaches, frameworks, or strategies.	Documents focusing solely on either climate adaptation or disaster risk reduction without integration.
Content Relevance	Focus on conceptual models, practices, programs, or policies that include empirical evidence, case studies, or documented impacts.	Theoretical studies without practical applications or empirical evidence.
Geographic Scope	Global, national, or regional in scope, provided regional studies offer transferable insights applicable to broader contexts.	Regional or local in scope that does not have the potential to inspire broader integration discussions.
Source Credibility	Published in peer-reviewed journals or credible grey literature, such as reports from reputable organizations (e.g., UN, NGOs, governments).	Non-credible sources, including blogs, opinion pieces, or unverified grey literature.
Language Accessibility	Available in English or translated into English with verified accuracy.	Not available in English or without a translation.

if information was or was not omitted. Following the research screening process was the analysis of any remaining sources of information that successfully passed the screening. This was conducted through a similar framework as before, once again provided by TRI in the form of an excel file, except this time the structure was applied in the form of an annotated bibliography (see appendix). Within the annotated bibliography file, each source was assigned a unique document identifier based on the region the knowledge was derived from and the order of which the document was discovered throughout the research process. For example, the first source from the region of Asia would be identifiable as "A0001." Furthermore, the most significant feature of the custom bibliography is that it includes a concise summary regarding DRR and CCA for each source as they pertain to each of the following categories: geographic scope, methodology, integration type, good practices, key enablers for integration, outcomes of integration, stakeholder involvement, barriers to integration, knowledge or practice gaps, and ethical considerations. This allowed for an organized layout where a compressed version of all of the significant information regarding DRR and CCA integration was made categorically available. The detailed annotated bibliography aforementioned allowed for and encouraged the final step of the global scoping review process. Lastly came the synthesis of results which was grouped by UNDRR regional division in order to establish DRR and CCA integration information applicable to Canada that can be differentiated by the region it is derived from.

Results

Throughout the six regions assessed as part of this global scope review, there were a total of 65 sources taken into consideration after the document screening process was completed.

Figure 2. Source Distribution



The overall spread amongst regions was fairly even at an average of 10.83 sources (rounded to 10) per region, where the Pacific area showed the least information with 9 sources in contrast to Africa which had the most sources at 13. The slight variation in number and geographic scope of sources assessed can be attributed to region specific dynamics that are capable of encouraging or limiting research in the field of integrated CCA and DRR good practice. For example, a region that suffers from political instability likely does not offer extensive opportunities for research of this topic, meaning that there is less information available to be synthesized for the region of interest in comparison to a region that does not suffer from political strife. Given that the region of origin from which sources of information are derived plays a crucial role in the availability of CCA and DRR integration research, the results concerning good practices have been separated and structured by UNDRR region division.

Asia

The Asian region is characterized by a diverse and dynamic landscape in terms of integrated DRR and CCA good practice assessment. It reveals information from 12 sources derived from countries such as Bangladesh, Vietnam, Nepal, China, and India, as well as additional insight with integrated practice focus from other nations who belong to a cross-border collaboration fostering organization known as the South Asian Association for Regional

Cooperation (SAARC) (Leitner et al., 2010; Nguyen et al., 2010; Chen et al., 2013; Setiadi et al., 2010; Mall et al., 2017; Shaw et al., 2010). Countries across Asia are highly prone to climate-related disasters such as drought or landslides which has allowed for a wide variety of approaches to managing disaster risk and long term climate change (Chakrabarti, 2010).

Integration Strategies

To combat vulnerability to climate hazards, there are three main pathways through which DRR and CCA integration occurs across Asia; policy and institutional mechanisms, conceptual models and frameworks, and community-based strategies. Beginning with policy, Asian countries have started to embed DRR and CCA objectives together into national planning structures (Nguyen et al., 2010). Vietnam has aligned its natural disaster prevention program to reflect national targets that have been agreed upon through collaboration with stakeholders to positively influence both climate adaptation and disaster mitigation (Nguyen et al., 2010). Similarly, Bangladesh has integrated climate resilience into its disaster management framework which has enabled more cohesive planning across different sectors (Chakrabarti, 2010). Furthermore, at the regional level, the SAARC encourages coordination of integration efforts, especially for smaller countries in this region that have a limited individual capacity for action who therefore benefit from support that resides outside of traditional borders (Shaw et al., 2010). Conceptual models and frameworks have also played a key role regarding integration advancement for this region. The Decentralized Climate Hazard and Disaster Integration (DCHDI) framework encourages governance on multiple levels catalyzing the decentralization of climate and disaster planning information (Chaiya et al., 2022). This approach supported action at various levels of government which, by extension, can be further extended into enablement of community organizations to assume a more direct role regarding adaptation and

risk reduction. Additionally, resilience planning frameworks were used to strengthen institutional coherence through guidance regarding alignment of adaptation goals with DRR priorities that are specific to the region of interest (Van der Keur et al., 2016). Research in the Asian region has also revealed the significance of the ability of governance systems to enhance both vertical and horizontal orchestration across institutions (Islam et al., 2020). This revealed that a strong communication channel between national groups and local actors can help to reduce fragmentation and improve the chances for success regarding multi-scale integration. At one of the lowest levels of governance, the community level, countries like Nepal and Bangladesh have led an inclusive approach to integration strategy that included women-led initiatives, participatory disaster preparedness, and the use of locally tailored agriculture (Leitner et al., 2010). In Nepal, this is bolstered by local non-governmental organization (NGO) collaboration with municipal governments to bring about community education, awareness campaigns, and planning processes that make inclusive considerations (Setiadi et al., 2010).

Enabling Conditions

Successful integration of DRR and CCA good practice in Asia is made possible by a combination of political leadership, governance structure, and local participation(Shaw et al., 2010). Strong political leadership was demonstrated through centralized political authority and coordination in countries like China where the national adaptation plan is managed by a centralized body that coordinates ministry level responsibilities with the allocation of resources (Chen et al., 2013). This supported streamlined implementation and accountability regarding DRR and CCA integration. Another enabling condition pertaining to this region is donor support in combination with regional cooperation. Organizations such as the United Nations Development Programme (UNDP) have provided both financial aid and technical assistance for

integration initiatives across several Asian country borders (Uchiyama et al., 2014). Furthermore, regional plans that are facilitated by the SAARC help countries, specifically those that are smaller with limited action capacity, to assume a coordinated approach regarding integration strategies (Shaw et al., 2010). In Nepal, this is bolstered by local non-governmental organization (NGO) collaboration with municipal governments to bring about community education, awareness campaigns, and planning processes that make inclusive considerations (Setiadi et al., 2010). Further enablement of DRR and CCA integration was made possible by community engagement through participatory rural appraisal methods that encourage rural populations to examine local levels of vulnerability which is then followed up with active participation in the development of solutions reflective of local knowledge and goals (Leitner et al., 2010). These participatory methods are frequently ameliorated by gender-responsive considerations as it ensures that the capacity and perspective of women are equally inputted to improve key enablers.

Knowledge Gaps & Barriers

Despite significant progress, there remain several barriers that limit the full integration of DRR and CCA good practice in Asia. One notable gap is the limited inclusion of local and Indigenous knowledge into national policy frameworks (Navab, 2024). Although it is widely recognized at the community level, this type of information is rarely acknowledged at the centralized government level where other information often takes shape as national strategy or policy (Navab, 2024). This disconnect between levels of governance is responsible for an observed reduction in cultural relevance and sustainability regarding many top-down approaches (Leitner et al., 2010). Another challenge is the limited capacity for monitoring and evaluation (M&E), particularly in marginalized or rural regions due to a lack of tools and institutional capacity to accurately determine the effectiveness of integrated DRR and CCA involvement over

time (Setiadi et al., 2010). Furthermore, tracking systems at a national level have demonstrated a wide variety of quality and consistency, further contributing to the lack of M&E for DRR and CCA integration outcomes (Charkabarti, 2010). At a sub-national level, practitioners are faced with another challenge which is the local lack of technical skill and assessment tools that are required to assess vulnerability or to integrate climate indicators into planning efforts (Van der Keur et al., 2016). This issue is additionally compounded by limited support from higher governance levels (Mall et al., 2017). Limited support often takes the form of financial hindrance which restricts the implementation of integrated strategies because funding channels can be siloed, focusing development on a single approach instead of an integrated method, which has restricted the scale and sustainability of integration initiatives in Asia (UNDRR, 2023). Lastly, a knowledge gap exists regarding adaptation plans in this region considering that programs have inadvertently increased vulnerability through the disconnect that was generated by failure to consider local dynamics and to connect with the communities that were affected (Piggott-McKellar et al., 2019). These hurdles exemplify the importance of inclusive planning, local comprehension, and transparent implementation plans.

Applicability to Canada

Good practices revealed in Asia introduce several useful lessons regarding DRR and CCA integration in Canada, with emphasis on rural and Indigenous communities. Planning approaches conceived at the community level, as seen in countries like Nepal and Bangladesh, have provided valuable models for resilience strategies that are locally led and inclusive (Leitner et al., 2010). These methods have demonstrated beneficial impacts for community participation, gender equity, and contextual relevance, all of which are principles that can be applied seamlessly to Canada due to alignment of regional climate reconciliation and justice aspirations.

The Vietnamese approach to DRR and CCA alignment led to another takeaway in how national level cooperation observed in this country provides a model for improvement of vertical integration among Canadian municipal, provincial, and federal governments (Nguyen et al., 2010). Finally, the incorporation of equity and rights considerations into frameworks in Asia offer an interesting perspective regarding how to structure climate and disaster policy. Several programs explicitly addressed the needs of the most vulnerable group which suggests that fair social inclusion was a founding principle of these structures (Navab, 2024). The alignment of Asian and Canadian social climate justice goals from respective frameworks allows for the aforementioned lessons to help foster inclusivity of vulnerable populations in Canada, particularly for rural and Indigenous communities that are associated with high vulnerability.

Africa

Across Sub-Saharan Africa, there has been a shift from incidental to structural integration of CCA and DRR. Several nations, including Kenya, Nigeria, and Zimbabwe, are institutionalizing convergence through national frameworks, sectoral policies, and joint coordination mechanisms (UNDRR,2020).

Integration Strategies

In countries like Benin and Malawi, integration occurs through joint institutional mechanisms that co-develop CCA and DRR strategies. These mechanisms enable cross-sectoral planning with DRR elements embedded in National Adaptation Plans (NAPs) and CCA considerations in national disaster response protocols (UNDRR,2020).

In Nigeria, the 2018 National Disaster Risk Management Policy attempts integration through mainstreaming climate risk within legal and institutional frameworks, although challenges

remain due to funding and mandate fragmentation (NEMA,2018). Adding to that, Kenya exemplifies strategic coherence by aligning DRR-CCA objectives under the Climate Change Act and disaster law provisions, linking Sendai Framework Priorities with national development planning (Nduku,2021). Examining sector-specific strategies, South Africa's integration has advanced in food security sectors, where policies are increasingly reflective of DRR-CCA coherence. However, municipal planning often lacks dedicated climate strategies, limiting the effectiveness of local-level implementation (Zembe et al., 2022). On the multi-hazard approaches, the AMHEWAS framework developed by the African Union highlights a continent-wide effort to integrate early warning systems (EWS), linking meteorological data with disaster management and climate response in real time (AUC,2022). A multi-hazard EWS has been implemented in 21 countries in Africa, and has reported that 15 out of the 21 countries have had limited to moderate in effectiveness (AFRP, 2024).

Key Enablers

One of the strongest enablers across African case studies is the presence of dedicated coordination structures. In countries like Ghana, Benin, Kenya, and Zimbabwe, coherence is strengthened through multi-level governance arrangements, with national DRR and CCA authorities working in tandem (UNDRR,2020). For example, Zimbabwe's Resilience Building Fund integrates both streams under one financing and programmatic platform, serving as a notable best practice. In Kenya, the Climate Change Directorate and National Disaster Management Authority operate under clear mandates with legislative backing, facilitating alignment of strategic goals, implementation, and monitoring (Nduku,2021). The AMHEWAS framework, developed for the African continent, offers a model for multi-hazard early warning and early action systems, leveraging the African Union, Regional Economic Communities, and

national governments to coordinate efforts across borders (AUC,2022). Figure X illustrates the governance structure underpinning TheAMHEWAS, it highlights how coordination flows from regional and national levels down to sectoral stakeholders, including health, agriculture, hydrology, local governments, and meteorological services. The model demonstrates an integrated, cross-sectoral approach to early warning that strengthens institutional coherence, an essential enabler for DRR and CCA convergence.

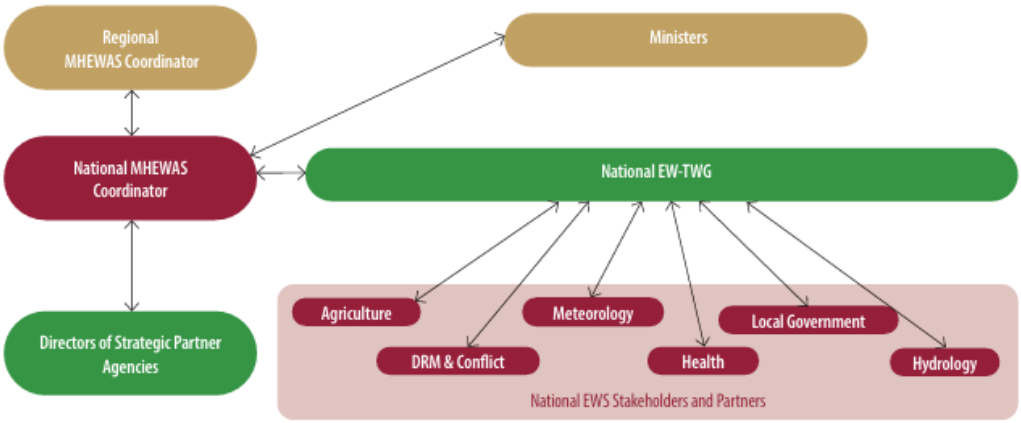


Fig 3: Proposed AMHEWAS Governance Structure – National Overview (African Union Commission, 2022.)

Several countries access international climate and disaster finance from sources like the Green Climate Fund, Global Facility for Disaster Reduction and Recovery(GFDRR), and African Risk Capacity (ARC). For example, Nigeria's partnership with IOM embeds DRR-CCA integration into human mobility and displacement planning, supported by multi-donor funds (IOM Nigeria, 2023). However, while external funding catalyzes integration, long-term success is more evident in countries where national budget lines are dedicated to both DRR and CCA. This is seen in the case of Benin and Malawi, where integrated budgets align across sectors (UNDRR, 2020).

Community-based initiatives are a critical part of Africa's enabling environment. In Namibia, for example, local indigenous knowledge systems were formalized into early warning protocols. Similarly, in Rwanda, biodiversity conservation and land-use programs integrate CCA goals while involving local governance bodies (Olhoff,2011). Moreover, in Kenya's Keiyo and Nandi districts, the integration of Indigenous Knowledge Systems with scientific forecasting has improved early warning dissemination and food security planning (Songok et al., 2011). Effective integration is frequently associated with decentralized systems, as in Kenya, where county-level disaster committees play a role in executing climate strategies. The need to center local voices, especially those of women, youth, and marginalized groups, was emphasized across several case studies (Nduku, 2021).

Knowledge Gaps & Barriers

A prominent barrier to integration across the African context is institutional compartmentalization. In many countries, DRR and CCA are managed by separate ministries or departments, resulting in duplicated efforts, misaligned funding, and inconsistent implementation (Amaratunga et al., 2021).

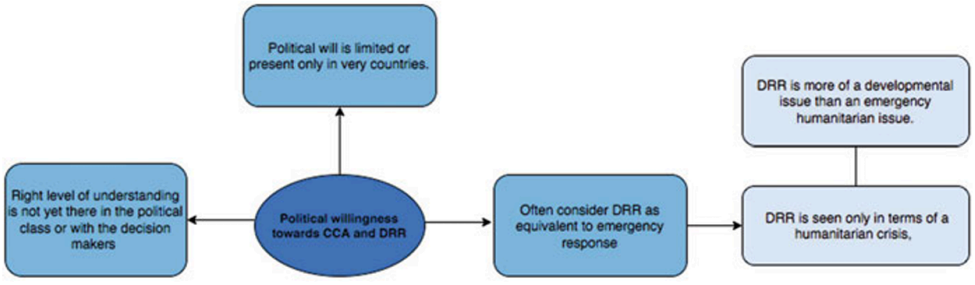


Fig 4: Issues relating to political will for CCA and DRR integration in Africa (Dias,2022)

This diagram outlines the interrelated factors that limit political support for DRR-CCA integration. It demonstrates how decision makers' limited understanding, and the common

perception of DRR as purely a humanitarian concern, can prevent it from being treated as a developmental priority. These misconceptions restrict policy innovation and high-level investment (Dias, 2022).

For instance, Nigeria's NEMA Act focuses largely on emergency response and lacks provisions for proactive climate planning or enforcing integration mandates across government sectors (Mashi et al., 2019). Despite policy commitments, operational fragmentation continues to hinder progress. Lack of mandates to compel cross-sectoral cooperation was cited in both national and sub-national contexts in Nigeria and Kenya (Nduku,2021). Secondly, limited technical capacity, especially at local government levels, restricts the implementation of integrated approaches. Many local agencies lack access to climate projections, DRR tools, or the training needed to apply these concepts effectively. In South Africa, even though Integrated Development Plans (IDPs) and Disaster Management Plans (DMPs) are mandatory, most municipalities lack standalone CCA strategies or personnel trained in both domains (Zembe et al., 2022).

In Kenya, while the policy framework is progressive, some county governments reported low engagement from national agencies and insufficient resources for local integration (Nduku, 2021). Thirdly, many integration initiatives remain project-dependent and donor-funded. Once international funding ends, continuity and institutional memory often fade. Integration is often reactive and donor-driven rather than structurally embedded into long-term development plans (Olhoff,2011). This dependency on short-term project cycles undermines long-term planning and resilience-building, as seen in multiple examples from Malawi and Nigeria (UNDRR, 2020).

Lastly, data gaps and inadequate access to reliable climate hazard data also hamper integration. Risk assessments often exclude social vulnerability indicators, and climate models may not be

localized enough to guide decision-making at the community level. This limited informed investment, policy planning, and early warning system functionality (AUC,2022).

Applicability to Canada

The use of decentralized governance in countries like Kenya and Rwanda offers a blueprint for aligning federal, provincial, and local mandates in Canada. Canadian municipalities, especially those in climate-vulnerable or Indigenous territories, could benefit from empowered local governance with clear roles in DRR-CCA implementation, much like county-level integration models observed in Kenya (Nduku, 2021). Similarly in Kasali (2011) highlights how Southern African countries benefit from governance systems where local governments are involved in DRR-CCA policy execution, supported by donor and NGO partnerships, thus reinforcing the case for Canada's own provinces and Indigenous communities to have tailored mandates and capacities for integrated risk adaptation. Formalizing multi-stakeholder platforms, African examples emphasize the role of joint national platforms, such as Zimbabwe's Reliance Fund or Nigeria's MECR framework (IOM Nigeria, 2023), that coordinate climate risk agencies. The whole of entities such as the African Union and Regional Economic Communities have a role in coordinating action across sectors and borders, with the emphasis on the engagement between governmental and non-governmental stakeholders to overcome fragmented institutional setups (Kasali,2011). Canada, with its similar need for coherence across jurisdictions and multiple ministries, could benefit from national DRR-CCA working groups that include Indigenous representatives, municipal leaders, and climate science experts. While many African states face challenges from siloed institutions, Malawi and Benin are increasingly showcasing structural integration through legislation and shared implementation frameworks. These countries embed DEE principles within CCA plans and vice versa, avoiding

duplication and enhancing accountability (UNDRR,2020). In Canada, many adaptation and emergency management plans still exist in parallel tracks, this model suggests policy reforms to mandate cross-cutting integration through legal and financial instruments.

Pacific

The Pacific region presents a unique setting for the integration of DRR and CCA good practice because of the isolated geographic nature that is characteristic of many of the countries in this region. The integration regarding this region is shaped by factors that often stem directly from its island-like geography such as cultural traditions, community unification, and predisposition to climate change induced hazards (McCommon et al., 2021). This section of the scoping review draws information from nine sources with emphasis on Pacific Island Countries (PICs) such as Fiji, Samoa, Vanuatu, Tuvalu, Papua New Guinea, and the Solomon Islands. In addition to national case studies, regional frameworks that span across the Pacific region were considered in order to demonstrate government level cooperation across various islands regarding integrated DRR and CCA planning within this unique setting (UNISDR & UNDP, 2012; McCommon et al., 2021).

Integration Strategies

Pacific methods of DRR and CCA integration were observed to cover multiple pathways which included policy frameworks, local-level community practices, knowledge based leadership, and analytical frameworks. Many nations belonging to this regional division use formal structures such as the Framework for Resilient Development in the Pacific (FRDP) and Joint National Action Plans (JNAPs) to assist through guidance of integration efforts (UNISDR & UNDP, 2012). These frameworks encourage coordination across sectors, demonstrative of a

connection between DRR and CCA through the implementation of both concepts together as part of broader national development goals that improve integration (UNISDR & UNDP, 2012). While programs such as the two previously mentioned are beneficial for a wide range of multi-level cooperation, the geographic isolation associated with PICs created opportunities for community level resilience building (Charan et al., 2016). Many of the localized communities from this region are classified as villages, a fact revealed through leadership responsibilities that are frequently undertaken by chiefs, elders, women committees, and faith groups (Charan et al., 2016). Therefore, climate related initiatives such as hazard mapping, early warning systems, and ecosystem based adaptation are often headed by groups within a village community (Charan et al., 2016). This was observed in Fiji where local actors had independently conducted zoning tasks and taken measures to protect ecosystems at a community level (Charan et al., 2016). Further reinforcing the isolated community strength theme, another integration strategy observed from this region was knowledge based leadership. To continue with the example from Fiji, CCA and DRR integration is addressed through the increased involvement of women groups in resilience planning due to the incorporation of related traditional ecological knowledge into formal government planning (Charan et al., 2016). The final integration strategy of note from the Pacific is the use of analytical frameworks such as the Capacity for Joint Action, a structure capable of assessing the success of institutional collaboration across sectors (Horne et al., 2025). Structures of this fashion support DRR and CCA integration by providing an opportunity to evaluate the outcomes of framework initiatives. For example, a virtual water flow model that examines how water-related climate hazards impact food security is supportive of an integrated DRR and CCA approach by offering a tool with the potential to positively influence early warning systems and long term resource planning (Adu et al., 2023).

Key Enablers

Conditions that enable integrated DRR and CCA strategy implementation observed in the Pacific consist of regional governance structure, donor support, cultural institutions, and some national mechanisms. At a regional level, organizations such as the Pacific Regional Environment Programme (SPREP), the South Pacific Commission (SPC), and the Pacific Climate Change Roundtable each play a role regarding facilitation and coordination of knowledge transfer, technical support, and harmonization of policy across borders (UNISDR & UNDP, 2012). Moreover, these large institutions provide crucial aid to smaller PICs to ensure capacity building and integrated programs regarding climate and disaster policy (UNISDR & UNDP, 2012). Despite this regional cooperation, implementation of any plan or program still requires financial backing. Donor engagement from groups like the United Nations Development Programme (UNDP) and AustraliaAid (AusAid) has provided the technical and financial resource aid needed while simultaneously encouraging recipient countries to solidify respective integration methods within national planning processes regardless of limited institutional capacity (McCommon et al., 2021; Hallwright et al., 2022). Another significant enabling condition derived from this region is social cohesion paired with strong cultural leadership. In many Pacific social settings, village chiefs and elders are greatly trusted figures at the community level of governance (Charan et al., 2016). This enables CCA and DRR integration through the establishment of communication lines that facilitate collective action for risk reduction and have also been used to spread early warning messages (McCommon et al., 2021). Lastly, research from the PIC Vanuatu demonstrated an example of national coordination through its National Advisory Board (NAB) as it successfully managed collaboration across sectors as well as vertical integration of CCA and DRR (Nalau et al, 2016). The NAB consists of a variety

of ministries, local stakeholders, and donor representation to provide a centralized structure for planning, information exchange, and evaluation initiatives (Hallwright, 2021).

Knowledge Gaps & Barriers

While integrated CCA and DRR plans in the Pacific are promising, the region is faced with its own set of constraints that inhibit the full implementation of development of integrated approaches. Several PICs lack comprehensive M&E frameworks designed to measure the effectiveness of integration, particularly at a local level (Soares et al., 2023). The absence of a metric to examine integration outcomes introduced a difficulty regarding assessment of progress, making the capacity to learn from successes or failures low (Soares et al., 2023). Furthermore, there is a disconnect between policy that is designed at a national level and how this policy is implemented at a community level (Gero et al., 2010). Misalignments have been demonstrated as a result of limited technical capacity, unclear mandates, or a lack of consideration for adaptation that is carried out on a local scale (Gero et al., 2010; McCommon et al., 2021). This can result in plans that are made with good intentions falling short of their goals. A communication mismatch regarding levels of governance bleeds into another knowledge gap derived from the Pacific. Although the significance of Indigenous knowledge is widely acknowledged in this region, it remains quite underused in national policy frameworks, training methods, and technical planning (Nalau et al., 2016). Catalyzing this problem, efforts made to incorporate this knowledge are often unrecognized due to being informal presentations which have limited strategic impact by extension (Charan et al., 2016). The final barrier to DRR and CCA integration revealed by this region is the limited access to climate data and tools. There is a lack of availability regarding real-time climate data, planning software, and modelling tools due to the remoteness of PIC communities (McCommon et al., 2021). Evidence based planning and local engagement for risk

management has been limited by this digital divide, therefore signifying a gap in climate data that serves as a barrier to CCA and DRR integration (McCommon et al., 2021).

Applicability to Canada

Integration strategies examined from the Pacific region offer valuable insights regarding climate and disaster related planning in Canada, particularly for Indigenous and isolated communities. The employment of traditional leadership structures such as chiefs, elders, women groups, and religious figures have demonstrated how institutions that are rooted in traditional culture can guide climate plans (Charan et al., 2016). This is applicable to Indigenous governance settings in Canada where there is strong cultural presence that allows for traditional processes and community decision making to integrate CCA and DRR. Another structure that can be adapted to Canada is the NAB from Vanuatu as it provided an example of how platforms that operate at the national level can coordinate efficiently with agencies and communities that function sub-nationally (Nalau et al., 2016). Similar approaches could improve intergovernmental coordination in Canada through support of integration planning between municipal, provincial, and federal governments. Lastly, the Pacific showed regional emphasis on localized and culturally appropriate integration strategies, demonstrative of the significance of locally tailored practices. This importance is applicable to DRR and CCA integration in Canada because it proposes the idea of collaborative resilience building, mindful of cultural customs, a strong bottom-up approach fit for Indigenous communities and other isolated regions in Canada.

Arab States

Efforts to integrate climate change adaptation (CCA) and disaster risk reduction (DRR) across the Arab States have progressed significantly in the past decade, although the level of

institutionalization and coordination remains varied. Across the region, policy convergence is most visible in national adaptation planning, regional water governance, and pilot programs for climate-resilient development. This region experiences compounding risks such as disaster risk, social vulnerability, and conflict. Fig X illustrates how several Arab countries face high levels of hazard exposure, vulnerability, and limited coping capacity.

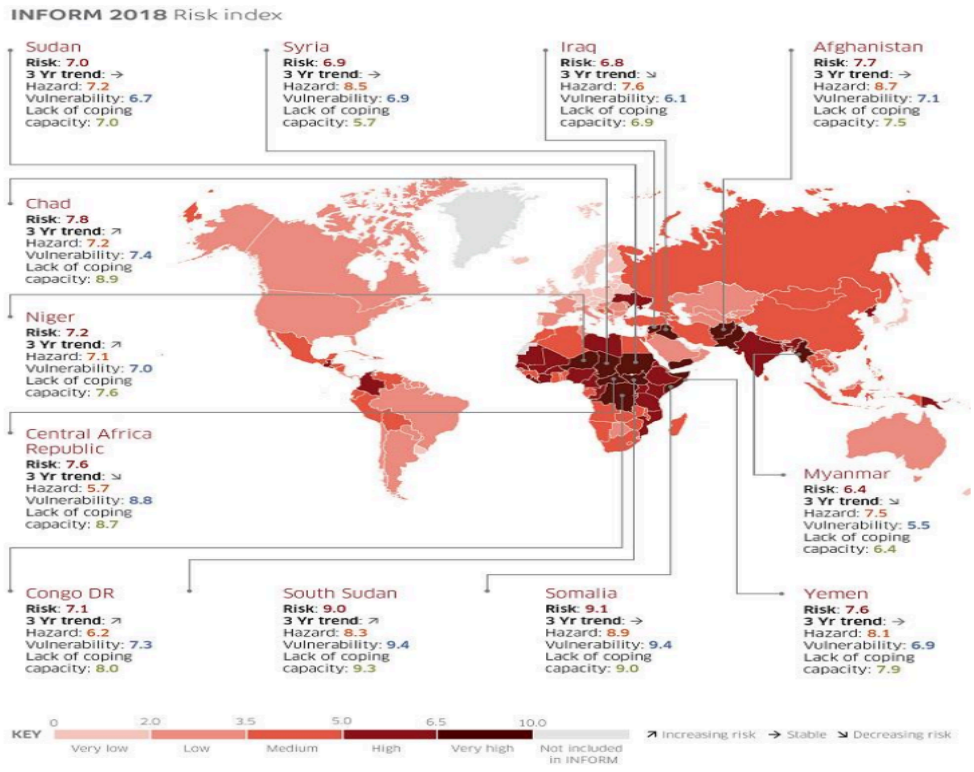


Figure 5: 12 countries with the highest overall risk of humanitarian crises and disaster (2018 INFORM Risk Index) (Adapted from Eltiny et al., 2019).

Integration Strategies

A number of Arab countries have embedded risk reduction into climate strategies by linking National Adaptation Plans (NAPs) and Nationally Determined Contributions (NDCs)

with disaster frameworks. For example, Jordan, Morocco, and Tunisia explicitly integrate DRR measures, such as early warning systems and drought preparedness, within their adaptation objectives (UNDP, 2018). These integrations often emphasize the interconnected risks of water scarcity, land degradation, and food security, which are intensified by both climate variability and disaster risks (ESCWA, 2017). The Arab Framework Action Plan on Climate Change (AFAPCC), launched by the League of Arab States in collaboration with ESCWA and UNDP, offers a strategic regional template for integration. It promotes a multi-sectoral and multi-scale approach, urging member states to align their DRR, CCA, and sustainable development agendas through shared risk mapping, integrated planning, and regional dialogue (UNDP, 2018; ESCWA, 2017). These efforts are further supported by the Arab Strategy for Disaster Risk Reduction (ASDRR), which frames DRR as a resilience mechanism for climate adaptation and environmental security. In the Gulf Cooperation Council (GCC), particularly in Qatar and the UAE, integration is pursued through national visions and climate strategies that embed resilience and disaster mitigation into infrastructure development and urban planning. These plans often draw from global frameworks like the Sendai Framework, yet adapt them to suit high-exposure urban zones, energy dependence, and transboundary resource challenges (Djoundourian, 2021). However, in conflict-affected or fragile contexts, such as Yemen, Sudan, and parts of Syria, integration is typically driven by humanitarian or donor-led programming. Projects funded by UN agencies and international development actors have begun to address both climate and disaster risks simultaneously, but these are not yet embedded in stable national systems (Peters & Peters, 2018). For instance, the World Bank's GCCA program has supported early warning system development in fragile zones, integrating risk education with agricultural and water

management policies (World Bank, 2013). In such cases, integration is reactive and project-based rather than systemic.

Key Enablers

Efforts to integrate CCA and DRR in the Arab States are strengthened by regional coordination frameworks, institutional reforms, and emerging finance mechanisms. These enabling conditions create pathways for aligning climate risk governance with national development goals, though their scope and implementation vary by context. One of the most critical enablers is regional governance architecture. The ASDRR 2030 and the AFAPCC encourage member states to embed climate resilience and multi-hazard planning into national policy frameworks, often referencing the Sendai Framework and the Paris Agreement (UNDRR,2021; ESCWA, 2019). These frameworks have been instrumental in driving coherence in national strategies and providing institutional templates for cross-sectoral coordination. ESCWA and the Arab Center for Climate Change Policies support integration through technical platforms such as RICCAR, which combines climate modeling with socioeconomic vulnerability mapping to guide policy responses. This has been used in countries like Jordan, Lebanon, and Morocco to inform risk-based investment planning and sectoral adaptation strategies (ESCWA,2017). At the national level, legal frameworks and inter-ministerial coordination are evolving. In Oman, climate adaptation and disaster preparedness are coordinated through the National Committee for Civil Defense, linking multiple ministries and local authorities (UNDRR,2021). Similarly, Lebanon's DRR platform integrates environment, health, education, and media sectors, supported by UNDP and the Lebanese Red Cross (ESCWA, 2017). Multiple-level innovation is an emerging strength. In Amman, Jordan, city authorities have incorporated climate risk into land-use planning and building design with donor and academic

support. However, Al-Nammari and Alzaghal (2015) emphasize that these efforts succeed where technical training and local autonomy are in place. This highlights the value of decentralization combined with institutional continuity.

Knowledge Gaps and Barriers

Despite promising frameworks and localized innovations, the Arab region faces persistent barriers to CCA and DRR integration. One of the most significant in institutional fragmentation, where responsibilities for climate and disaster risk governance are spread across different ministries with limited coordination (ESCWA, 2019; Djoundorian, 2021). In many countries, environmental ministries lead climate adaptation planning, while emergency management authorities oversee DRR, often without formal mechanisms for policy alignment (UNDP, 2018). Legal and regulatory gaps further hinder integration. Although some countries have updated sectoral strategies, few have passed legislation mandating cross-sectoral or inter-ministerial integration of climate and disaster policy (ESCWA, 2017). For example, Amman's urban resilience is often shaped by external donor projects rather than embedded in enforceable building codes or land-use laws (Al-Nammari & Alzaghal, 2015). Another challenge is low technical capacity and limited funding. Local governments often lack access to risk data, forecasting tools, or trained personnel to apply integrated planning methods (World Bank, 2013). Additionally, access to global climate finance mechanisms remains limited due to weak institutional readiness, especially in fragile contexts like Yemen or Libya (Al-Saihi & Luomi, 2019; Peters & Peters, 2018). Compounding these issues is the overreliance on externally driven projects, which tend to prioritize short-term outputs over institutionalization. Many pilot projects never translate into long-term programs due to the absence of national ownership, particularly in conflict-affected states (Peters & Peters, 2018).

Applicability to Canada

Though geographically and politically distinct, the Arab States offer several transferable lessons for Canadian DRR-CCA integration: The lack of integrated legal mandates in many Arab countries has highlighted the value of codifying CCA-DRR convergence in national laws. Canada could strengthen its own frameworks by requiring that all adaptation and emergency management plans explicitly address both climate and disaster risks (ESCWA, 2021; Djoundourian, 2021). Examples from Jordan and Sudan illustrate the benefits of participatory risk assessments and women-led disaster planning initiatives (UNDP, 2018; Peters & Peters, 2018). In remote and Indigenous communities, Canada could scale similar models that leverage local knowledge and social capital. Several Arab States have struggled to absorb climate finance due to poor institutional readiness. Canada's experience in facilitating subnational access to GCF or Adaptation Fund resources could be improved by creating streamlined, municipal-level pathways, drawing from regional coordination challenges faced in MENA (Al-Sarihi & Luomi, 2019; World Bank, 2013).

Europe

The European region is characterized by a well documented and diverse landscape with regards to the integration of CCA and DRR. This section of the scoping report is composed of information from 10 sources with a large focus on the European Union (EU) and its member states, as well as Balkan countries and other non-EU countries. Throughout Europe, there was significant attention drawn to institutional coherence, policy harmonization, and innovation, due to the influence of high policy capacity and mechanisms for strategic alignment that have yielded

both success stories and cautionary lessons from this region (World Bank, 2008; Bisaro et al., 2022).

Integration Strategies

A blended CCA and DRR approach from a European perspective has introduced several methods regarding an integrated implementation process that included the use of conceptual models and frameworks, policy implementation, as well as urban integration. Many studies from this region have conceptualized DRR and CCA as an interlinked subsystem falling under the umbrella term of sustainable development (Burns et al., 2017). This integrates DRR and CCA by grouping the two concepts together underneath a larger idea. For example, urban resilience study models have demonstrated integration through a systems thinking lens where CCA and DRR are not perceived as isolated phenomena, but rather as forces that interact with each other within a broader policy setting (Burns et al., 2017). In addition to this, simulations have been developed to facilitate stakeholder comprehension through a vivid illustration of climate disaster scenarios where stakeholders learn to react and support decision making concerning integration in urban settings (Booth et al., 2020). Aside from these more conceptual models, a defining characteristic of the European approach is the organization of DRR and CCA policies underneath practical strategic models and frameworks such as the EU Green Deal, the Sendai Framework, and Horizon 2020 (Mysiak et al., 2018). Initiatives such as those previously mentioned encourage policy harmonization across sectors and EU member states with some countries utilizing these programs to develop national roadmaps that form a distinct connection between integration and innovative research (Leone et al., 2020). The last integration strategy examined from Europe was urban level integration. Analysis of case studies at the municipal level have revealed how cities across Europe are facilitating DRR and CCA integration through urban practices such as climate

services, spatial planning, and risk assessment (Leone et al, 2021). As observed in the CLARITY project that took place in Naples, Italy, data visualization and multi-risk assessment methods were applied to inform urban planners and align CCA with DRR practices (Leone et al., 2021).

Key Enablers

Conditions that enable CCA and DRR integration across this region include strong governance, strategic alignment for policy, stakeholder engagement, and mechanisms dedicated to funding. Beginning with the strong governance structure associated with the EU, cross sectoral platforms have encouraged vertical and horizontal integration of DRR and CCA in many EU countries (Mysiak et al., 2018). Further enabling is observed through the coordination of national agencies coming together to conduct disaster planning by way of mandate, policy, and tool alignment (World Bank, 2008). Policy alignment in Europe at the national adaptation level often included DRR language and indicators (Bisaro et al., 2022). This policy coherence has supported integration across government levels over time (Leone at al., 2020). There is a sense of shared accountability given the EU-wide targets and protocols that are in place. Accountability can happen on many levels, examples of which include local and stakeholder levels. Community engagement strengthens implementation and credibility as seen in an Italian case study wherein municipal governments partnered with local organizations and energy representatives to develop bioenergy solutions that are capable of DRR and CCA goal integration (Cavicchi et al., 2017). Lastly, the EU has access to a variety of funding mechanisms that support integration in the region. Programs such as Horizon 2020 and other national resilience funds supported integration through generation of financial incentive and mandated innovation (Mysiak et al., 2018). These mechanisms have shown the ability to sustain long term alignment between integrated DRR and CCA priorities (Leone et al., 2020).

Knowledge Gaps & Barriers

Although taking strong sides in the use of integrated DRR and CCA approaches to climate resilience, the EU faces its own unique set of barriers similarly to the other regions. Despite investments made into climate services, many regions are still faced with challenges regarding standardization of data, risk sharing, and resilience data (Mysiak et al., 2018). Fragmented platforms and inconsistency related to indicators are responsible for limited regional integration (Islam et al., 2020). Policies conceived at the union level often promote integration however, frameworks at the local level could remain disconnected or in lack of resources which stands to further the regional knowledge gap (Bisaro et al, 2022). Continuing the regional barrier trend, non-EU and rural zones are challenged by additional barriers such as a lack of technical staff, limited funding, and absence of decision support tools given that they do not receive as much aid from EU initiatives (Bisaro et al., 2022). Lastly, there is little known from the European region about the long term outcomes regarding integration efforts (Islam et al., 2020). There is room for more research about how governance systems, political drivers, and institutional culture can mold integration success (Burns et al., 2017).

Applicability to Canada

Considering structural, demographic, and societal similarities that Canada shares with the European region as it relates to integrated DRR and CCA good practice, there are multiple takeaways that can be made. The first is that Canada could adopt a similar style to the EU regarding coordination mechanisms that bridge jurisdiction silos such as federal, provincial, and local organization (Mysiak et al., 2018). European examples have demonstrated the significance of committees that span across ministries along with a shared resilience framework (Leone et al., 2020). Canada can also learn from the CLARITY project as it offers a strong model for Canadian

cities. By integrating DRR and CCA into spatial planning initiatives through the use of digital tools and local data, cities like Naples have shown how climate risk can be addressed within infrastructure policy (Leone et al., 2021). This idea can be applicable to urban Canadian city settings such as Toronto or Vancouver. Furthermore, community led initiatives in rural Europe such as the bioenergy integration project in Italy have demonstrated how local knowledge, collaboration, and engagement can be used to support an integrated approach to resilience (Cavicchi et al., 2017). The success of local cooperation can be transferred to Canada to assist with planning in rural and Indigenous communities. Finally, European roadmapping efforts have showcased how research funding, pilot projects, and a shared set of indicators can support national guidance for DRR and CCA planning overtime (Leone et al., 2020). Similar tools or techniques could enhance coherence for Canadian adaptation strategies.

Americas & Caribbean

This region is characterized by a diverse array of socio-political systems, climatic zones, and exposure to both rapid-onset and slow-onset hazards, From the boreal landscapes of Canada to the tropical islands of the Caribbean and the drought-prone regions of Latin America, the region faces a broad spectrum of climate risks that necessitate integrated approaches to resilience.

Integration Strategies

In Canada, integration of CCA and DRR is anchored at the national level through frameworks such as *Government of Canada Adaptation Action Plan* and the Building a *Resilient Canada* report. These documents emphasize holistic policy alignment, multisectoral planning, and Indigenous-cenetered governance models (Council of Canada Academies, 2022; ECCC,

2022). Regionally in Latin America and the Caribbean (LAC), integration strategies have emerged through institutional cooperation and community-based initiatives. The Caribbean Disaster Emergency Management Agency (CDEMA) promotes coherence across national adaptation plans (NAPs) and DRR strategies, often embedding climate risk into community resilience programs (Anderson, 2012). For example, Dominica's integration of the Sustainable Development Goals and the Paris Agreement Commitments into DRR-CCA legislation stands as a replicable best practice (IFRC, 2020).In Mexico, subnational strategies in Tabasco illustrate how municipal climate laws can be harmonized with flood governance to reduce risk via institutional reforms and participatory planning (Rivera, 2016).Similarly, Chile's Aranicania Region has attempted bottom-up resilience building by aligning international goals with community priorities, though effectiveness is hindered by governance fragmentation and insufficient resource allocation (Banwell, et al., 2020). Additionally, El Salvador and Colombia have begun merging DRR and CCA by coordinating national climate policies with civil protection agencies, though jurisdictional overlap remains a challenge (Lucatello, 2021).
At the theoretical level, integration frameworks grounded in systems theory encourage institutions to view DRR and CCA as interdependent functions of sustainable development, calling for dynamic planning, rather than static policy (Burns et al., 2017; Birkmann & Vin Teichman, 2010).

Key Enablers

Several enabling factors are common across the region. In Canada, key enabler is cross sectoral consultation embedded within federal planning frameworks, as well as the federal-provincial collaboration model that fosters vertical coherence (ECCC, 2022).

Additionally, Indigenous governance and local knowledge systems are increasingly positioned as foundational to policy implementation (Council of Canadian Academies, 2022).

In the Caribbean, regional bodies such as CDEMA and institutional platforms facilitate policy harmonization across national borders (Anderson, 2012). In Latin America, especially under the Sendai Framework, multi-stakeholder engagement and integration of non-governmental actors have proven crucial for implementation success (Cabra;-Ramirez et al., 2025).

Legal recognition of CCA and DRR linkages at subnational levels, as seen in Tabasco and Mexico, enables better planning accountability and community participation (Rivera, 2016).

Multilevel governance structures and participatory mechanisms are also flagged as critical enablers throughout the literature (Birkmann & Von Teichman, 2010). In SIDS, such as those in the Caribbean, resilience is strengthened through multi-sector, multi-actor programs tailored to local vulnerabilities, addressing diverse risks from sea-level rise to ecosystem degradation (Robinson, 2017).

Knowledge Gaps and Barriers

Common barriers to DRR-CCA integration in the Americas include institutional fragmentation, inconsistent funding, and coordination challenges across jurisdictions. In Canada, despite progressive national strategies, multi-jurisdictional complexity can hinder coherent policy delivery at the provincial or local levels (Council of Canadian Academies, 2022). The absence of real-time risk information systems further limits localized decision-making (ECCC, 2022). While community engagement is improving, Indigenous knowledge iftern remains underutilized or excluded due to historical mistrust and systemic inequalities (CCA, 2022).

In the Caribbean, many states face constraints from political instability and donor dependency, leading to short-lived integration efforts that fail to become institutionalized (Anderson, 2012).

Meanwhile, Latin America struggles with limited financial resources and fragmented stakeholder responsibilities, which disrupt programmatic continuity (Cabral-Ramirez et al., 2025).
On a conceptual level, normative and knowledge silos between climate and disaster communities persist, obstructing unified risk governance (Birkmann & von Teichman, 2010; Burns et al., 2017).

Applicability to Canada

Lessons from across the Americas reinforce Canada's trajectory toward multi-level, inclusive resilience governance. The Caribbean's experience with regional coordination through CDEMA highlights the benefits of supranational institutions that support policy alignment across jurisdictions, paralleling Canada's need for strengthened federal-provincial integration(Anderson, 2012). Mexico's example of municipal climate legislation informing flood risk strategies suggest the value of embedding CCA-DRR coherence at the subnational level, particularly in climate-exposed provinces (Rivera, 2016). Likewise, Latin America's focus on co-production of knowledge and inclusion of marginalized groups offers an equity-informed lens that resonates with indigenous governance principles in Canada (Cabral-Ramirez et al., 2025). The systems-based frameworks proposed in theoretical literature suggests that Canada's risk governance could benefit from interdisciplinary planning tools and unified metrics for adaptation and disaster outcomes (Burns et al., 2017; Birkmann & von Teichman, 2010).

Global Trends

A synthesis of findings across six global regions reveals several core trends shaping the evolving landscape of integrated DRR and CCA. While regional contexts vary widely, consistent

global patterns have emerged that demonstrate both progress and persistent challenges in bridging the two domains.

1. **Integrated Approaches Replacing Siloed Planning**

   Historically, DRR and CCA were treated as separate technical or policy domains. However, this review found a global shift toward integrated frameworks that consolidate risk governance. In Vietnam, disaster risk and adaptation are fused within national development plans, while Mexico's municipal laws link flood governance to climate legislation. Similarly, Dominica's Climate Resilience Act weaves together DRR and CCA under a unified legal umbrella. These examples reflect a broader move toward "policy convergence", where integration is formalized through strategic planning and legislative reform.

2. **Nature-Based Solutions (NbS) Gaining Momentum**

   Nature-based solutions (NbS) are gaining traction as integrative tools that deliver both ecological and social co-benefits. In Rwanda, Namibia, and Fiji, communities use traditional knowledge to implement reforestation, watershed protection, and coastal restoration for both risk reduction and climate adaptation. These ecosystem-based interventions reflect a growing recognition of NbS as operational pathways that align sustainable development with climate resilience.

3. **Governance Alignment from National to Local Levels**

   Effective integration is closely linked to vertical governance coherence. In Kenya, Benin, and South Africa, legislative mandates and decentralized decision-making have enabled policy alignment between national frameworks and local implementation. Canada's federal;-provincial planning model and the Pacific's Joint National Plans (JNAPs) further

illustrate the importance of cross-tier collaboration, Nevertheless, many countries still grapple with disconnects between national policies and local capacities, especially in fragile or resource-constrained settings.

4. **Community-Led and Indigenous Models Gaining Global Recognition**

   Across all regions, bottom-up approaches, particularly those led by women, Indigenous peoples, and local knowledge holders, are increasingly cited as critical to successful integration. Nepal's participatory rural assessments, Fiji's women-led village zoning, and Kenya's Indigenous forecasting systems are just a few examples of how community action enhances cultural relevance, equity, and sustainability. These approaches support both operational effectiveness and social legitimacy.

5. **Technology and Data Systems Enhancing Integration**

   Digital tools, predictive analytics, and climate information systems are increasingly central to risk governance. Multi hazard early warning systems (EWS) such as AMHEWAS in Africa and GIS-based urban planning in Italy's CLARITY project represent efforts to fuse climate forecasting, infrastructure planning, and public engagement. However, digital divide remains, especially in Small Island Developing States (SIDS) and remote areas where data access, broadband coverage, and modeling capacity are limited.

6. **Equity Remains Uneven Across Regions and Scales**

   Despite rhetorical commitments to equity, implementation is often short. Many adaptation and risk governance efforts still lack meaningful inclusion of marginalized groups, particularly in Canada, South Africa, and parts of the Arab States. Indigenous knowledge remains underutilized in national frameworks, and gender-sensitive planning,

while present in some cases (e.g Nepal, Jordan), is inconsistently applied. This inequity threatens the long-term viability of integrated strategies and underscores the need for systemic inclusion.

7. **Funding and Capacity as Persistent Constraints**

   In all six regions, funding bottlenecks and capacity deficits are key impediments. Integration remains donor-driver in many low-income contexts (e.g., Malawi. Yemen), while richer countries like Canada still face challenges aligning climate and disaster funding streams. The lack of institutionalized, long-term financing, especially at subnational levels, limits implementation, monitoring, and scalability.

8. **Fragile and Conflict-Affected Settings Remain Underserved**

   The Arab region and parts of Sub-Saharan Africa illustrate that integration in fragile settings is often project-based and externally led. In Yemen, Sudan, and Nigeria, risk governance efforts lack embedded institutional frameworks. Without sustained international support and conflict-sensitive design, integration remains unsustainable in these high-risk contexts.

Conclusion

This Scoping review provides a nuanced, comparative analysis of DRR and CCA integration across six global regions. It demonstrates that while integration is increasingly embedded in theory and policy, its execution remains uneven due to institutional, technical, and socio-political complexities. Success is most evident where integration is legally codified, supported by multi-level governance structures, and co-produced with local actors. From Vietnam's national alignment frameworks to Fiji's community zoning models and Kenya's decentralized planning, integration works best when it is both top-down and bottom-up.

Canada can draw valuable lessons from these experiences. Its national frameworks advanced, yet the operationalization of DRR-CCA coherence remains inconsistent across provinces and territories. Indigenous communities, in particular, would benefit from models that embed traditional knowledge and localized governance into resilience planning, an approach proven successful in the Pacific, Asia, and Africa. Equally important is the adoption of robust monitoring systems, inclusive planning processes, and stable funding channels. Global trends show that integration cannot rely on short-term projects or parallel programming. Instead, a structural shift is needed, toward legally embedded, equity focused, and community led approaches that reflect the interconnected nature of today's climate and disaster risks. In this context, integration is not simply a technical fix but a governance transformation, one that calls for systemic coordination, long-term vision, and deep social inclusion. As Canada and the global community seek to navigate compounding crises, the integrated governance of CCA and DRR stands out not only as a best practice, but as an imperative.

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