Submission by the Coalition for Disaster Resilient Infrastructure (CDRI)

On activities in relation to the Sharm el-Sheikh joint work on implementation of climate action on agriculture and food security (FCCC/SBI/2025/L.2, para. 16)

1. Introduction

Escalating climate and disaster events are placing global food systems under mounting pressure. Disasters undermine food security across all dimensions: availability, access, and stability. They disproportionately affect developing nations and smallholder farmers. Droughts are the leading cause of agricultural production loss globally, followed by floods, storms, and pest outbreaks. Critically, disaster impacts extend well beyond fields and harvests: damage to irrigation networks, rural roads, ports, and energy and water infrastructure compounds losses by disrupting agribusiness productivity and severing the supply chains that connect producers to markets and households, driving food shortages and price volatility.

The Sharm el-Sheikh Joint Work Programme on Agriculture in the UNFCCC process recognizes that food security and agriculture lie at the heart of adaptation, resilience, and sustainable development. Infrastructure systems, including irrigation, rural transport, energy, water, logistics, and digital networks, form the enabling backbone of the agri-food systems. Yet infrastructure resilience remains insufficiently integrated into agricultural adaptation planning.

CDRI's Global Infrastructure Resilience report demonstrates that 75 percent of infrastructure needed by 2050 is yet to be built[1] which presents a rare window of opportunity to embed agri-food infrastructure resilience before the next wave of investments is locked in. Infrastructure resilience of the agri-food systems could generate 7-12x returns, while adding 5-15% upfront costs.

This submission highlights how DRI serves as a critical lever for achieving the objectives of the Sharm el-Sheikh joint work, specifically by safeguarding the infrastructure that underpins global agriculture and food security.

2. How DRI supports Sharm el-Sheikh joint work on implementation of climate action on agriculture and food security

The Sharm el-Sheikh Joint Work emphasizes the implementation of climate action through systemic and holistic approaches. Disaster resilient infrastructure (DRI) supports the joint work by ensuring the continuity of essential services, such as power, water, and transport, that are indispensable for agricultural productivity and the stability of food systems. DRI operationalizes the systems-based approach called for under the Joint Work by addressing cross-sector interdependencies between agriculture, water, energy, transport, and finance.

CDRI's resilience framework focuses on three essential capacities: the ability of systems to absorb shocks, respond during crises, and recover rapidly. In the context of the Joint Work, this means protecting irrigation networks from floods, maintaining rural roads for market access,

[1] Coalition for Disaster Resilient Infrastructure (CDRI). (2025). Global Infrastructure Resilience (GIR) Report, Second Edition. https://cdri.world/resilience-dividend/global-infrastructure-resilience-report-second-edition/

and ensuring energy reliability for food processing. By identifying critical assets and quantifying the resilience dividend[2], DRI enables parties to transition from aspirational policy to measurable and operational integration of the Sharm el-Sheikh agenda. This systemic approach reduces cascading failures across sectors, preventing local hazard events from escalating into regional food crises[3].

2.1. Resilient Agriculture

Modern Agriculture is highly dependent on infrastructure resilience, yet this sector faces severe risks from climate extremes. Irrigation infrastructure is a primary pillar of global food output, contributing over 40 percent of total production despite covering only 20 percent of cultivated land[1]. CDRI's Global Infrastructure Risk Model and Resilience Index (GIRI)[4] identifies irrigation systems in South and Southeast Asia, Central America, and Eastern Africa as being among the most vulnerable to floods and cyclones. For example, in Vietnam and Bangladesh, future climate scenarios project a 50 percent intensification of flood-related annual average losses (AAL) for irrigation assets[1].

To build Resilient Agriculture, parties must adopt Nature-based Solutions (NbS) and hybrid engineering. NbS, such as mangrove restoration in coastal farming zones or living snow fences[5] in mountain regions, provide cost-effective buffers that protect agricultural land and infrastructure from erosion and storm surges. In mountainous terrain, where landslides alone cause $26 billion in annual global losses[6], indigenous techniques like ancestral stone terracing in Peru have proven vital for stabilizing slopes and managing water flows[7].

Furthermore, decentralized infrastructure, such as solar mini-grids and micro-hydropower, enhances the autonomy of rural farming communities, ensuring they maintain access to energy for water pumping even when national grids fail. Case studies, such as the Beghamak watershed project in Afghanistan[8], demonstrate that combining community-driven reforestation with engineering measures can effectively mitigate avalanche and flood risks to vital agricultural land. Transitioning to these resilient models is essential to protect the livelihoods of smallholder farmers and ensure that agricultural systems can withstand intensified climate impacts.

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[2] The resilience dividend is defined as the total value derived from investing in Disaster Resilient Infrastructure over its lifecycle, encompassing reduced future asset loss and damage, avoided service disruptions, and wider social, economic, and environmental co-benefits. (CDRI, 2025)

[3] CDRI. (2025). Action Agenda: Integrating Disaster Resilient Infrastructure in National Adaptation Strategies. https://driconnect.cdri.world/resources/cdri-publications/action-agenda

[4] CDRI. (2023). Global Risk Model and Resilience Index. https://giri.unepgrid.ch/

[5] Minnesota Department of Transportation. (n.d.). Living snow fences. https://www.dot.state.mn.us/environment/livingsnowfence/

[6] UNDRR. (2025). Global Assessment Report on Disaster Risk Reduction 2025.
Resilience Pays: Financing and investing for our future. https://www.un-ilibrary.org/content/books/9789211576740

[7] CDRI. (2025). Shaping Resilience in Mountains: The Case for Disaster Resilient Infrastructure. https://cdri.world/shaping-resilience-in-mountains/

[8] CDRI. (2025). Shaping Resilience in Mountains: The Case for Disaster Resilient Infrastructure. https://cdri.world/shaping-resilience-in-mountains/

Example of Scalable and Implementation Country driven Pilots.

Feasibility Study for Agri-Voltaic Energy Security in India

Research on agrivoltaic systems (co-location of solar photovoltaic panels above agricultural fields) conducted in the Nagpur Metropolitan Region of India, an area receiving over 300 sunny days per year, demonstrates that agrivoltaics resolves land-use competition between solar farms and cropland while providing decentralized energy for irrigation. Analysis of six major crops in the region found that shade-tolerant Kharif varieties, including rice and soybean, showed high compatibility with agrivoltaic configurations, and that non-compact panel arrangements can maintain full crop yield efficiency while still generating solar energy. Importantly, decentralized agrivoltaic systems connected to microgrids ensure consistent energy access for water pumping and food processing even during grid failures caused by extreme weather, directly enhancing community resilience against cascading climate shocks. The research further identified that communities prefer locally generated power directed towards cold storage and agribusiness uses, which reduces post-harvest losses and strengthens supply chain stability. Parties should consider agrivoltaics as a priority resilient infrastructure model that strengthens the food–energy nexus and diversifies income for smallholder farming communities in solar-rich regions.

Read more: https://cdri.world/fellowship/feasibility-study-for-agri-voltaic-energy-security-in-india/

2.2. Food Security

Food security is closely linked to the resilience of infrastructure, including irrigation, farm-to-market transportation, energy for processing, and communication[1]. Infrastructure failures often result in indirect economic impacts that are, on average, seven times larger than the direct damage to the physical assets themselves[1]. When roads and ports fail due to disasters, fresh produce cannot reach markets, leading to supply chain disruptions, lost income for producers, and higher prices for consumers.

For Small Island Developing States (SIDS), the risk is particularly acute, as many nations depend on a single port or airport as a lifeline for food imports[9]. A failure in these critical nodes can lead to immediate and widespread food shortages. To mitigate these risks, parties should invest in multi-modal transport redundancy, resilient logistics hubs and Early Warning Systems (EWS) for critical infrastructure. EWS allows operators to prepare for disruptions and activate contingency plans, such as shipping products ahead of predicted floods.

Ensuring the resilience of energy and water utilities is equally vital for food processing and storage. Power outages can cripple cold chains, leading to massive food spoilage and health risks[1]. By embedding resilience into the governance of these "lifeline" sectors, parties can prevent a single point of failure from cascading into a national food security crisis[10].

[9] CDRI (2023). Global Infrastructure Resilience: Capturing the Resilience Dividend. https://cdri.world/resilience-dividend/global-infrastructure-resilience-report-first-edition/

[10] CDRI. (2025). Action Agenda: Integrating Disaster Resilient Infrastructure in National Adaptation Strategies. https://driconnect.cdri.world/resources/cdri-publications/action-agenda

Example of Scalable and Implementable Country Driven Pilot. Modelling Impacts on Food Security from Debris Flows in India

In mountainous regions, geophysical hazards such as debris flows pose a particularly severe threat to food supply chains through road network disruptions. CDRI Fellowship research in the Sikkim Himalayas (India), which modelled the cascading impact of debris flow-induced road network failures on the Public Distribution System (PDS), found that approximately 1.2 lakh people live in medium to high isolation zones, with nearly 30,000 households dependent solely on Fair Price Shops for staple food supplies. Using a Composite Road Disruption Index validated at over 92 per cent field accuracy, the study identified that 38 per cent of road links in the region are highly susceptible to debris flow disruption, with zero route redundancy on key supply corridors. Scenario modelling demonstrated that disruptions exceeding 60 days can place over 28 per cent of the population at risk of delayed or interrupted food supply, while food costs in private markets surge by 200–500 per cent during road closures. The research demonstrated that strategic pre-positioning of decentralized food storage godowns in high-risk, underserved areas can reduce average food delivery times by 88 per cent and extend service coverage to an additional 120,000 people. These findings underscore the urgent need for parties to integrate geospatial hazard modelling and road network vulnerability assessments into food security planning frameworks, enabling the pre-positioning of emergency food stocks, development of route redundancy, and deployment of real-time Web-GIS platforms for coordinated supply chain management during and after disaster events.

Read more: https://cdri.world/fellowship/modeling-impacts-on-food-security-from-debris-flows-in-india/

3. Recommendations to parties

1. **Mainstream Disaster Resilient Infrastructure in NAPs and NDCs:** CDRI can support Parties in elevating infrastructure resilience from a technical annex to a central pillar of their National Adaptation Plans through technical guidance and peer exchange, specifically identifying and prioritizing assets critical to the agricultural value chain[10].
2. **Utilize Standardized Risk Metrics:** Parties should adopt probabilistic risk models like GIRI[11] to quantify contingent liabilities in the agricultural sector, providing the evidence base needed to attract private investment and de-risk projects.
3. **Deploy Layered Finance Mechanisms:** To ensure rapid recovery of food systems, parties should implement diversified financial instruments, including parametric insurance and catastrophe bonds, to provide immediate liquidity after disasters strike agricultural infrastructure and other infrastructure systems critical for food security.
4. **Strengthen Inter-ministerial Coordination:** Establish national platforms that convene finance, planning, and agricultural ministries to manage the interdependencies of food security and prevent cascading risks from infrastructure failures[10].
5. **Scale Agrivoltaic Systems as Dual-Use Resilient Infrastructure:** Parties in solar-rich regions should consider integrating agrivoltaic systems into national adaptation strategies and rural electrification programmes. Agrivoltaics directly address the food-energy nexus by providing decentralized energy for irrigation, reducing heat stress in

[11] CDRI. (2023). Global Risk Model and Resilience Index. https://giri.unepgrid.ch/

crops through shading, and diversifying farmer incomes, while resolving land-use competition between solar farms and agriculture.

6. **Pre-position Emergency Food Storage and Integrate Geospatial Hazard Modeling into Food Security Planning:** In hazard-prone mountainous and isolated regions, parties should deploy road network vulnerability assessments and debris flow susceptibility models to identify high-risk supply chain chokepoints. Parties should invest in Web-GIS platforms that integrate hazard forecasting with Public Distribution System data to enable real-time supply chain monitoring and proactive emergency response planning before disasters strike.

How CDRI Supports the Joint Work

CDRI offers:

1. Global Infrastructure Risk analytics (GIRI)

2. Technical advisory for resilient infrastructure

3. Capacity building & fellowship programmes

4. South–South knowledge exchange

5. Action Agenda on policy integration guidance for NAPs/NDCs

6. Support for SIDS & mountainous countries

4. Conclusion

Resilient infrastructure is the backbone of adaptation, the guarantor of development gains, and the foundation of a climate-secure food future. The Sharm el-Sheikh Joint Work provides a vital platform for this transformation. Parties must recognize that by safeguarding the roads, power grids, and irrigation systems that sustain agriculture, we protect the most marginalized communities who bear the brunt of climate shocks.

5. Request to Parties to the UNFCCC and the UNFCCC Secretariat

CDRI wishes to confirm its availability to provide technical expertise that would support Parties in matters related to implementation of climate action on agriculture and food security. CDRI remains committed to supporting parties by providing the data, technologies, and governance frameworks necessary to capture the resilience dividend.

Submitted by: Coalition for Disaster Resilient Infrastructure (CDRI)

CDRI is a global coalition dedicated to enhancing the resilience of infrastructure systems to climate and disaster risks. With 65 Members, it includes national governments, international bodies, and businesses collaborating to exchange knowledge, drive research, and invest in disaster resilient infrastructure.

To learn more about CDRI, visit https://cdri.world/

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Date: 8 March 2026