

CREST Chronicle

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In focus

COASTAL RESILIENCE

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Reimagining Coastal Resilience in a Multi-Hazard World

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Dr. Sanjay K. Srivastava is a CUNY CREST affiliate and an Adjunct Research Professor at the UNU-Hub (R-SIRUS) at the City College of New York and the S. Radhakrishnan Chair Professor at the National Institute of Advanced Studies, India.

With extensive experience across international organizations and space agencies, he has been a leading voice in advancing disaster risk reduction through the integration of science, policy, and technology. From 2014 to July 2025, he served as Chief of Disaster Risk Reduction at the United Nations Economic and Social Commission for Asia and the Pacific, where he led regional efforts to strengthen resilience across Asia and the Pacific.

His earlier roles include Regional Adviser at UNESCAP, Head of the SAARC Disaster Management Centre, and Deputy Project Director at the Indian Space Research Organisation, where he contributed to the use of space-based technologies for disaster management. Dr. Srivastava has authored over 150 publications and served as lead author of major regional assessments, including the Asia-Pacific Disaster Report and the State of the Climate in Asia and the Southwest Pacific. He holds a PhD in Remote Sensing and an Executive Certificate in Digital Transformation from the University of California, Berkeley (2023).

Coastal zones across the Indian Ocean and wider Asia-Pacific are at the frontline of a rapidly evolving risk landscape. These regions, long defined by their economic vitality and ecological richness, are increasingly exposed to multi-hazard threats arising from the intersection of geophysical processes and climate change. Dr. Srivastava works at the intersection of science, policy, and global risk, where coastal resilience is no longer a distant concern but an immediate and evolving challenge across the region.

Coastal risk is no longer episodic or singular. It is systemic. Earthquakes beneath the ocean floor can trigger tsunamis that traverse national boundaries, while intensifying cyclones interact with sea-level rise and extreme rainfall to produce compound flooding. Rapid urban expansion into low-lying coastal zones further amplifies exposure.

This convergence of hazards is generating cascading and compounding risks, where impacts propagate across interconnected systems — energy, water, transport, health, and livelihoods — creating disproportionate and nonlinear consequences.

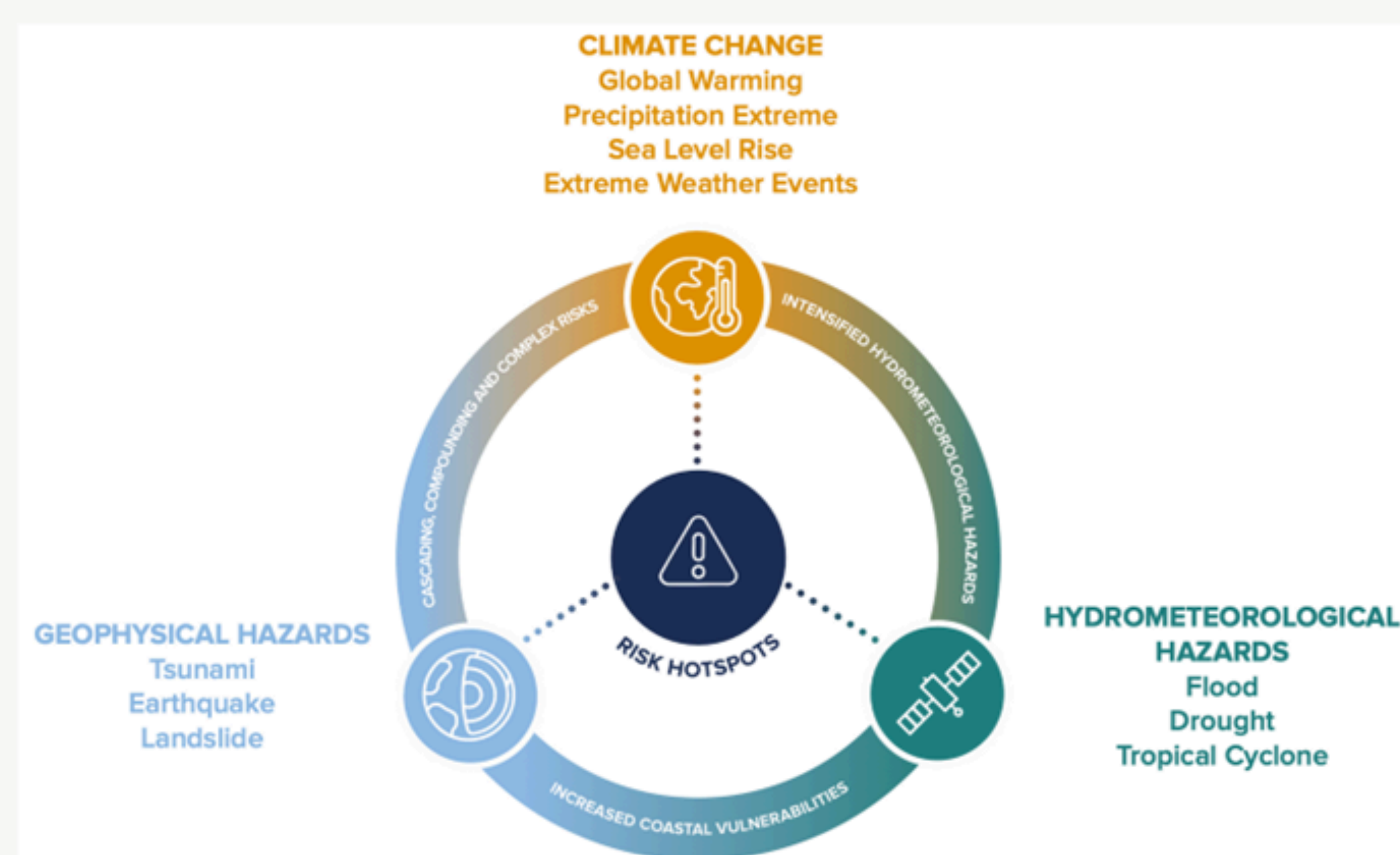


Image: A multi-hazard context of coastal risk: Cascading, compounding, and complex risk

Coastal cities are growing rapidly, often without adequate planning. Informal settlements are expanding into flood-prone and low-lying areas, driven by the need for jobs and housing. For example, coastal cities in the Indian Ocean basin are expanding into high-risk zones exposed to tsunamis, earthquakes, flooding, and cyclones. Unplanned growth is also leading to informal settlements in vulnerable areas, while 2 million residents in coastal cities may face displacement by 2030 due to sea-level rise and storm surges. By 2030, more than half the region's population will be concentrated in a small number of high-risk cities. For many, living near the coast is not a choice—it is a necessity. But it also means living with constant exposure to risk.

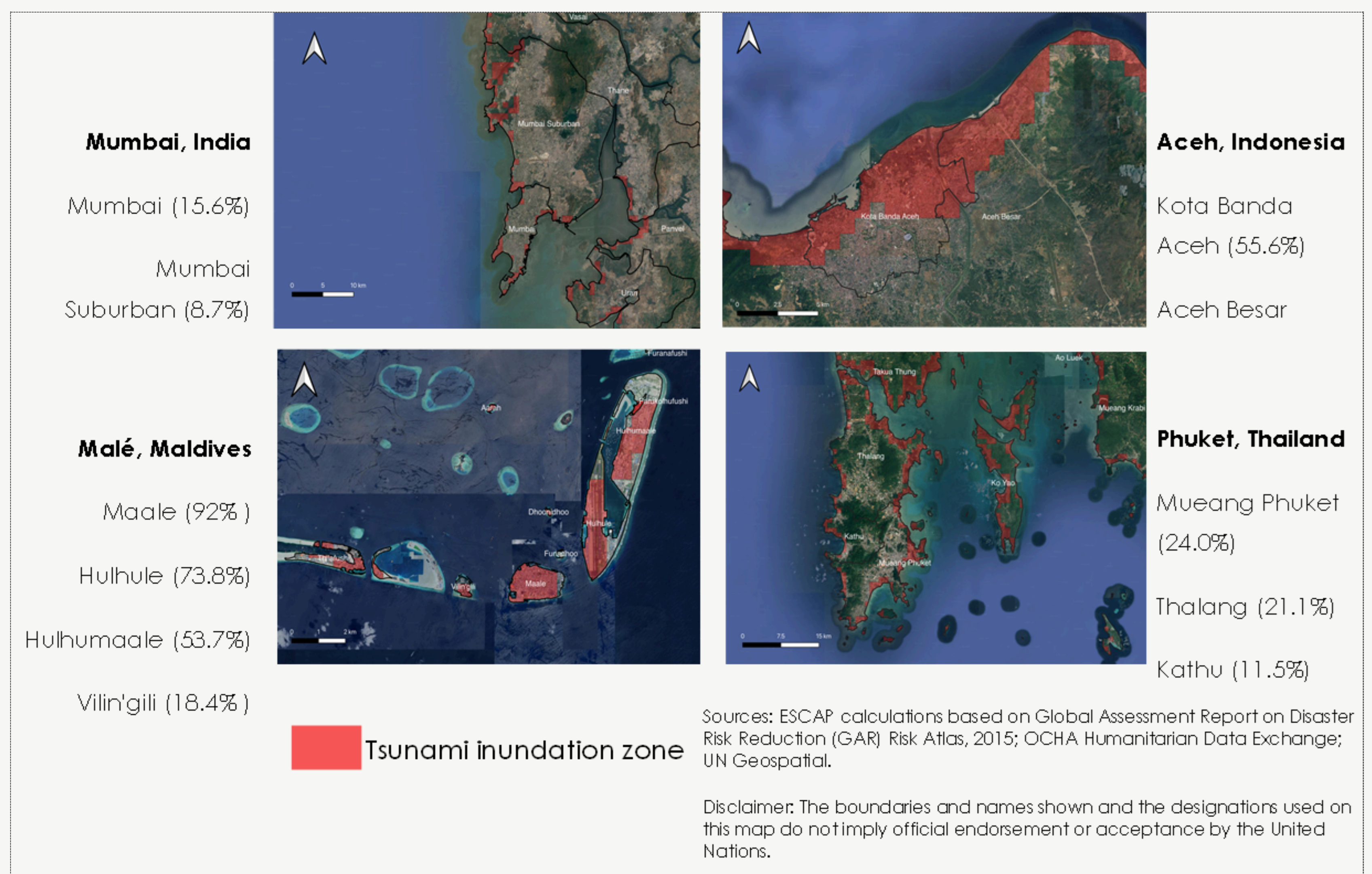
Tsunamis, cyclones, and ocean systems connect countries across the region. This makes cooperation essential. International cooperation helps countries share data, strengthen early warning systems, and respond collectively.

Early warning systems have improved significantly. But the challenge is no longer just issuing warnings—it is ensuring they lead to timely and effective action. Advances in science and technology are helping bridge this gap; for example, satellite data provides real-time monitoring. AI enables prediction of impacts, not just hazards; digital tools, including digital twins, simulate how cities respond to disasters. This shift—from predicting events to understanding impacts—is transforming how decisions are made.

“It is important to remember that we all share the same wave.
Hazards do not respect national boundaries.”

Sanjay K. Srivastava

Image: Cities at risk: urban vulnerabilities in the Indian Ocean coasts



Rethinking Resilience

Coastal resilience is no longer just about building stronger infrastructure. It is about living with risk in smarter ways, which requires integrating science, technology, and local knowledge; protecting and restoring natural ecosystems; designing inclusive systems that reach the most vulnerable and strengthening cooperation across borders. Ultimately, resilience is about moving from reacting to disasters toward anticipating and preparing for them. The coastlines of Asia-Pacific are on the frontline of a changing climate and evolving risks. Yet they are also spaces of innovation and opportunity.

In Conversation with Sanjay Kumar Srivastava

What is your research focus in coastal resilience?

My research focuses on multi-hazard coastal risk assessment, early warning systems, and anticipatory governance in the Indian Ocean and Southwest Pacific. It examines how geophysical hazards—such as earthquakes and tsunamis—interact with climate risks like cyclones, storm surges, and sea-level rise to create cascading impacts.

The key challenge is moving from siloed hazard analysis to integrated, systems-based risk understanding, and translating science into operational, decision-ready tools, particularly in low-capacity countries.

Which regions are central to your work, and why are they vulnerable?

My work centers on the Indian Ocean and Southwest Pacific, among the most hazard-exposed coastal regions globally. Their vulnerability stems from long coastlines, dense populations, critical infrastructure in high-risk zones, socio-economic constraints, and environmental degradation. Together, these factors create high exposure, high vulnerability, and intensifying multi-hazard risk.

How can research inform real-world coastal resilience strategies?

My work bridges science and policy by translating risk knowledge into operational frameworks. Contributions to regional platforms and flagship reports have supported evidence-based policymaking and the development of coastal resilience strategies across the Asia-Pacific region.

How have international collaborations shaped your work?

Engagement with international institutions has strengthened my work in impact-based forecasting and risk analytics. Adopting global best practices has supported the development of multi-hazard modeling frameworks and contributed to the implementation of initiatives like Early Warnings for All.

Collaborations with organizations such as the Pacific Disaster Center have been particularly influential in shaping my approach to impact-based forecasting.

What role do emerging technologies play in your work?

Emerging technologies are central to advancing coastal resilience. Earth observation enables real-time monitoring, AI and GeoAI support predictive analytics, and digital twins allow simulation of coastal systems. Together, these tools shift the focus from hazard prediction to impact intelligence, enabling more anticipatory and informed decision-making.

“The shift we need is from predicting hazards to understanding their impacts—only then can we enable truly anticipatory and effective resilience.”

Sanjay K. Srivastava

What are the biggest gaps in current resilience efforts?

Key gaps lie in integrated multi-hazard risk understanding, actionable risk intelligence, and institutional capacity. Despite advances in science, translating data into decision-ready insights remains limited—especially in low-capacity settings.

Strengthening the link between science, governance, and finance is essential for scaling resilience.

What role do collaborations like UNU-Hub (R-SIRUS) and CREST play?

Institutional collaborations such as CREST and the UNU Hub (R-SIRUS) play a critical role in bridging science, policy, and practice, particularly in developing country contexts. They provide scalable platforms to address knowledge and capacity gaps while strengthening the science-policy interface in support of resilience-focused Sustainable Development Goals.

These partnerships enable the co-production of knowledge aligned with policy needs, support capacity development, and foster regional learning across high-risk geographies.

My engagement with the CREST Institute has focused on advancing the shift from hazard and risk assessment to impact-based forecasting and anticipatory action. In cities like Mumbai, this means understanding how hazards translate into disruptions to infrastructure, services, and livelihoods—helping inform more targeted resilience strategies.

Ultimately, such collaborations are essential for moving toward integrated, solution-oriented approaches that can be implemented at scale.

What are your priorities moving forward?

Future priorities include leveraging advances in Earth observation for real-time monitoring, AI and machine learning for predictive risk analytics, and digital twin technologies to simulate coastal systems and test policy scenarios. Integrated data platforms that link hazard, exposure, and vulnerability will also be key.

At the same time, technological innovation must be complemented by stronger regional cooperation for transboundary early warning systems, integration of resilience into infrastructure planning, and inclusive approaches that ensure vulnerable populations benefit from these advances.

The goal is to build scalable, interoperable, and people-centered resilience systems that support both risk reduction and sustainable development.