Progress in Landslide Research and Technology

A Summary of Volume 3, Issue 1, 2024

The Aratozawa landslide, Japan. Triggered by the Iwate-Miyagi Inland Earthquake, its volume is estimated at 67 million m^3.
The landslide-induced tsunami in the Aratozawa dam reservoir reached 9 meters.

A Global Challenge Demanding a Collaborative Response

"Transforming existing scientific evidence into actionable knowledge and insights, informing policymaking, and steering action toward desired outcomes."

- Motoko Kotani, Foreword

The international community has committed to reducing disaster risk through a series of landmark agreements. This research directly supports:

- **The Sendai Framework for Disaster Risk Reduction (2015-2030):** A global blueprint for managing disaster risk.
- **The 2030 Agenda for Sustainable Development Goals (SDGs):** Specifically SDG 11: Make cities and human settlements inclusive, safe, resilient, and sustainable.
- **The Paris Climate Agreement:** Recognizing the link between climate change and the increasing frequency of geological hazards.

The International Consortium on Landslides: Uniting Global Expertise

At the forefront of this global effort is the **International Consortium on Landslides (ICL)**, a global non-governmental organization.

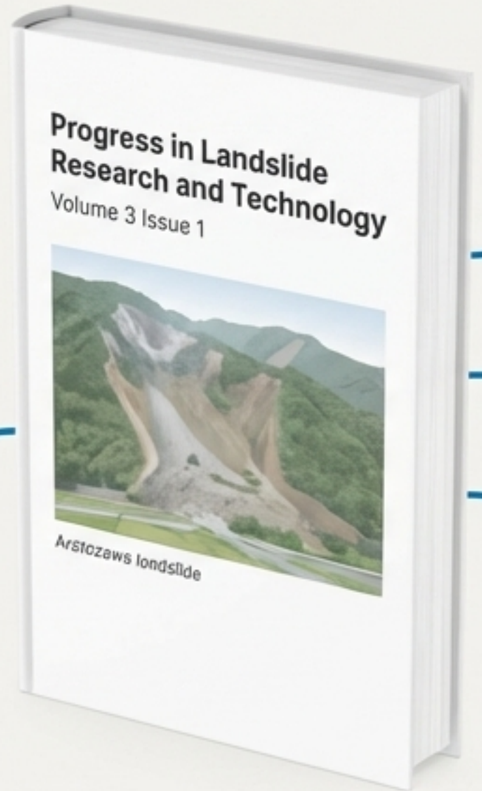
The ICL spearheads the **Kyoto Landslide Commitment 2020 (KLC2020)**, a global partnership signed by 90+ organizations to continue expand the Sendai Landslide Partnerships.

Mission: To create a common platform for the global promotion of understanding and reducing landslide disaster risk.

A New Platform for Progress: ‘Progress in Landslide Research and Technology’ (P-LRT)

The P-LRT Open Access book series was launched as a core activity of the KLC2020. Its purpose is distinct from traditional academic journals.

Key Objective: To be the common platform for publishing recent progress in landslide research and technology for **practical applications and the benefit of society**.



Original & Review Articles

ICL Landslide Lessons

Case Studies & Technical Notes

Teaching Tools with Online Extras (e.g., videos)

A Tale of Two Publications: Designed for Practice, Not Just Theory

Feature	ICL Book Series “P-LRT”	ICL Journal “Landslides”
Primary Aim	Promotion of **reducing** landslide disaster risk	Promotion of **understanding** landslide risk
Scope	Original articles for **practice and society**	Original research for **landslide science**
Online Access	**Open Access (Free)**	Charged Access
Publication Fee	Book Processing Charge (BPC)	Free if accepted

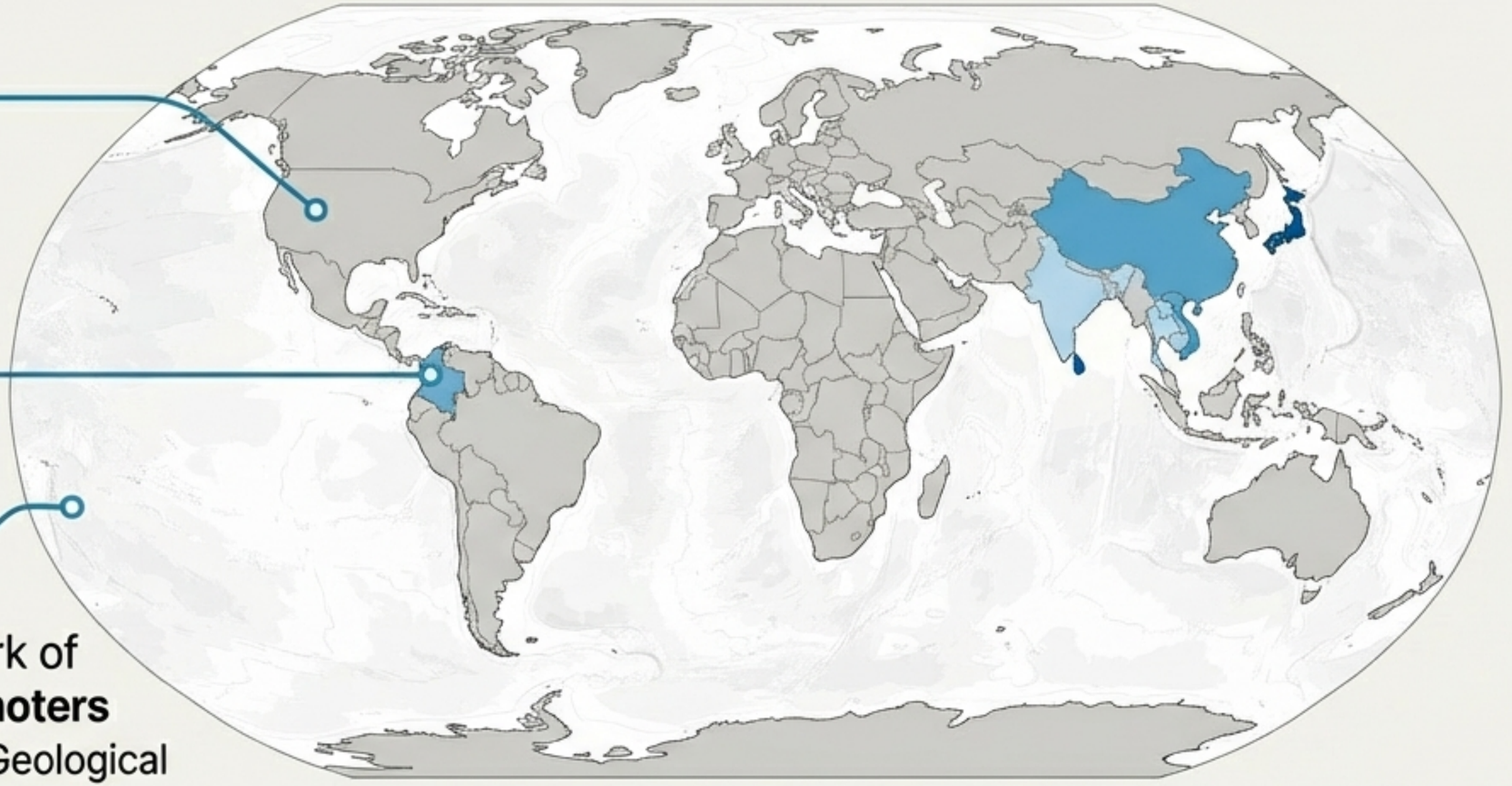
P-LRT's Open Access model ensures that practitioners, engineers, and community leaders in in landslide-prone areas can freely access and apply the latest scientific advancements.

A Global Brain Trust: The Power of International Collaboration

30+ Research contributions in this single issue.

Authors from **12+** countries including Japan, Sri Lanka, China, Vietnam, and Colombia.

Supported by a network of KLC2020 **Official Promoters** from both public (e.g., Geological Survey of Canada) and private



"The worldwide information dissemination... and strengthening of the network for landslide risk reduction is a key component of the success and sustainability of the Kyoto Landslide Commitment." — **Kyoji Sassa**

A Thematic Look Inside Volume 3, Issue 1

The latest volume presents a wealth of new research. To understand its collective impact, we have curated the key contributions into three central themes that define the cutting edge of landslide risk reduction.

1 **From Pixels to Prediction:** Revolutionizing How We See Risk

2 **Deconstructing Disaster::** Uncovering Triggers and Complex Mechanisms

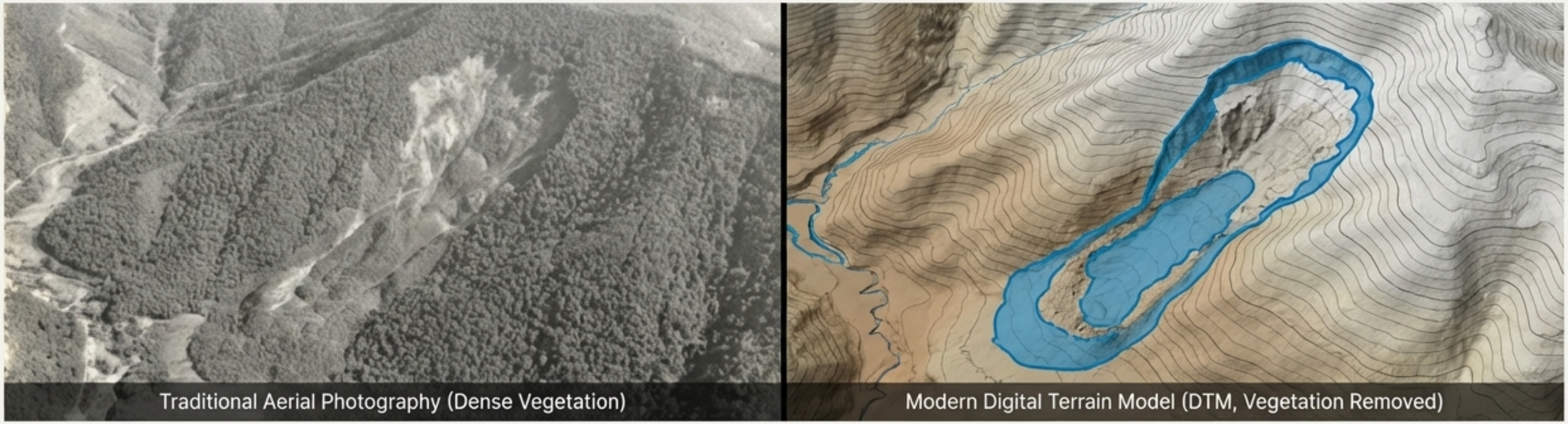
3 **From Research to Resilience:** Applying Science for Safer Communities

Theme 1

From Pixels to Prediction: Revolutionizing How How We See Risk

Spotlight: Mapping Hidden Risk from Space

Interpretation and Mapping for the Prediction of Sites at Risk of Landslide Disasters: From Aerial Photography to Detection by DTMs (Miyagi et al.)



The Question

How do we map hidden landslide risks across vast, inaccessible regions, moving beyond traditional, expert-dependent aerial photo interpretation?

The Approach

Utilizing AW3D satellite data to create high-resolution Digital Terrain Models (DTMs). This allows for the systematic extraction of landslide features (main scarps, moving bodies) from contour line patterns.

The Insight

This method revealed extensive, previously unrecognized landslide topography in Vietnam and Sri Lanka, proving its value for wide-area assessment and discovering risks that are obscured by vegetation or difficult to access.

"...discovering risks that are obscured by vegetation or difficult to access."

Spotlight: An Intelligent Eye on the Slope

The Slope Monitoring Using Embedded System with Optical-Thermal Image Fusion and Machine Learning (Chung et al.)

The Question

Can we develop a low-cost, automated, on-site monitoring system that detects both surface movement and potential subsurface instability?

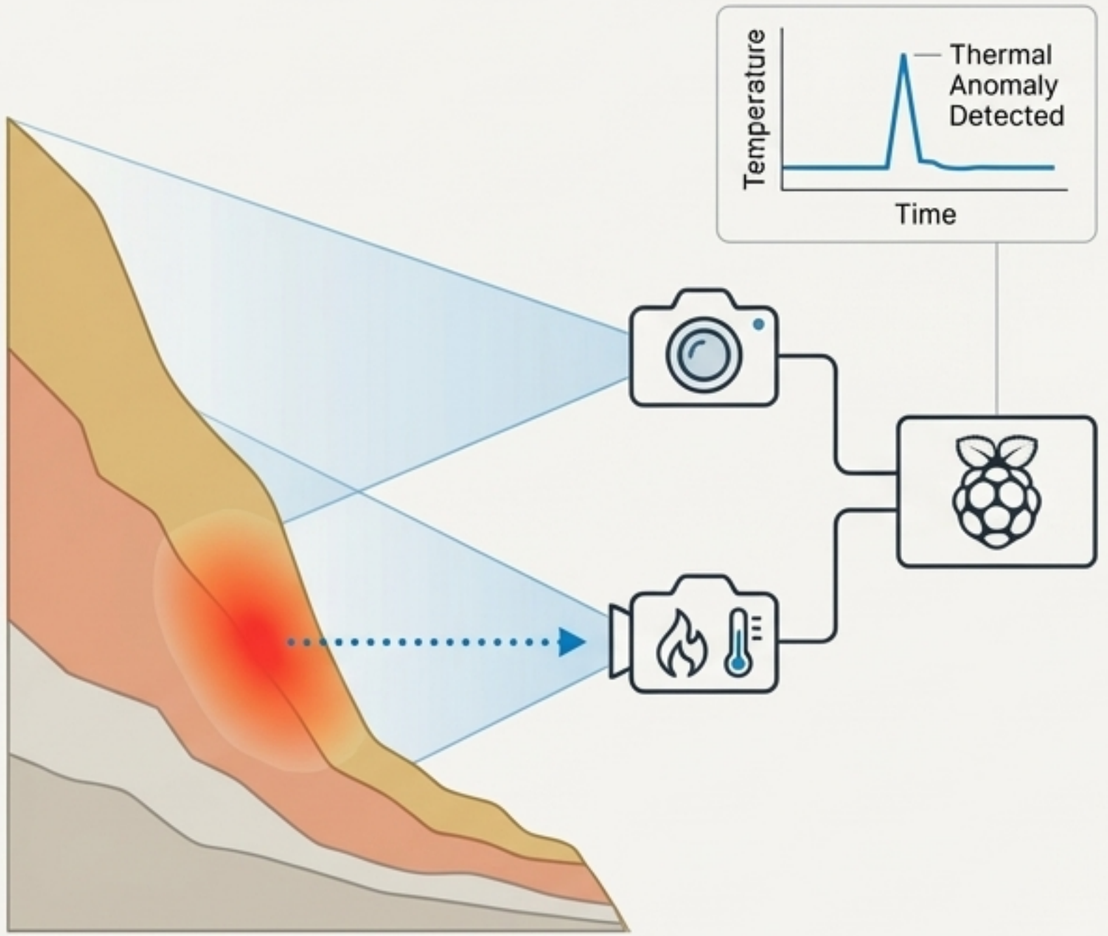
The Approach

Building an embedded system using a Raspberry Pi that combines a standard optical camera with a thermal imaging camera. Machine learning algorithms are then used to analyze the fused image data.

The Insight

Fusing optical and thermal images allows the system to detect not only physical displacement but also temperature differences caused by factors like water seepage. This provides a more comprehensive picture of slope stability and can identify concealed hazard zones before a failure occurs.

"Fusing optical and thermal images... provides a more comprehensive picture of slope stabllity and can identify concealed hazard zones before a failure occurs."



Theme 2
Deconstructing Disaster: Uncovering Triggers and Complex Mechanisms

Spotlight: The Dual Impact of Rain and Earthquakes

Multiple Landslides in an Area Draped in Volcanic Matters:
The Dual Impacts of Rains and Earthquakes (Nakata et al.)

The Question

How did the 2018 Hokkaido Eastern Iburi Earthquake trigger over 7,000 landslides, and what role did preceding rainfall play?

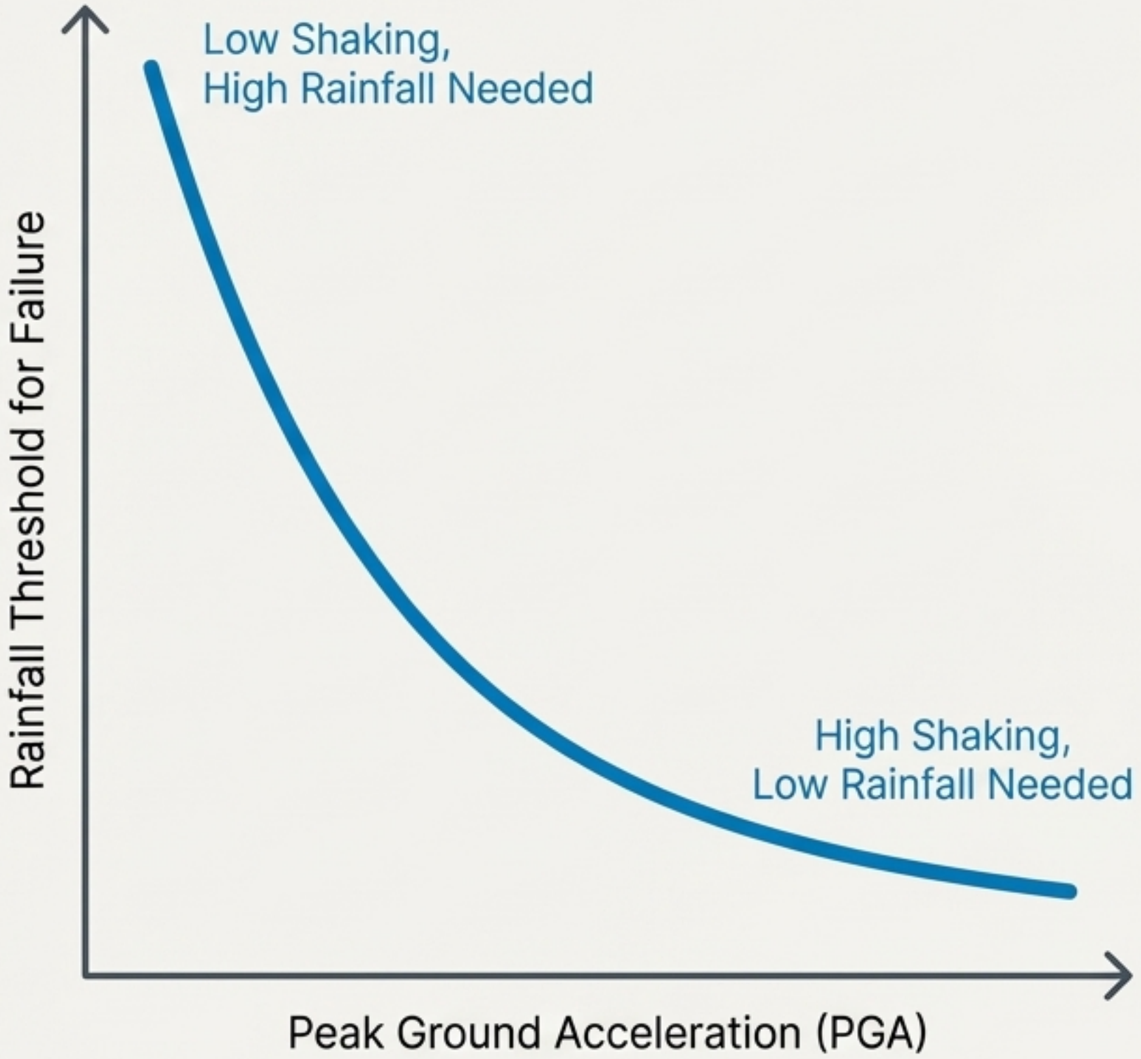
The Approach

Using the Multi-Scale Simulator for the Geo-Environment (MSSG) to model rainfall accumulation in the month prior to the earthquake, and correlating this data with the Peak Ground Acceleration (PGA) at each landslide location.

The Insight

The study revealed a clear inverse relationship: as the intensity of earthquake shaking (PGA) increases, the amount of rainfall required to trigger a landslide decreases. This quantifies the dangerous synergy between seismic and meteorological triggers in volcanic soils.

"The dangerous synergy between seismic and meteorological triggers in volcanic soils."



Spotlight: The Warming Oceans and Hidden Threats Below

Global Warming May Accelerate Submarine Landslides in the Oceans
-Possible Disaster Chain Reactions- (Kitazato)

The Question

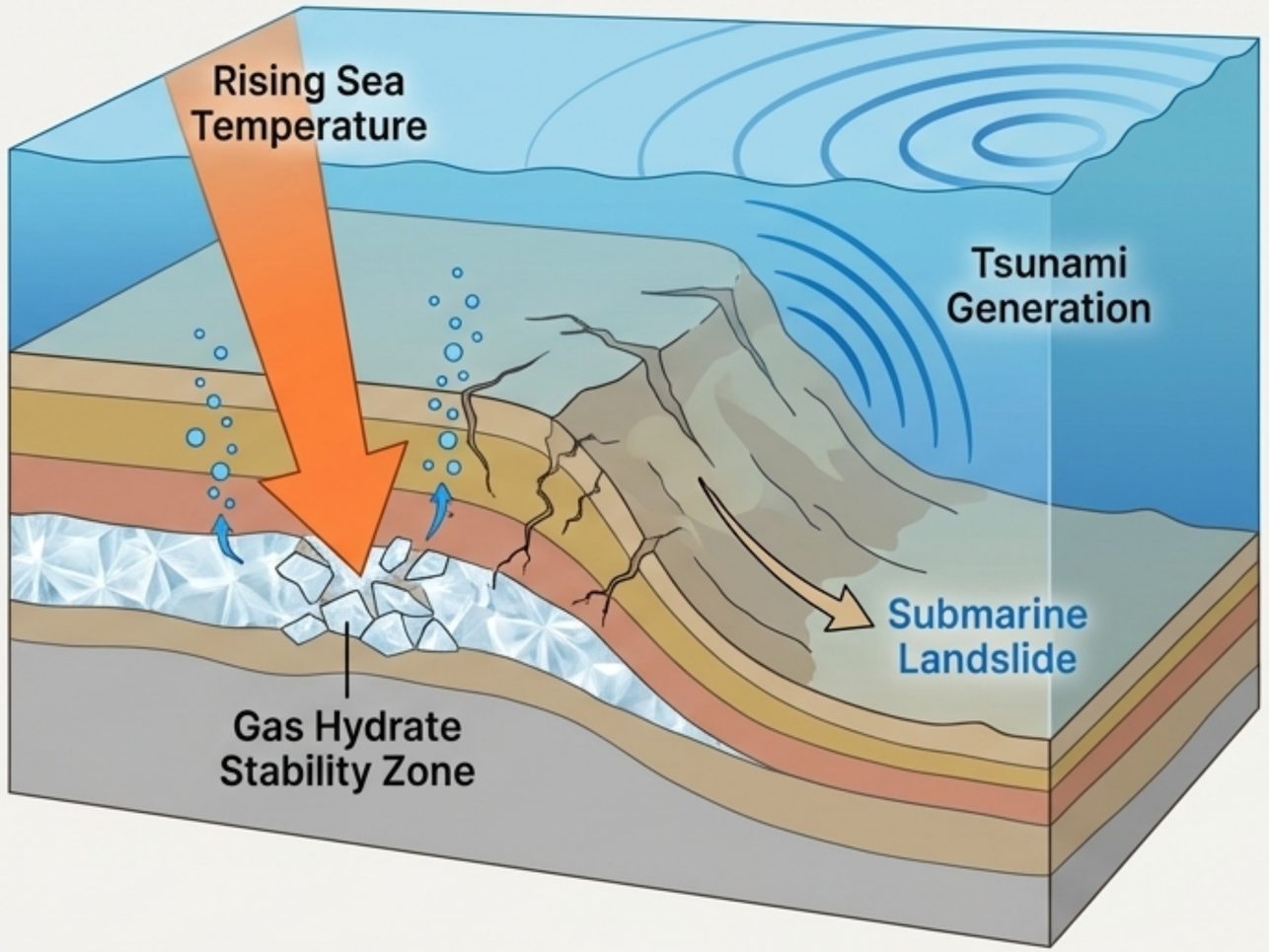
How could global warming and rising ocean temperatures affect the stability of the seafloor and trigger cascading disasters?

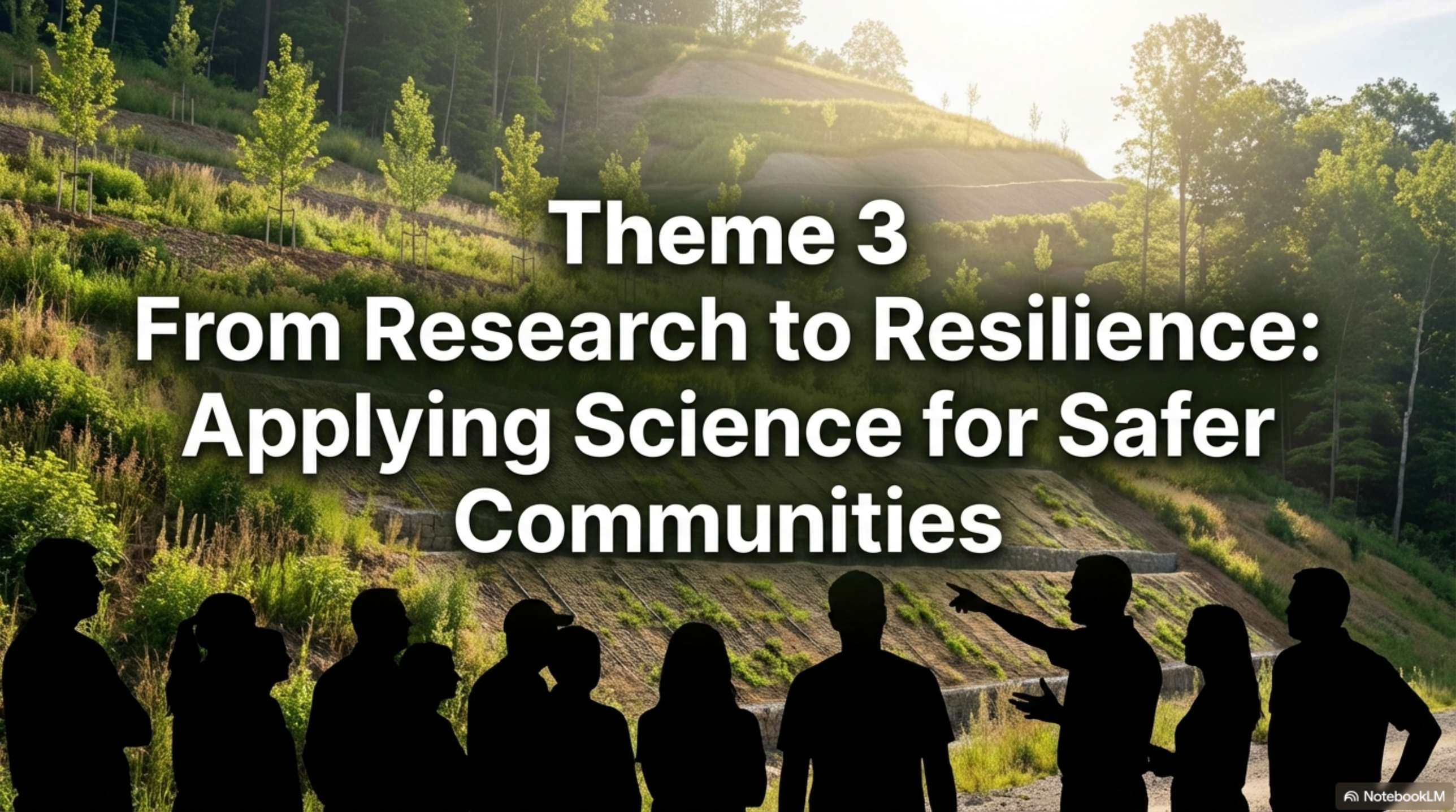
The Approach

Analyzing the stability of gas hydrates—ice-like structures of methane trapped in water—which are sensitive to temperature and pressure changes on continental slopes.

The Insight

Rising ocean temperatures threaten to melt these gas hydrates. This can destabilize vast areas of the seafloor, potentially increasing the frequency and scale of submarine landslides, which in turn can trigger devastating tsunamis.




Theme 3
From Research to Resilience: Applying Science for Safer Communities
NotebookLM

Spotlight: Managing Risk in an Urban Landfill

Research paper: Landslide Hazard Evaluation of a Large Waste Landfill in Bogotá City (Lozano & Ávila)

The Question

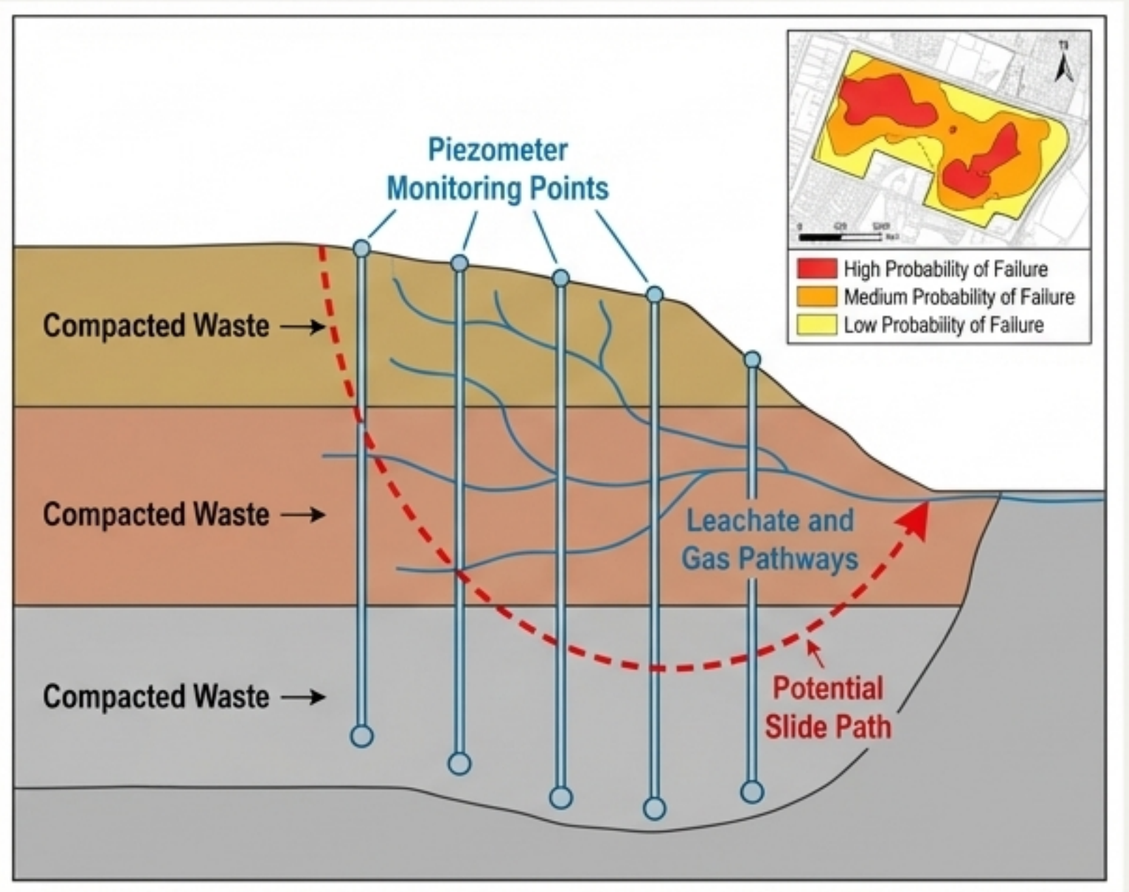
What are the unique landslide hazards of a massive urban solid waste landfill, and how can they be effectively monitored and managed?

The Approach

A comprehensive hazard evaluation of the Doña Juana landfill in Bogotá, using CPTu tests, a network of over 300 piezometers to monitor fluid pressure, and probabilistic stability modeling.

The Insight

Fluid pressure from leachate and gas is the single most critical factor controlling the landfill's stability. Under seismic conditions, high pressure levels create a high probability of failure, underscoring the vital need for robust, continuous monitoring and efficient drainage systems for such critical infrastructure.



Spotlight: The Social Side of Early Warning

Research paper: Introducing Japanese Landslide Warning and Evacuation System to Sri Lanka: Field Survey of Social Aspect in the Arayanake Area (Fujita)

The Question

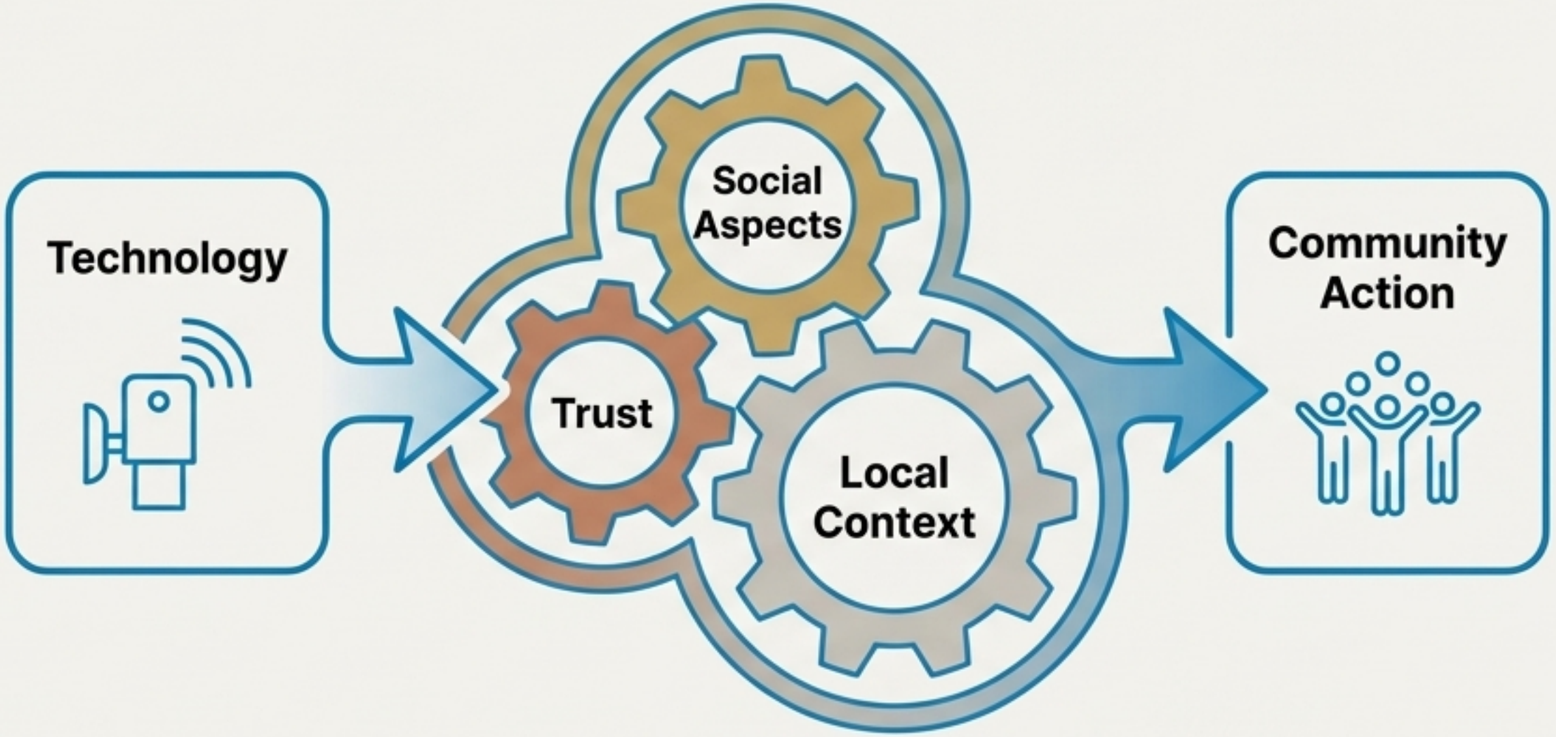
How can a successful landslide early warning system from one country be effectively adapted to the unique social and cultural context of another?

The Approach

Conducting field surveys and social research in the Arayanake area of Sri Lanka (site of a major 2016 landslide) to understand local perspectives before introducing a Japanese-style warning system.

The Insight

Effective risk reduction is not just about technology transfer. Success hinges on understanding social dynamics, building community trust, and tailoring systems to the local context to ensure that warnings are understood, believed, and acted upon.



The crucial, often-overlooked link

Synthesizing the Progress: Seeing, Understanding, and Acting

Volume 3, Issue 1 demonstrates tangible progress on multiple fronts:

We See Risk More Clearly

With advanced satellite mapping and on-site intelligent monitoring, we are identifying hazards with greater precision and speed.

We Understand Triggers More Deeply

By modeling the complex interplay of seismic, meteorological, and climatic factors, we are uncovering the root causes of failure.

We Act More Effectively

By applying this knowledge to real-world challenges—from urban landfills to community warning systems—we are building tangible resilience.

Join the Commitment to Reduce Landslide Risk

The ‘Progress in Landslide Research and Technology’ series is an open, living platform. Its success depends on the engagement of researchers and practitioners like you. We invite you to:

1. Access the Knowledge

Download the full Volume 3, Issue 1, and all other P-LRT publications for free. Apply these insights in your work.

2. Contribute Your Expertise

Consider submitting your own research, case studies, or teaching tools to continue the cycle of collaborative progress.

Scan to access the P-LRT book series.

klc2020@landslides.org

Together, we can transform science into action for a safer world.