Lessons from the 2025 Sumatra Floods: Toward Integrated Flood Risk Management

Presented at the 17th ICFM Webinar

December 18, 2025

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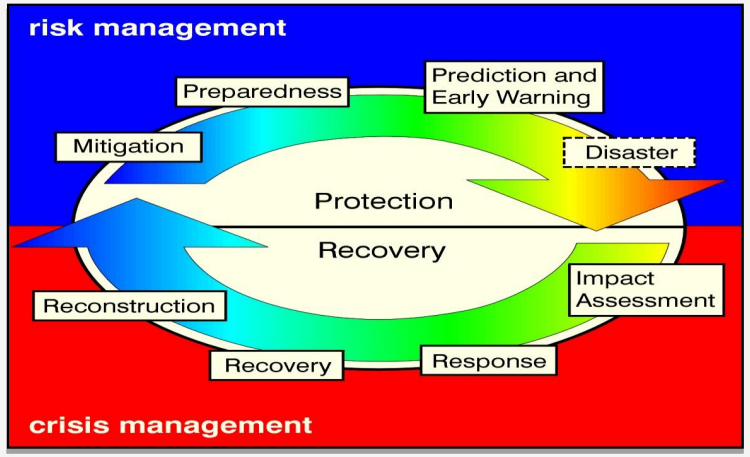
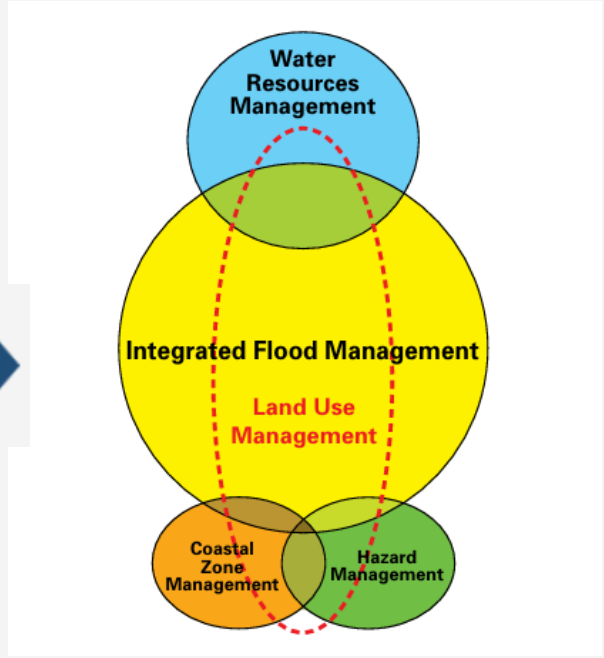
Our Journey Today





1.THE IMPACT

What happened, and the scale of loss

2. THE DIAGNOSIS

Why was it so catastrophic? Root causes

3. THE SOLUTION

How to fix the system:

The shift to IFRM

The 2025 Catastrophe: Scale of Impact

- **Scope:** 3 provinces (Aceh, N. Sumatra, W. Sumatra), 52 districts affected.
- **Human Toll (as of mid-Dec):**
  - **Fatalities:** 1,059 **Missing:** 192 **Displaced:** 588,226 people.
- **Infrastructure:**
  - ~158,000 houses damaged;
  - 435+ bridges,
  - 1,200+ public facilities destroyed.
  - Economic Cost: Reconstruction estimated at USD 3.11 billion

Sources: BNPB (17 Dec); Human Initiative SITREP 7 (10 Dec); Reuters (15 Dec).

Not Just Water: How Forest Loss Turned Rain into Ruin

What Happened:
The 2025 Sumatra floods were more like a **liquid landslide** than a normal flood. Water mixed with mud, logs, and mining waste became a **destructive slurry** that smashed bridges and buried villages.

Why It Was So Bad:

- **Forests were cleared** in the mountains
- **Without tree roots** to hold the soil, rain washed entire hillsides into rivers
- **Water turned into thick, heavy debris flows** that destroyed everything in their path
- **The Result:**
  ☔ Rainfall → 🪵 Logs + ⛰️ Soil + 🏚️ Debris = 💥 **Catastrophic Destruction**


REUTERS/Willy Kurniawan


REUTERS?Ajeng Dinar Ulfiana

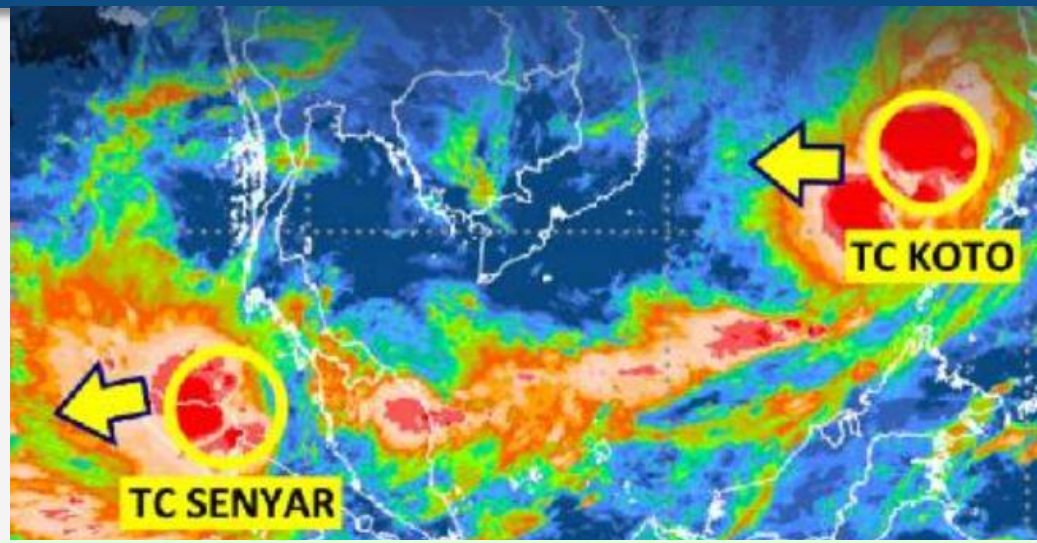
What Drove the Catastrophe? Four Converging Factors

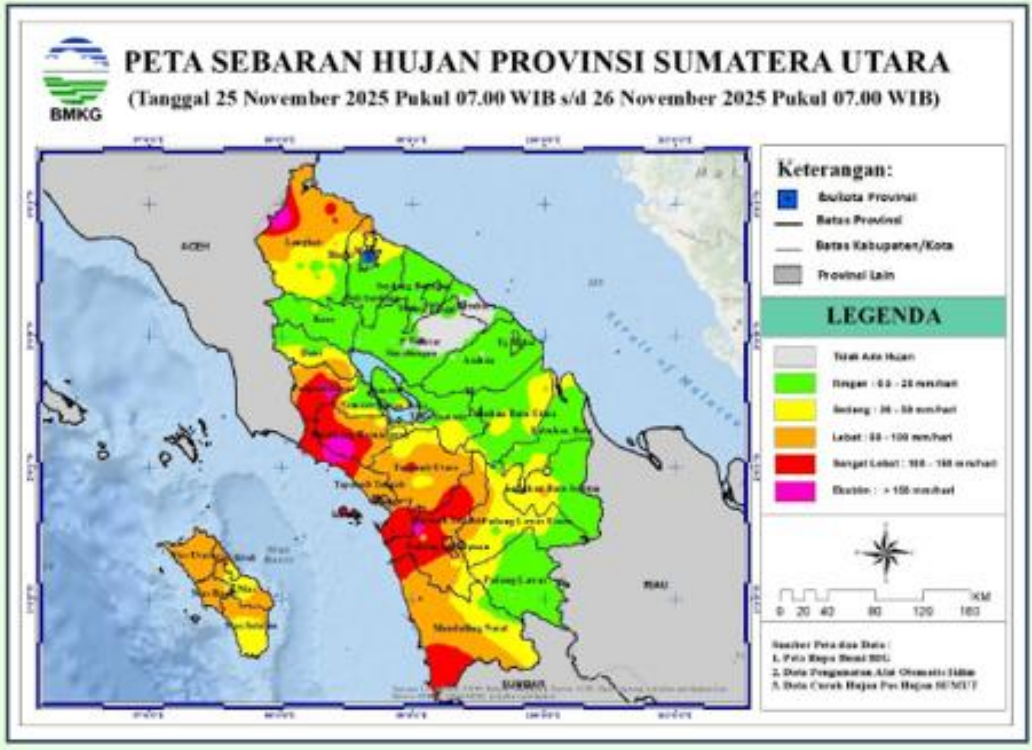
The disaster was not natural but systemic. These four drivers combined to create the catastrophe.

Driver	Mechanism & Impact	Evidence
1. Climate-Amplified Cyclone 	**Trigger:** Rare cyclone 'supercharged' by high sea temps.	Storms "supercharged by climate change" (Reuters).
2. Deforestation 	**Amplifier:** Loss of forest cover accelerated runoff & landslides.	A total of 1.2 million hectares of forest has disappeared across the three provinces between 1990 and 2024. Gov't task force probing 31 companies for violations that worsened floods (Kompas)
3. Mining & Land Degradation 	**Amplifier:** Increased erosion, sediment, and landscape vulnerability.	Extractive permits currently cover approximately 2.5 million hectares of land in Sumatra[ABC News]
4. Gaps in Early Warning & Response 	**Multiplier:** Fragmented systems delayed evacuation and aid.	BMKG issued an early warning about the storm a week in advance, but no other agencies followed up on it

Driver 1 – Natural Drivers – Extreme Meteorology and Topographic Volatility

- **Meteorological Trigger**: Tropical Cyclone Senyar triggered the disaster by dumping over 300 mm of rain daily in the Malacca Strait between November 24-27, 2025—an extreme and rare event.
- **Topographic Acceleration**: The steep gradients of the Bukit Barisan Mountain Range act as a gravity-driven engine, rapidly funneling intense precipitation into high-velocity flash floods.
- **Landscape Vulnerability**: This combination of climate-intensified rainfall and rugged terrain creates a high-risk environment where natural drainage systems are easily overwhelmed.





Driver 2 – Deforestation & Land-Use Change

- **Large-scale loss**: A total of 1.2 million hectares of forest has disappeared across the three provinces between 1990 and 2024, an average of 36,305 hectares per year.
- Affected provinces: North Sumatra (500,404 ha), Aceh (379,309 ha), and West Sumatra (354,651 ha).
- **The Hydraulic Impact:** Reduced infiltration **accelerates surface runoff** and increases sediment, turning heavy rain into devastating flash floods.
- **The Accountability:** A government task force is investigating **31 companies** across the three provinces for activities that exacerbated the disaster

https://www.kompas.id/artikel/en-seberapa-parah-kerusakan-dan-lenyapnya-hutan-di-sumatera

https://sumbar.kabardaerah.com/2025/12/dari-hutan-ke-lumpur-bagaimana-deforestasi-memperparah-banjir-dari-aceh

Driver 3 – Mining & Watershed Degradation

- **Core Message: Extractive activities physically degrade the watershed's protective capacity.**
- **The Footprint:** There are **over 1,900 active mining permits** covering **~2.5 million hectares** in Sumatra. [ABC News]
- **The Mechanism:** Operations cause severe erosion, increase landslide risk, and **silt up river channels**, reducing their capacity to carry floodwaters.
- **The Systemic Issue:** The problem is **not only illegal mining**; legal concessions in upstream areas create **systemic, permitted vulnerability**. [ABC News]

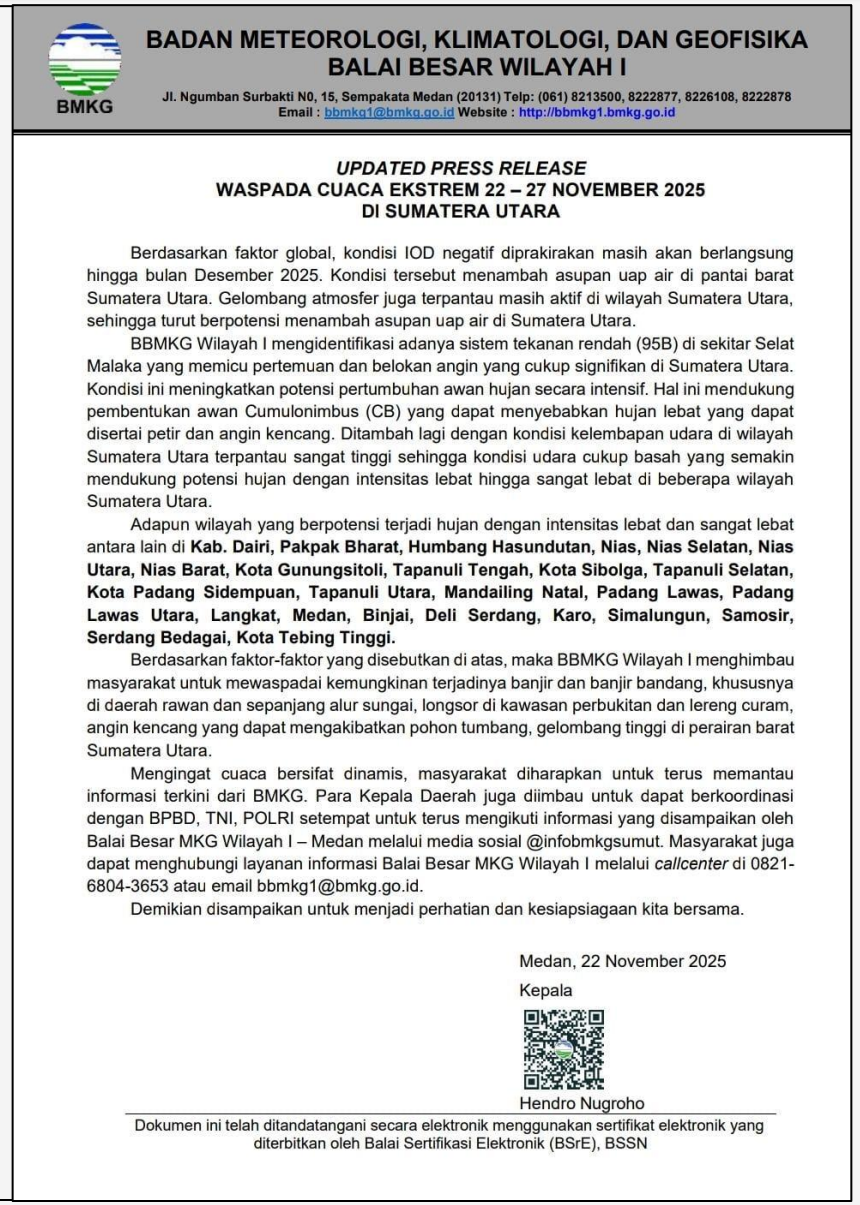
https://en.antaranews.com/news/396073/environment-ministry-seals-west-sumatra-mining-sites-due-to-flooding

Driver 4 – Gaps in Early Warning & Preparedness

- Indonesian Agency for Meteorology, Climatology and Geophysics **BMKG had issued an early storm warning a week in advance**, but no relevant agencies took follow-up action to translate this information into concrete preparedness measures for at-risk communities.

Preparedness gap:

- In an end-to-end and inclusive early warning system, a forecast from BMKG is only the first step; **it must be followed by clear protocols** for emergency agencies, local governments, and community organizations to act.
- When these actors **fail to respond, the system breaks down**, leaving communities without timely evacuation planning, resource prepositioning, or risk communication.



BMKG

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UPDATED PRESS RELEASE
WASPADA CUACA EKSTREM 22 – 27 NOVEMBER 2025
DI SUMATERA UTARA

Berdasarkan faktor global, kondisi IOD negatif diprakirakan masih akan berlangsung hingga bulan Desember 2025. Kondisi tersebut menambah asupan uap air di pantai barat Sumatera Utara. Gelombang atmosfer juga terpantau masih aktif di wilayah Sumatera Utara, sehingga turut berpotensi menambah asupan uap air di Sumatera Utara.

BBMKG Wilayah I mengidentifikasi adanya sistem tekanan rendah (95B) di sekitar Selat Malaka yang memicu pertemuan dan belokan angin yang cukup signifikan di Sumatera Utara. Kondisi ini meningkatkan potensi pertumbuhan awan hujan secara intensif. Hal ini mendukung pembentukan awan Cumulonimbus (CB) yang dapat menyebabkan hujan lebat yang dapat disertai petir dan angin kencang. Ditambah lagi dengan kondisi kelembapan udara di wilayah Sumatera Utara terpantau sangat tinggi sehingga kondisi udara cukup basah yang semakin mendukung potensi hujan dengan intensitas lebat hingga sangat lebat di beberapa wilayah Sumatera Utara.

Adapun wilayah yang berpotensi terjadi hujan dengan intensitas lebat dan sangat lebat antara lain di **Kab. Dairi, Pakpak Bharat, Humbang Hasundutan, Nias, Nias Selatan, Nias Utara, Nias Barat, Kota Gunungsitoli, Tapanuli Tengah, Kota Sibolga, Tapanuli Selatan, Kota Padang Sidempuan, Tapanuli Utara, Mandailing Natal, Padang Lawas, Padang Lawas Utara, Langkat, Medan, Binjai, Deli Serdang, Karo, Simalungun, Samosir, Serdang Bedagai, Kota Tebing Tinggi.**

Berdasarkan faktor-faktor yang disebutkan di atas, maka BBMKG Wilayah I menghimbau masyarakat untuk mewaspadai kemungkinan terjadinya banjir dan banjir bandang, khususnya di daerah rawan dan sepanjang alur sungai, longsor di kawasan perbukitan dan lereng curam, angin kencang yang dapat mengakibatkan pohon tumbang, gelombang tinggi di perairan barat Sumatera Utara.

Mengingat cuaca bersifat dinamis, masyarakat diharapkan untuk terus memantau informasi terkini dari BMKG. Para Kepala Daerah juga diimbau untuk dapat berkoordinasi dengan BPBD, TNI, POLRI setempat untuk terus mengikuti informasi yang disampaikan oleh Balai Besar MKG Wilayah I – Medan melalui media sosial @infobmkgsumut. Masyarakat juga dapat menghubungi layanan informasi Balai Besar MKG Wilayah I melalui *callcenter* di 0821-6804-3653 atau email bbmkg1@bmkg.go.id.

Demikian disampaikan untuk menjadi perhatian dan kesiapsiagaan kita bersama.

Medan, 22 November 2025

Kepala

Hendro Nugroho

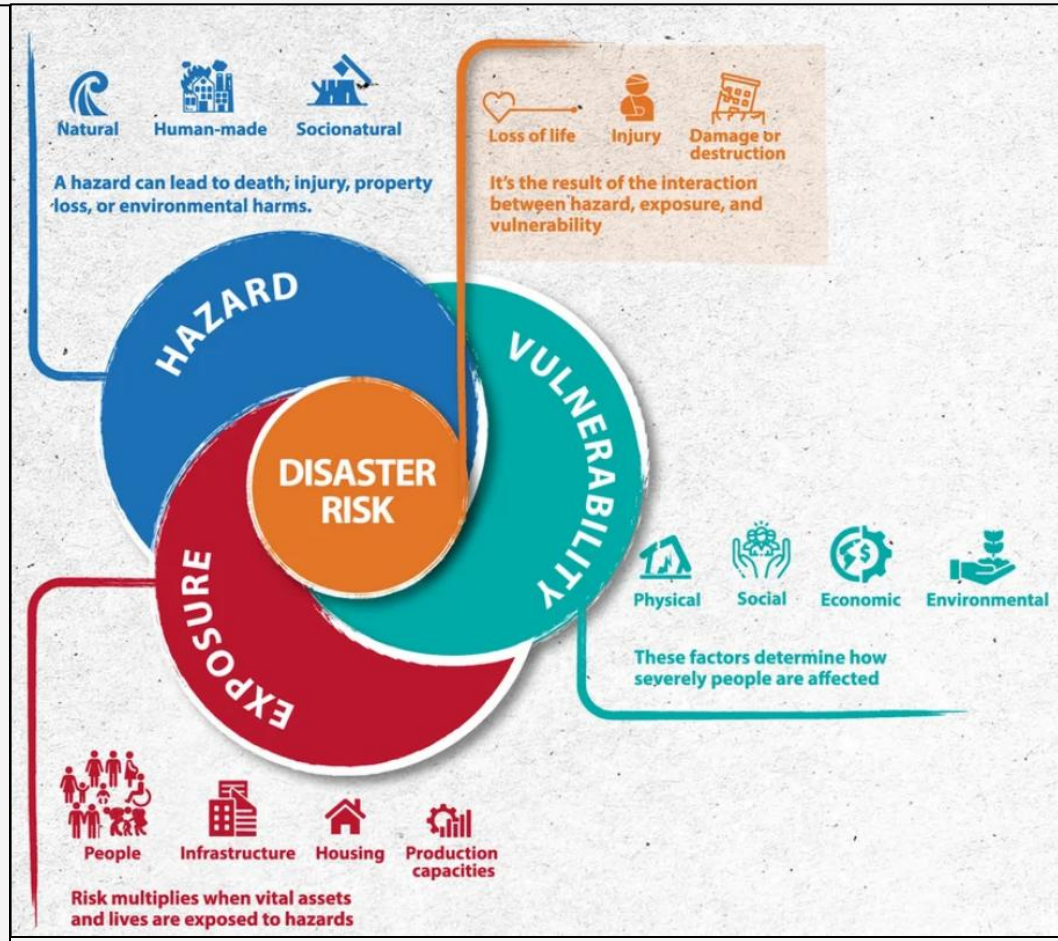
Dokumen ini telah ditandatangani secara elektronik menggunakan sertifikat elektronik yang diterbitkan oleh Balai Sertifikasi Elektronik (BSrE), BSSN

Anatomy of the Disaster: The Risk Equation

- **Disaster Risk** = Hazard × Exposure × Vulnerability

- **Applied to Sumatra 2025:**
  - **Hazard (H): Exceptionally High.** Climate-supercharged cyclone.
  - **Exposure (E): Very High.** People & assets concentrated in floodplains.
  - **Vulnerability (V): Critically Amplified.** By deforestation, poverty, and weak preparedness.

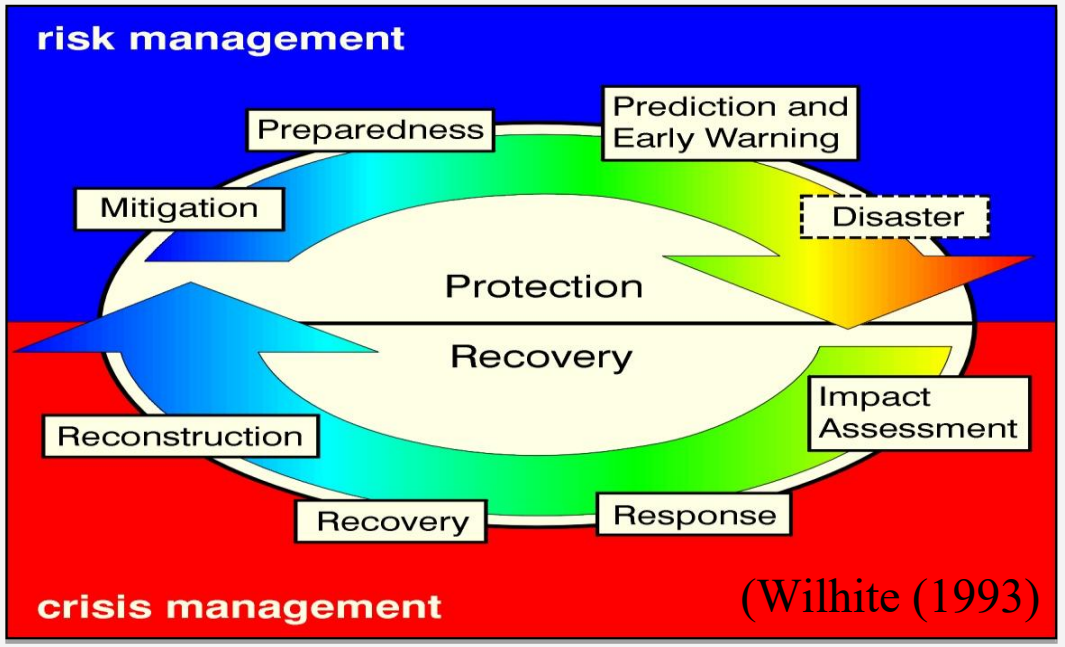
- **Key Message:** High hazard met a landscape made vulnerable by policy and practice.



https://www.preventionweb.net/understanding-disaster-risk/component-risk/disaster-risk

The Governance Challenge

- **Fragmented Response:** The disaster crossed **multiple provincial boundaries**, overwhelming siloed management systems.
- **Reactive Policy Cycle:** Emphasis remains on **emergency response over long-term risk reduction**.
- **Unaddressed Drivers:** Upstream land degradation continues despite known downstream risks.
- **IFRM Insight: Siloed approaches in water, forestry, and disaster management are destined to fail** against systemic risks.

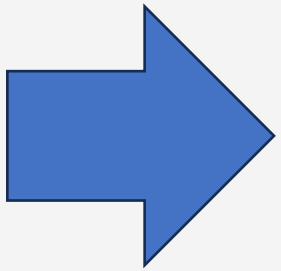


The Strategic Shift: Introducing IFRM

Integrated Flood Risk Management (IFRM): A proactive framework that connects policies, sectors, and landscapes.

- **isolated** infrastructure projects
- **reactive** disaster response

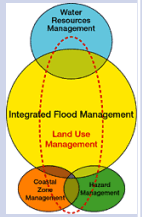
- **siloed** sectoral planning



Integrated Flood Risk Management (IFRM)

- **basin-wide ecosystem management**
- **proactive** reduction of exposure & vulnerability
- **coordinated**, risk-informed governance.

Applying IFRM: From Diagnosis to Action in Sumatra

IFRM Lever	Concrete Policy Action	Addresses This Driver
Risk-Based Spatial Planning 	Enforce **legally-binding "no-build" zones** in high-risk corridors.	**Exposure**
Ecosystem Restoration 	**Mandate and fund restoration** of degraded upland forests and critical watersheds.	**Vulnerability (Deforestation)**
Robust Early Warning 	**Deploy community-based flood alert systems** with clear evacuation protocols.	**Vulnerability (Preparedness)**
Cross-Sectoral Governance 	Establish **independent River Basin Authorities** with the centralized legal power to align and regulate land-use permits across all sectors to ensure environmental integrity and long-term flood resilience.	**Governance Fragmentation**

Policy Recommendations & Pathways

PHASE 1: IMMEDIATE (Next 6 Months)

Secure & Build Back Smarter

- Halt deforestation in critical watersheds.
- Audit companies & enforce "Build Back Better."

PHASE 2: MEDIUM-TERM (1-3 Years)
Reform Planning & Governance

- Legislate risk-based spatial plans.
- Establish cross-provincial basin authorities.

PHASE 3: LONG-TERM (3+ Years)
Mainstream Resilience

- Integrate IFRM into national development plans.
- Capitalize a national "Fund for Resilience."

The Sumatra Lesson: Managing the Drivers of Catastrophe

HAZARD
Climate-intensified cyclones & extreme rainfall

Trend: WILL Increase

EXPOSURE
People & assets in floodplains

CAN Be Managed.

VULNERABILITY
Deforestation, land degradation, weak preparedness

CAN Be Reduced.

Flood Risk = Catastrophe

The Key Insight:
The **hazard** is a given. The scale of the **disaster** is determined by our policy choices on **exposure** and **vulnerability**
We cannot control **cyclones**, but we fully **control land use**, **preparedness**, and **governance**.
Integrated Flood Risk Management is the essential framework to control these levers.

Final Takeaway: *Floods are inevitable. Disasters are a policy choice!*

We extend our deepest hopes for a swift recovery for the people of Sumatra. Moving forward, let us work toward a future where sustainable management and environmental integrity prevent such tragedies from ever happening again.

Thank you

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Indonesiana.id
ANTARA FOTO/Syifa Yulinnas