IWMI
International Water Management Institute

Investment Brief

Financing the last mile: an investment case for Early Warnings for All

Key messages

- Countries with comprehensive multi-hazard early warning systems record disaster mortality nearly six times lower than those without, and every dollar invested in hydromet and warning services returns between four and thirty-six dollars.
- Early Warnings for All costed delivery at USD 3.1 billion for 2023–27; its dedicated funds have approved about USD 220 million. Over half of tracked national early warning finance sits in five countries, three-quarters of the total is lent rather than granted, and low-income and fragile states each receive under 7% of pre-arranged disaster finance.
- National hydromet budgets go mostly to salaries; in the least-developed and island countries assessed by the Alliance for Hydromet Development, 95% of services have no maintenance budget and nearly half of surveyed stations do not work. Operations and maintenance is nobody's line item.
- Pre-arranged finance reached USD 9.4 billion in 2024 and anticipatory action protected 9.6 million people in 2025, with documented returns of up to USD 7 per dollar in the best cases. Yet anticipatory funding remains far below the 5% of humanitarian finance that donors committed to under the Grand Bargain, and many national disaster funds, Bangladesh's among them, still cannot release money on a forecast.
- The instruments are available now: ring-fenced operations budgets, grant-based finance for the most exposed, forecast-triggered instruments, Universal Service Funds for last-mile delivery and costed early warning commitments in NDC 3.0.

Introduction

Water is the medium through which most climate disasters arrive, and the people who suffer first are the farmers, herders and fishing families whose livelihoods depend on knowing what the next season will bring. In 2022 the United Nations set a deadline: by the end of 2027, everyone on Earth should be protected by a multi-hazard early warning system. Progress has been real. The number of countries reporting such a system has more than doubled in a decade to 119, and comprehensiveness scores have risen 45% on average (WMO and UNDRR 2025). But three in ten people who experienced a hazard in the past five years still received no warning (Lloyd's Register Foundation 2024), coverage is weakest among small island states and across Africa, and the financing on which the final push depends is under pressure from the steepest fall in official development assistance on record (OECD 2026).



An automatic weather station in Sri Lanka
Photo by Department of Meteorology, Sri Lanka

Early warning is among the highest-return resilience investments a government can make, and the money is going to the wrong places. It flows as loans rather than grants, to large economies rather than the most exposed, to building systems rather than running them, and to response after the shock rather than action before it (WMO 2025a; Alliance for Hydromet Development 2024; Plichta et al. 2025). With fourteen months to the deadline, the task is no longer to prove that early warning pays. It is to fix how it is financed.

Purpose and scope

This brief draws on IWMI's synthesis of the *Eyes on the Storm* webinar series, convened in 2025–26 with the World Meteorological Organization, the UN Office for Disaster Risk Reduction, the International Telecommunication Union, the International Federation of Red Cross and Red Crescent Societies and other partners. More than seventy practitioners from national meteorological and disaster services, space agencies, insurers, hydropower operators, humanitarian networks and community organizations described what works in early warning and what does not. Their evidence is combined here with the latest global data on early warning and disaster risk finance published between late 2025 and October 2026.

The brief is written for ministries of finance and planning, development banks and climate funds, telecommunications regulators, and the Early Warnings for All (EW4All) partnership itself. It sets out the investment case, shows where current finance falls short along the early warning value chain, identifies the instruments that convert warnings into action, and closes with six recommendations that can be acted on before the 31st UN Climate Change Conference (COP31) in November 2026 and the EW4All deadline a year later. The brief is organized around the four pillars of the EW4All framework, which Box 1 introduces together with the cost the initiative has attached to each.

The four pillars function as a single value chain (Figure 1): a weakness in any one breaks it, and *Eyes on the Storm* found the chain most often breaks at the last mile, between Pillars 3 and 4.

Box 1. The four pillars of early warning and what each costs

Early Warnings for All is organized around four pillars, each led by a UN agency, and its 2023–2027 Executive Action Plan attached a cost to each.

Pillar 1, disaster risk knowledge (UNDRR; USD 374 million) covers hazard, exposure and vulnerability data, including the hydrological knowledge of river basins on which flood and drought risk assessments rest.

Pillar 2, detection, observation, monitoring and forecasting (WMO; USD 1.19 billion) covers observation networks, data exchange and forecast models.

Pillar 3, warning dissemination and communication (ITU; USD 550 million) covers the channels that carry a warning to people, from cell broadcast to sirens and community messengers.

Pillar 4, preparedness and response capability (IFRC; USD 1 billion) covers early action protocols, pre-arranged finance, drills and shelters.

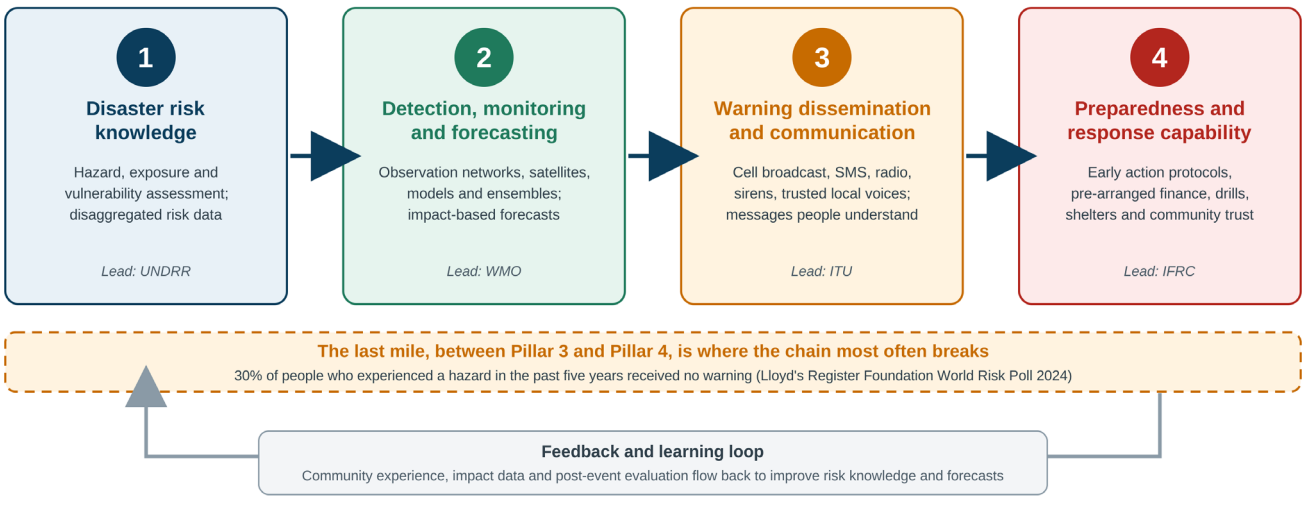


Figure 1. The Four Pillars of Early Warning as a value chain.

The return on warning

The economic case is settled; what has changed is who needs to hear it. Countries with comprehensive multi-hazard early warning systems record disaster mortality nearly six times lower than those without (WMO and UNDRR 2025), and the financial return is of the same order. The World Bank estimated in 2012 that upgrading developing-country hydromet services to developed-country standards would cost about USD 1 billion a year and return USD 4–36 billion a year in avoided losses and productivity, saving some 23,000 lives a year (Hallegatte 2012). The Alliance for Hydromet Development's 2024 Gap Report puts the ratio at up to 36:1 for hydromet and at least 10:1 for climate services (Alliance for Hydromet Development 2024), and the World Bank's assessment of the Global Basic Observing Network finds returns above 25:1 (SOFF 2025). The widely quoted claim that USD 800 million would avert USD 3–16 billion a year in losses traces back to the same 2012 work and should be cited as such (Stephens 2023).

Early warning delivers a triple dividend: losses avoided when a hazard strikes; investment unlocked because risk is known, a gain that accrues even in years with no hazard; and co-benefits for agriculture, water, energy and health. Mozambique illustrates the first: Cyclone Idai in 2019 killed 603 people and cost USD 3 billion; Cyclone Freddy in 2023 killed 198 and cost around USD 500 million, a difference WMO attributes in large part to better warning and preparedness (WMO 2024). The second dividend is why hydropower operators, insurers and commercial data providers in the *Eyes on the Storm* series now treat early warning as part of their core operations rather than a public good someone else provides. The third dividend is the everyday value of the same forecasts to sectors that never see a disaster: WMO cites evidence from China that each 1% gain in forecast accuracy raises crop yields by 0.34%, and the Hydromet Gap Report values climate services to weather-sensitive sectors at more than USD 160 billion a year (WMO 2024; Alliance for Hydromet Development 2024).

For finance ministries the argument is fiscal. The G20's Cape Town declaration of October 2025 stated it directly: the cost of inaction exceeds the cost of action (WMO 2025c). An International Monetary Fund (IMF) working paper published in June 2026 finds that each additional percentage point of disaster losses relative to GDP raises the odds of sovereign default by two to three per cent, and that delayed adaptation compounds the risk (de Soyres et al. 2026). India's Economic Affairs Secretary put it plainly in April 2026: disasters are "fundamentally a development and a fiscal challenge" (The Indian Express 2026). Early warning is the lowest-cost instrument for reducing that volatility, because it turns an unbudgeted emergency into a planned, triggered expenditure.

Where the money is, and isn't

The EW4All Executive Action Plan costed the 2023–27 push at USD 3.1 billion: USD 374 million for risk knowledge (Pillar 1), USD 1.19 billion for observation and forecasting (Pillar 2), USD 550 million for dissemination (Pillar 3) and USD 1 billion for preparedness (Pillar 4) (WMO 2023). Against this, the channels built for the purpose remain small (Figure 2). The Systematic Observations Financing Facility (SOFF) has approved USD 116 million for country investments and needs a further USD 200 million to serve the thirty countries now waiting, out of an estimated USD 500 million capital need across all 77 least-developed countries and small island states (SOFF 2025). The Climate Risk and Early Warning Systems (CREWS) initiative has received USD 142 million since 2015 and allocated USD 104 million to projects; in June 2026 it had USD 12.5 million available against a USD 124 million approved pipeline (CREWS 2026). The Green Climate Fund's early warning portfolio of about USD 933 million is the largest single source, but it is project-based and slow (GCF 2026).

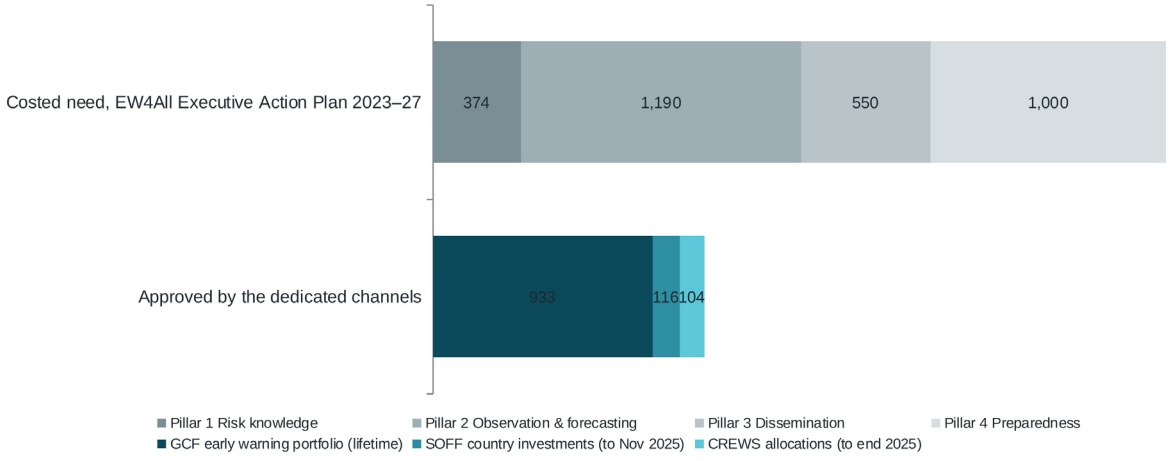


Figure 2. Early Warnings for All: funding costed for 2023–2027 versus funding approved through its dedicated channels (USD million).
Sources: WMO 2023; GCF 2026; SOFF 2025; CREWS 2026.

Figure 2 shows that EW4All financing channels have approved just over a third of the 2023–27 plan's cost, even when the Green Climate Fund's entire early warning portfolio since inception is included. The two purpose-built funds together account for about USD 220 million.

Three distortions matter more than the headline gap. First, the money is concentrated: the WMO–UNDRR Global Observatory for EWS Investments finds that 54% of national early warning finance tracked across 329 projects sits in five countries (China, Bangladesh, India, Pakistan, Indonesia), while small island, least-developed and landlocked states show "significant gaps" (WMO 2025a). Second, 75% of it is loans or credits, which the most indebted countries cannot absorb. Third, it is unevenly spread across the value chain. Risk knowledge is both the cheapest pillar and the least funded: fewer than one in three countries report the capability, and EW4All member states report it as the pillar where progress is hardest (WMO and UNDRR 2025; Amarnath and Alahacoon 2026). Hydrology sits outside SOFF's meteorological mandate, so river gauges, which supply the data that flood forecasts depend on, have no dedicated global financing, a gap that Recommendation 3 below addresses. And dissemination, the last mile, is in ITU's words "underfinanced": only around forty to forty-five countries have cell broadcast, even though a national platform costs roughly USD 2 million (ITU, n.d.; WMO 2025d).

The *Eyes on the Storm* evidence shows what this looks like on the ground. Zambia's water authority relies on the Global Flood Awareness System (GloFAS) because under-investment has left its own gauges unable to monitor river flows in detail. WMO's Water at the Heart of Climate Action project in the Nile basin began with national capacity assessments, which found existing systems short of hydrological data, above all river discharge. And across Africa, only 14 of the 55 African Union member states have a national drought monitoring system (Amarnath and Alahacoon 2026).

Build versus fuel

Most early warning finance pays to build systems; almost none pays to run them. In the twenty least-developed and island countries diagnosed by the Alliance for Hydromet Development, national services draw about 88% of their budgets from government, but three-quarters of that goes to salaries, three in four services depend on donor projects for anything else, and 95% have no resources for station maintenance or calibration (Alliance for Hydromet Development 2024). Nearly one-third of national meteorological services told WMO in 2025 that they have no funds for infrastructure or service upgrades at all (WMO 2025b). The result is a landscape of stations installed by one project and abandoned before the next; around 45% of surveyed stations are inoperable (Alliance for Hydromet Development 2024). The Global Status report's verdict is that funding is "rising but not targeted or sustained for long-term operations and maintenance" (WMO and UNDRR 2025).

Countries that have broken this pattern have two things in common: early warning has a line in the national budget and a basis in law (Table 1).

Table 1. Countries that have mainstreamed early warning into national budgets and law

Country	What was mainstreamed	Source
Japan	JMA budget of ¥55.8 billion (FY2025), of which ¥19 billion is operations and maintenance; alert system enshrined in law; 97% fewer disaster deaths than the 1950s–60s	MLIT Japan 2025; GSMA 2026; World Economic Forum 2023
India	Heat and lightning notified as national disasters in August 2026 on the Finance Commission's recommendation, unlocking state and national disaster funds; Mission Mausam 2,000 crore for radars, computing and AI	Sirur 2026; PTI 2024
Bangladesh	EW4All national roadmap 2025–2030 costed by pillar (about USD 132 million for Pillars 1–3) funded through the government's development budget alongside World Bank, ADB and JICA	WMO 2026
Kazakhstan	Kazhydromet fully funded from the state budget since 2021; national flood and drought early warning system agreed August 2026 under the Civil Protection Law and Water Code	World Bank 2022; Birbayeva 2026
Philippines	Republic Act 12287 (2025) allows a state of imminent disaster to be declared three to five days ahead, releasing funds before impact	Department of Agriculture and FAO, in funds for NGOs 2025



Community in Zambia after the floods of January 2023
Photo by agricomm; IWMI

The hydropower chapter of Eyes on the Storm shows the same logic at sector level. After the 2021 Chamoli avalanche, India's Ministry of Power mandated early warning for vulnerable hydropower projects; NHPC's cloud-based system is now credited with protecting staff and equipment through the 2022 and 2024 Subansiri floods (Amarnath and Alahacoon 2026).

The International Hydropower Association's resilience guidance ties early warning protocols to investor requirements, turning them from an optional extra into a condition of finance.

From warning to money

A warning saves lives only if someone can afford to act on it. Pre-arranged finance – money agreed before a disaster and released when a forecast or observed trigger is met – is the instrument that closes the gap. It reached a record USD 9.4 billion in 2024, with payouts more than doubling to USD 879 million. But the growth has come from contingent loans, which are available mainly to countries with the capacity to borrow. Low-income countries and fragile or conflict-affected states each receive less than 7% of the total, and development-partner support for pre-arranged finance amounts to about 1.2% of all crisis financing (Figure 3) (Plichta et al. 2025).

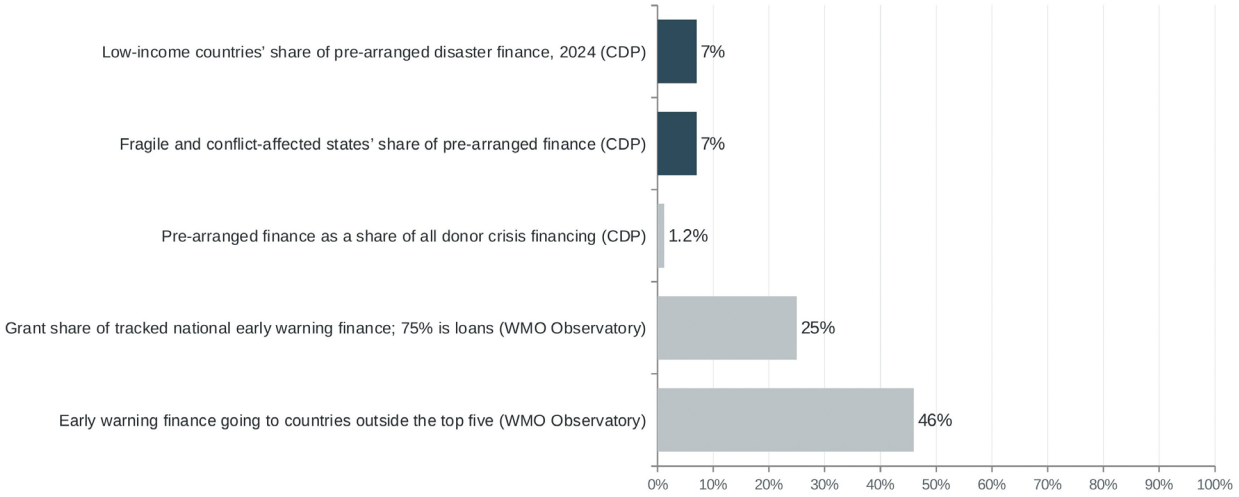


Figure 3. Share of early warning and disaster risk finance reaching the most exposed countries, 2024–2025 (per cent of each total). *Sources:* Plichta et al. 2025; WMO–UNDRR Global Observatory 2025. Country-group shares plotted as upper bounds ("less than 7%").



The community-based flood early warning system on the Ratu River: a low-cost water-level sensor on the bridge transmits readings to a caretaker's home, who alerts downstream communities in Nepal and India.
Photo by Mahendra Bahadur Karki/ICIMOD



An area of degraded land in the Ferlo region of Senegal.
Photo by G. Gray Tappan

As Figure 3 shows, countries facing the greatest disaster exposure and tightest budgets receive the smallest shares of funding, largely as debt.

Where early warning and finance are linked, the results are measurable:

- Jamaica, Hurricane Melissa, October 2025. Within fourteen days the government received USD 91.9 million from Caribbean Catastrophe Risk Insurance Facility (CCRIF) parametric policies; its USD 150 million catastrophe bond paid out in full by 1 December. A disaster risk financing strategy built over several years turned a category-five storm into a budgeted event (CCRIF SPC, n.d.; World Bank 2025).

- Southern Africa, 2024 El Niño drought. African Risk Capacity policies paid out USD 32 million for Zimbabwe, USD 9.9 million for Zambia and USD 11.2 million for Malawi; Zambia's payout reached 462,000 people through the government's existing cash-transfer system (African Risk Capacity 2024).

- Bangladesh, 2020 monsoon floods. Cash of USD 53 per household reached 145,000 people four days before the flood peak; recipients were 36% less likely to go a day without eating and lost fewer assets and livestock (Pople et al. 2021). The Dhaka heatwave protocol described in *Eyes on the Storm* follows the same model, with IFRC finance released once a temperature trigger is crossed.

- Anticipatory action globally. There were 262 active frameworks in 2025, up 70% in a year, with 146 activations in 54 countries protecting 9.6 million people (Anticipation Hub 2026). Even so, anticipatory action remains well short of the 5% of humanitarian funding that donors committed to under the Grand Bargain (OCHA 2025). FAO's review of ten interventions finds returns of up to USD 7 per dollar, though most cases return less (FAO 2023).

The International Institute for Environment and Development's (IIED) 2025 analysis of eight countries puts the choice starkly: a one-in-twenty-year event would cause USD 21.4 billion in losses; covering those losses reactively through humanitarian response and social protection would cost about USD 93 billion by IIED's estimate, whereas the same protection through early investment costs USD 4.1 billion (Bharadwaj and Karthikeyan 2025). The constraint is not evidence but plumbing: defined triggers, existing budget lines and instruments contracted in advance. Bangladesh's Disaster Management Fund, for example, still cannot release money on a forecast; a 2026 roadmap to add forecast-based triggers and budget codes is the kind of reform this brief argues for everywhere (Prothom Alo 2026).

Who else can pay

Public finance alone will not close the gap. The 2025 collapse in official development assistance, down 23% in a single year and 26% for bilateral aid to the least-developed countries,

has settled that question (OECD 2026). Four other sources are already in use and can be scaled.

Blended and outcome-based instruments: CREWS' 2030 strategy targets USD 1 billion in additional finance by combining USD 400 million of de-risking with USD 600 million of co-finance, and commits to working directly with finance ministries (CREWS 2025). SOFF's Climate Data Impact Bond, launched in 2025, aims to raise USD 200 million of upfront investor capital by end-2026 against donor outcome payments, enough to bring thirty least-developed and island countries up to basic observing standards (SOFF, n.d.).

Telecom regulation and Universal Service Funds: Thailand financed its national cell broadcast system with USD 33 million from its Universal Service Obligation fund, covering capital costs and three years of operation; Argentina's fund covers capital while operators pay to run it (GSMA 2026). With 98.9% of the world's population under mobile coverage, the same mechanism could fund last-mile delivery in most of the 140 countries that still lack an inclusive mobile warning system (ITU, n.d.).

Private data and analytics: Google's Flood Hub now forecasts river floods up to seven days ahead for two billion people in more than 150 countries at no cost to governments (Google, n.d.). Commercial radar satellite operators such as Synspective and ICEYE supply all-weather damage mapping within hours, as the Noto earthquake response in *Eyes on the Storm* shows (Amarnath and Alahacoon 2026); the insurers Swiss Re and Munich Re already buy such data (NewSpace Economy 2026). IIED's work with Zurich demonstrates the reverse flow: insurers' catastrophe models can make the business case for resilience, showing a four-to-sixfold return on power-sector investments (Bharadwaj and Karthikeyan 2025).

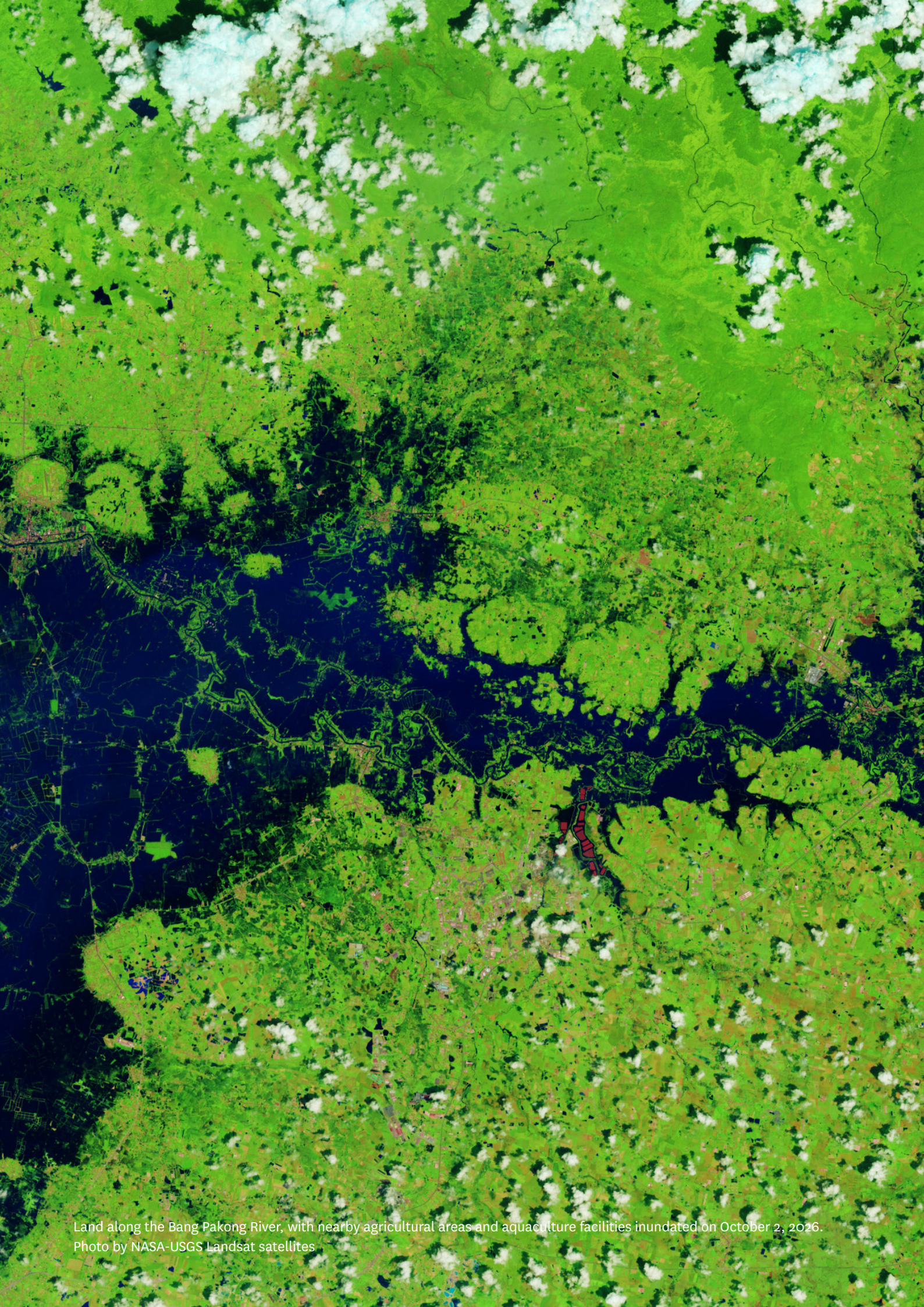
New public windows: The Fund for Responding to Loss and Damage opened its first USD 342 million call in 2026 and received USD 2.8 billion of requests; its guidance covers planning frameworks and gaps in climate information, so early warning is within reach if countries ask for it (Fernandez 2026). Around half of new nationally determined contributions (NDCs) and all submitted national adaptation plans (NAPs) reference early warning, but only a quarter of NDCs specify what they will build (UNFCCC and GEO 2024; C2ES 2025); NDC 3.0 submissions ahead of COP31 are the moment to attach costed early warning commitments that climate funds can finance.

The common thread is that each of these sources needs a public counterpart: a trigger, a regulation, a budget code or a roadmap. Where the rules are clear, private firms supply data and capital, as CREWS' partnership with a Tongan weather-app developer and Intersec's role in England's new flood warning service both show (Amarnath and Alahacoon 2026). Where the rules are absent, they do not.

Key recommendations

The six recommendations below follow the value chain from observation to action. Each names the actors best placed to deliver it, and each can be started within existing budgets and mandates.

1. **Fund the fuel, not only the build** (*Pillar 2; finance ministries, multilateral development banks (MDBs), climate funds*). Every early warning investment should carry a ring-fenced operations and maintenance line for at least ten years, reported separately, and national hydromet services should have a protected budget code. Donors should stop counting stations installed and start counting stations that still report.
2. **Change the mix for the most exposed** (*all pillars; MDBs, climate funds, donors*). Shift early warning finance for least-developed countries, small island states and fragile settings from loans to grants and highly concessional terms, and set a floor on their share of pre-arranged finance, which today is under 7%.
3. **Bring risk knowledge and hydrology inside the financing architecture** (*Pillars 1 and 2; WMO, SOFF, GCF, World Bank*). Extend SOFF-type systematic financing to river gauging and to exposure and vulnerability data, the two cheapest and least-funded parts of the chain, so that flood and drought warnings have the data they depend on.
4. **Attach money to every warning** (*Pillar 4; governments, humanitarian donors, risk pools*). Each national EW4All roadmap should name the pre-arranged instrument that will pay when its triggers are met, whether a contingent credit, a regional risk pool, an anticipatory window or a national fund with forecast-based release rules, and raise anticipatory action to at least the 5% of humanitarian funding targeted under the Grand Bargain.
5. **Use telecom regulation to pay for the last mile** (*Pillar 3; regulators, ITU, GSMA, operators*). Mandate cell broadcast and the Common Alerting Protocol as licence conditions and fund them from Universal Service Funds, as Thailand and Argentina have done, so that no country is held back by a USD 2 million platform.
6. **Lock early warning into the climate finance cycle before 2027** (*all pillars; governments, UN Framework Convention on Climate Change (UNFCCC)*). Put costed early warning commitments into NDC 3.0 and NAP updates, request them explicitly from the Loss and Damage Fund, and use COP31 to secure the financing that will sustain EW4All beyond its deadline.



Land along the Bang Pakong River, with nearby agricultural areas and aquaculture facilities inundated on October 2, 2026.
Photo by NASA-USGS Landsat satellites

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Acknowledgments

This brief is based on the Eyes on the Storm webinar series, a collaboration between IWMI, the International Telecommunication Union (ITU), the World Meteorological Organization (WMO), the Coalition for Disaster Resilient Infrastructure (CDRI), COPE Disaster Champions, the International Federation of Red Cross and Red Crescent Societies (IFRC), the Risk-informed Early Action Partnership (REAP), the UK Met Office, the UN Economic and Social Commission for Asia and the Pacific (UNESCAP), and the UN Office for Disaster Risk Reduction (UNDRR). The authors thank the presenters whose evidence it synthesizes.

This work was partially supported by the CGIAR Climate Action Program and Japan's Ministry of Agriculture, Forestry and Fisheries. The authors are grateful for the support of the CGIAR Trust Fund contributors (www.cgiar.org/funders).





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Suggested citation

Amarnath, Giriraj, Alok Sikka, Ian Overton, Ritu Bharadwaj, Avinash Venkata Adavikolanu, and Catalina Jaime. 2026. *Financing the Last Mile: An Investment Case for Early Warnings for All*. International Water Management Institute. https://doi.org/10.5337/2026.233.

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