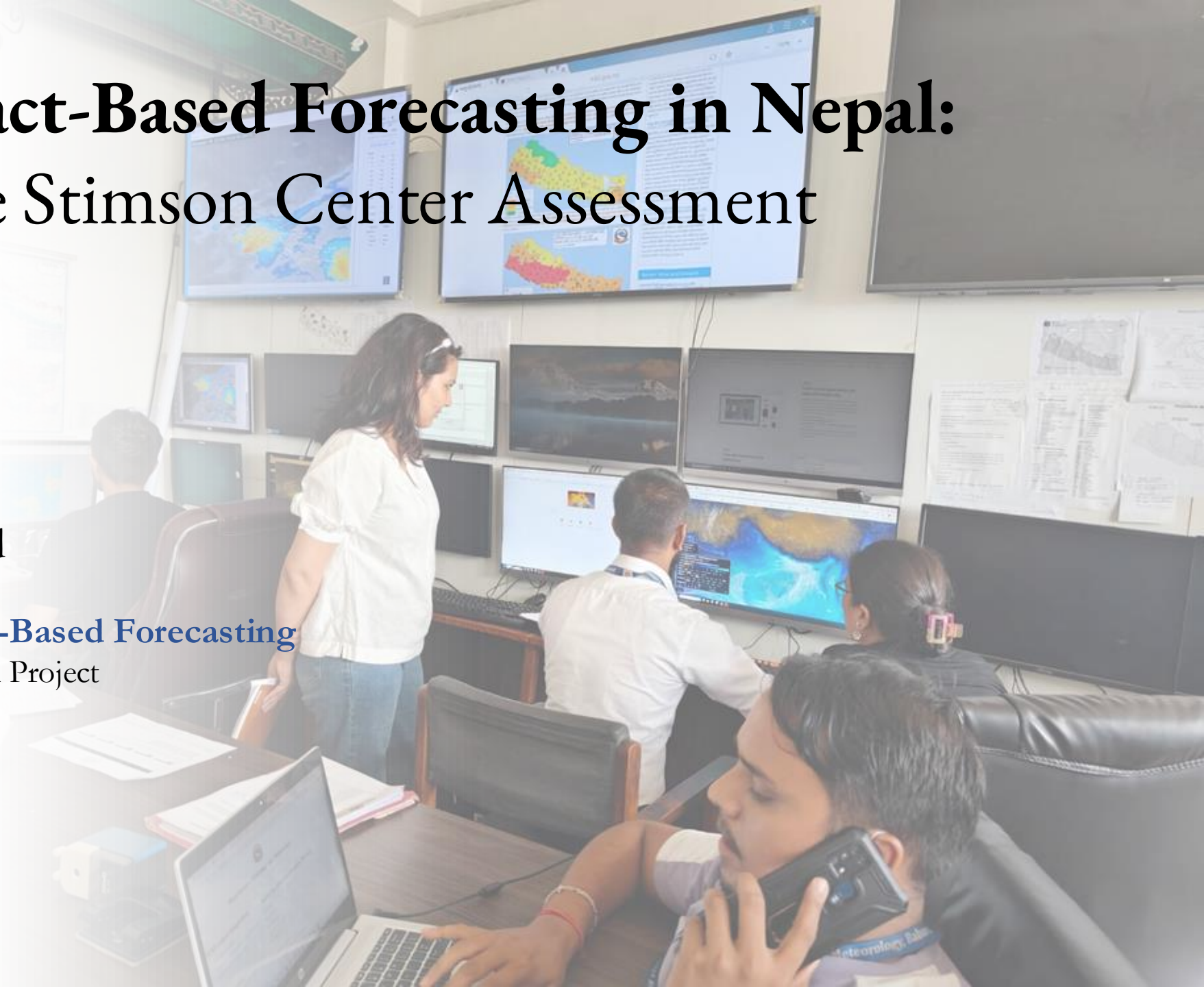
Enhancing Impact-Based Forecasting in Nepal: Findings from the Stimson Center Assessment



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Regional Workshop on Impact-Based Forecasting
SAHF IBF WG Implementation Plan Project

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Stimson's Assessment of DHM's Impact-Based Forecasting Program (Oct 2024 - June 2025)

Assessment Goals

- To analyze current IBF program structure and function, protocols and practices – identifying strengths and weaknesses
- Generate a series of strategic recommendations for DHM that can help improve IBF processes and operations
- Use our findings to facilitate dialogue among key IBF stakeholders about shared challenges and best practices
- Share ideas that can support DHM's goals to expand their IBF program to other high-risk areas across Nepal in the coming years

Process

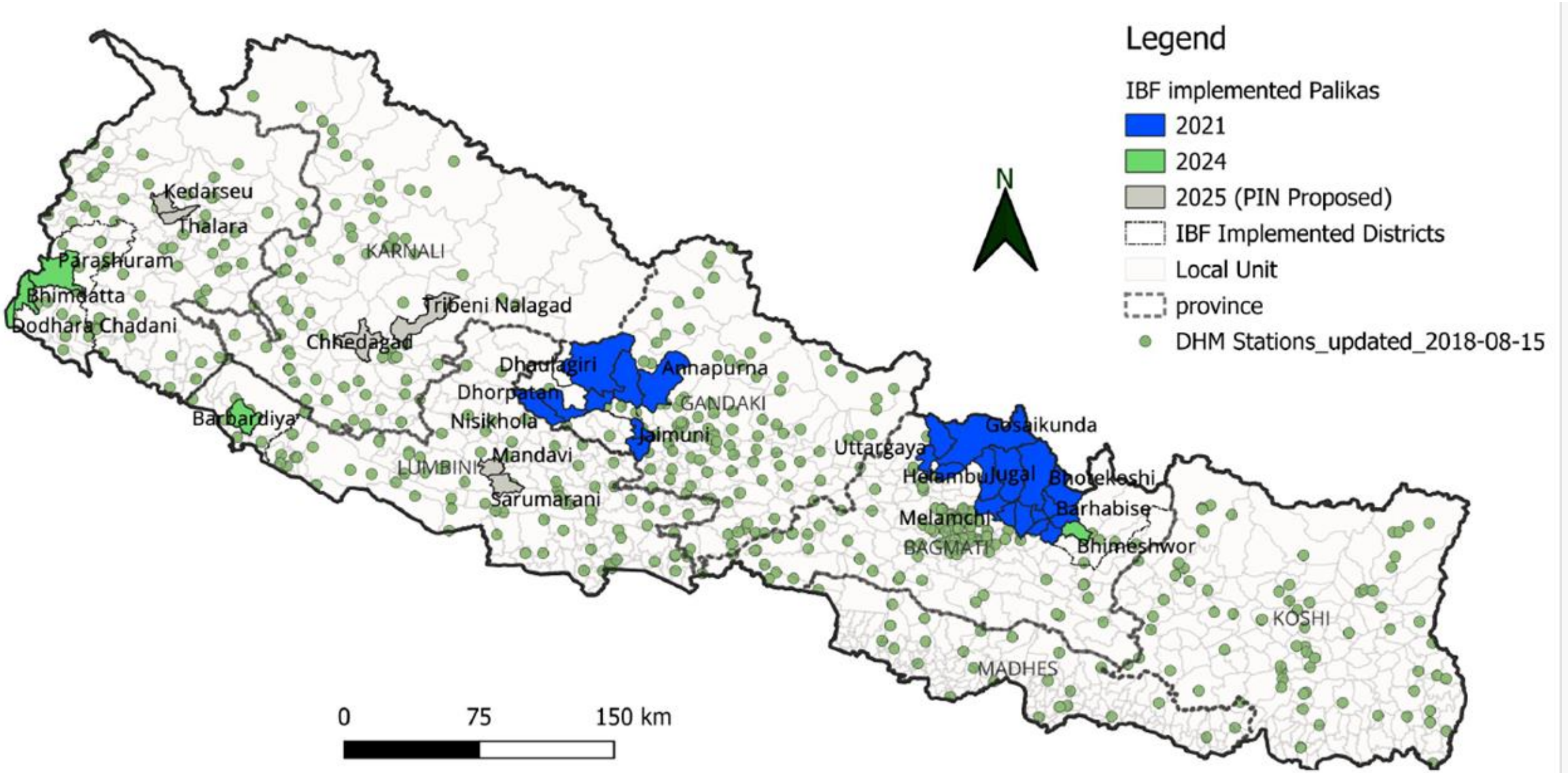
- August/September 2024: The former Director General of Nepal's DHM asked Stimson to conduct a formal third-party assessment of DHM's Impact-Based Forecasting (IBF) program - Stimson submitted a formal proposal and received official DHM approval in Sept 2024
- Oct 2024 – May 2025 - Data collection and field-based research
- May 2025 - Findings were shared with DHM colleagues and presented at the IBF Partners Workshop held in Kathmandu on May 10, 2025
- Final report was delivered internally to DHM in early June 2025

Impact-Based Forecasting Stakeholders in Nepal

- Effective IBF requires intersectoral cooperation at multiple scales
- NGO actors have proven to be critical partners in piloting IBF and building momentum
- More data collection, information sharing and collaboration is required to improve and expand IBF systems

The Evolution of Impact-Based Forecasting in Nepal

Year	No. of Piloted Districts and Municipalities	Districts Covered	IBF Implementation Type	I/NGO Support	Trainings and Workshops
2021	4 Districts, 16 Municipalities	Sindhupalchowk, Rasuwa, Myagdi, Baglung	Daily IBF Bulletins		Initial Training on Weather Forecast by UK Met to DHM
2022	4 Districts, 16 Municipalities	Sindhupalchowk, Rasuwa, Myagdi, Baglung	Event-based, targeted for bad weather with Heavy rainfall as Hazard and Landslide as Impact	PIN	Virtual Training to LGs by UK Met: 2021 Review and 2022 Preparation; Training Workshop on IBF to Sectoral Ministries and DHM by RCRCC
2023	4 Districts, 16 Municipalities	Sindhupalchowk, Rasuwa, Myagdi, Baglung	Event-based, targeted for bad weather with Heavy rainfall as Hazard and Landslide as Impact	PIN	Monsoon Reflction Workshop by PIN in its working areas
2024	8 Districts , 29 Municipalities	Sindhupalchowk, Rasuwa, Myagdi, Baglung, Dolakha, Bardiya, Kanchanpur, Dadeldhura	Event-based, targeted for bad weather with Heavy rainfall as Hazard and Landslide and Flash flood as Impacts	PIN+ IHRR	Monsoon Reflection Workshop by PIN and IHRR in its working areas



At the time of assessment- DHM's Impact-Based Forecasting program was active in 29 municipalities across 8 districts in Nepal –IBF implemented in 31 palikas in 2025, and expected to expand to at least 6 new municipalities in the future)

IBF Assessment Methodology

- Repeated Consultations with DHM Meteorological Forecasting Division team
- Field Consultations in IBF Program Areas: FGDs and KIIs with Local Government, DRR Focal Person, CDMC members, and vulnerable populations
- KIIs with IBF Pilot NGO Partners (PIN & IHRR)
- Consultation and Interviews with NDRRMA
- Expert Interviews with IBF & EWS practitioners (national, regional and international)
- IBF Sessions/Workshop in Sindhupalchowk
- Participating in IBF & AA related discussions hosted by IHRR, RIMES, NDRRMA AA Clinic
- Content analysis of IBF bulletins & DHM special bulletins
- Content analysis of CDMC Viber group conversations and Social media posts & analysis of DHM public communication and outreach (e.g. themed videos)
- Literature review of IBF related policy and guidance documents (e.g. WMO, UKMet)

Stakeholder Engagement

- Stakeholder consultations were conducted across 18 municipalities in 8 districts (over 60 % of total IBF area)

- 162 stakeholders engaged in total

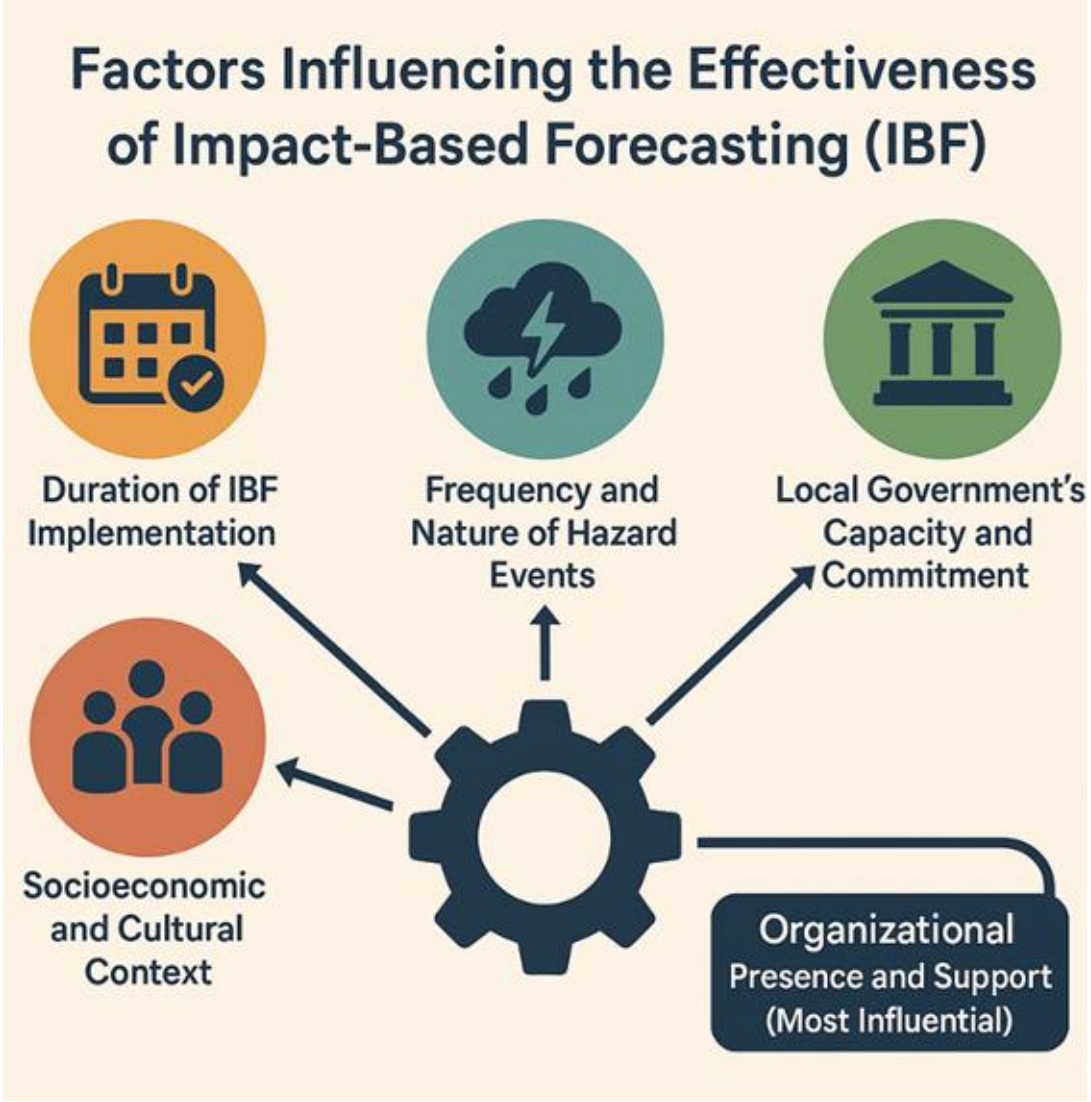
GoN Institutions (DHM, NDRRMA)	10
Local Government (Chairman/Mayor, Deputy Chairs, DRR Focals, LEOC Personnel)	31
IBF Partners (PIN, IHRR, CSRC)	12
Other NGOs and Practitioners	5
EWEA/IBF Experts	8
Other Sectoral Experts (Ncell, Hydro)	2
CDMC & Community Members	14 FGDs (94 Participants)

Key Findings & Strategic Recommendations

IBF Outcomes in May 2025: Significant Progress, Yet Uneven

- Significant momentum and demonstrable government ownership in places like **Bhotekoshi** - four years of work yielded high-quality relations, effective data management, locally-led
- Successful IBF-driven early actions and no casualties in **Dodhara-Chandni** during the recent record-breaking cloudburst Event (July 7, 2024) demonstrate the value of IBF and need for links to AA
- Slower progress (or lost momentum) in **Baglung** or **Myagdi** – where there is less involvement and fewer DRR planning activities, despite risks (though recent hazard events have increased IBF interest)
- In places like **Melamchi** and **Helambu** - a different modality for IBF/EWS is being implemented - much of the work required for effective IBF is going on, but is not effectively synced with DHM's approach – a missed opportunity of sorts

Signals a need for SOPs, greater coordination between sites, and knowledge sharing activities



Navigating Core Challenges & Limitations

- **Geographical Complexity Limits Downscaling:** *"It is not really possible for any federal agencies to generate forecasts for specific areas…. The ground scenario is extremely complex. People are coming up with so many high-middle-low risk colors that come from GIS, but the reality is different."*
- **Data Sparsity due to the station network:** Himalayan geography and resource constraints limit possibilities for installing and maintaining station networks
- **Climate change increases forecast uncertainty** - creates increased volatility, increasing recurrence of extreme events, and new patterns of impact (exposure and vulnerability)
- **Human interventions create a dynamic risk environment:** *"Conditions are always changing. There are many cases where experts say a place is safe and then next year a landslide or flood happens, and people need to shift… or new road construction diverts water flows and increases risk in new places."*
- **Risk communication is a chronic challenge** and public awareness about disaster risk concepts and forecasting is limited
- **Feedback loops :** Limits to downscaling and spatial resolution limit stakeholder buy-in and interest (creating a Catch-22); unexpected extreme events like the 2021 Melamchi disaster; Kathmandu floods in September 2024 are unforeseen

Summary of Key Findings

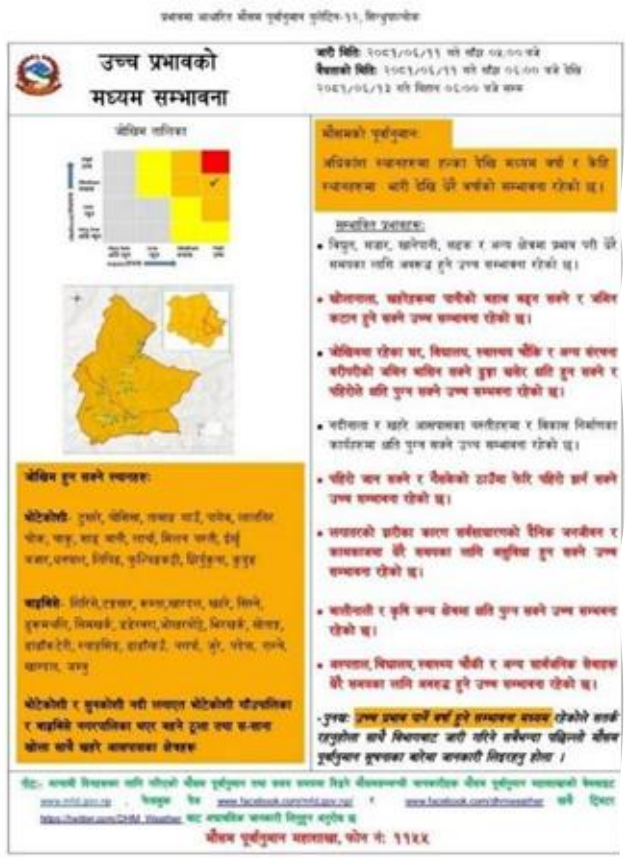
- **Forecast accuracy is improving** along with post-event validation practices, but downscaling remains a challenge (technical support and training is needed)
- **Information infrastructure and formal SOPs should be developed** to limit variance driven by uneven patterns of impact data collection and management
- **Both positive and negative case studies suggest that IBF is NOT successful in a vacuum** – but as an alerting mechanism complementary to other DRM actions, from standardized monsoon preparedness to the site-specific EAP development
- **Municipal "DRR Focals" are essential actors** in information dissemination, outreach, and data management needed to improve IBF in place - more sharing between sites is needed
- **Nepal's IBF bulletin template should be formally workshopped** to identify key user needs, and new data visualizations and language for effectual risk communication
- **Disaster response and other immediate DRM concerns often crowd out IBF** during local government meetings (e.g. DDMC) – bias toward present issues, classic issue
- NGO partners are useful for building IBF program momentum, enabling data collection, and enhancing dialogue - **long-term sustainability requires local government ownership**
- The majority of IBF stakeholders value IBF bulletins but many hope for more information - signals **a need to manage expectations and communicate uncertainty**

IBF Partners Workshop (May 2025) Breakout Session Findings:

Strengthening IBF Bulletin, DRR Focal Support & Information Management

Highlights the value of conducting focus groups to evaluate language, format, and visualizations

More collective brainstorming needed to refine information products – support of key advisors like BBC Media Action has made a difference in 2025



Specific Recommendations on Improving the IBF Bulletin

- The quantitative forecasted rainfall range should be clearly specified in the IBF bulletin, providing quantitative estimates to improve preparedness.
- The IBF bulletin could mention the first point of contact at both the local and district levels, helping stakeholders know exactly who to reach out to during emergencies.
- The IBF bulletin could include a link to the respective Palika's website, so users can access more detailed information and coordinate directly with local authorities.
- Forecasts at the basin level are necessary, especially in areas like Baglung–Jaimini Municipality, to better reflect hydrological risks and support watershed-scale planning.
- Recommended actions (when provided) in the current IBF bulletin are too general, and should instead offer concrete, multi-line instructions such as "Ensure crops are insured within 48 hours" or "Postpone harvesting in the red zone until conditions stabilize.
- DHM can explore the possibility to provide real-time AWS/weather data via API integration to Palika websites, if Palika requests it.
- The IBF can feature a graphical representation of rainfall evolution over three days, clearly showing which day has the highest concentration of rainfall, similar to the format already used by DHM.
- If a school or critical facility is at risk, its name should be clearly listed in the impact section, to alert local officials and families
- Can a QR codes be included in the bulletin that takes users to a DHM webpage that explains key terms and concepts
- Many other ideas….

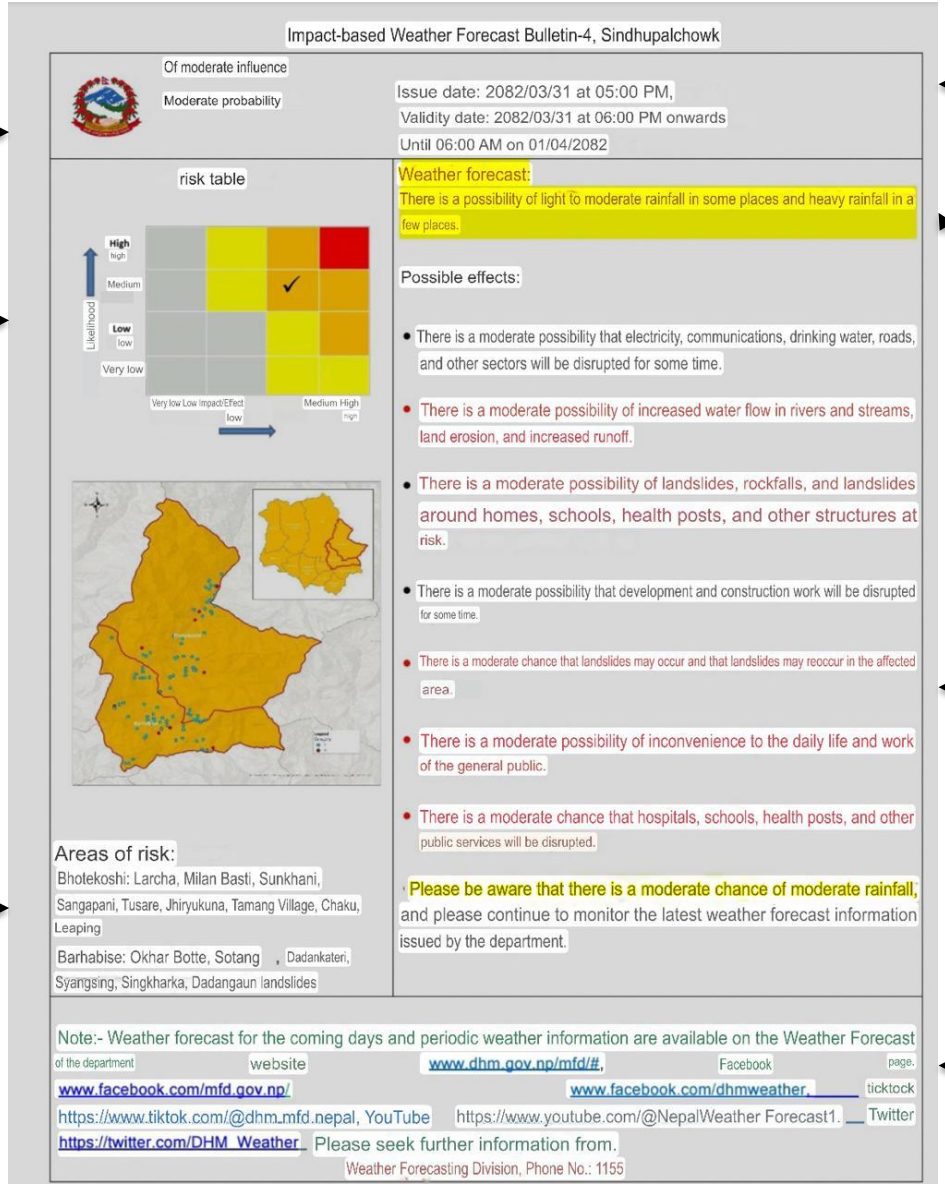
DHM's IBF Bulletin for Bhotekoshi Rural Municipality (2025)

Hazard Information :
the magnitude of the hazard and the probability/likelihood of the event.

Likelihood and Level of Impact: The Risk Matrix
a communication tool used to assess and convey risk by plotting the level of impact against the likelihood of occurrence of hazard.

Location of Impact:
Visual representation, using district or municipal maps indicating risk level using the color code from the Risk matrix.

Probable Areas of Risk
List of municipalities/communities identified as high-risk areas, based on information collected and verified by the respective local governments.



Time and date/period of expected impact.
- the Issued date- when the IBF Bulletin is released and shared
- the Validity date- when the effects will begin and when they are expected to cease.

Weather Forecast
the expected intensity of rainfall and probable spatial scale of the forecast.

Probable Impacts/Types of Impact
- detailed information about the potential impacts and the severity of those impacts.
- outlines who and what may be affected, and in what ways.
- it primarily targets communities, highlighting the disruption of essential services

Sources for Weather Information
Links to official websites and social media platforms where weather information is regularly updated.

DRR Focals Play a Pivotal Role: Increase Coordination & Support

Problem : DRR Focals are critical actors in all areas, but the quality of DRR Focals' work is very uneven, in part because they are very busy and chronically overcommitted (particularly during the monsoon). DRR Focals are not often in communication on IBF – which is a missed opportunity.

Recommendations

- Take Steps Toward Formalizing their Role in IBF? Requires funding to formally modify TORs, but a worthwhile investment
- Organize customized trainings for DRR focals and develop SOPs for data collection
- **Technical Support:** DRR Focals chronically report a lack of technical support to help streamline processes and improve response times. One commonly cited example is the need for GIS skills and support. We recommend organizing GIS trainings (perhaps using Survey123) or trying to create a GIS lead at the provincial-level who could work on IBF and other DRM activities (Previously, RIMES provided GIS support, but with the cessation of their assistance, operationalizing LEOC has become more challenging)
- **Increase coordination between DRR focals** and facilitate information sharing - since we found – by creating monthly DRR Focal IBF Coordination calls
- **Improve continuity and increase institutional memory during personnel transitions** (e.g. shared email accounts provide access to past IBF content and comms; create a password-protected archive of bulletins)
- **Integrate DRR Focals within ongoing M&E functions** (see below); formally supporting this aspect, which easily gets lost

IBF Sessions at the Nepal DHM UK-Met Office Training Workshop

DHM Headquarters, Kathmandu
November 20-21

Major Highlights:

- Refresher Course on IBF by UK-Met
- Post-Monsoon IBF Coordination
- Group Discussions / Breakout Sessions
- Exercise on “Mapping Impacts, Vulnerabilities, and Key Early Actions”
- **Highlighted role of DRR Focal Persons in IBF** – highlighted practical examples, challenges, and best practices for data/communication management

Complemented by Stimson’s “DRR Focal Persons Listening Session”

Impact Data: The Heart of the Matter

Problem 1: Collecting the data necessary to assess potential impacts (hazard, exposure, and vulnerability) takes time, energy, and effective lines of communication – it also requires localized validation to be credible and considered by IBF alerting authority.

Problems 2 & 3: Impact data is often uneven and imperfect, limiting comparative analysis. Any risk assessment process must reckon with issues of resolution – what is the appropriate scale and unit of analysis?

Localized Data Collection is Essential – Needs to Recognize Data Standards but Also Capture Local Nuance

Since DHM cannot be present in all IBF locales, **impact-related data must be collected by local authorities** (often in partnership with local NGO partners, CDMC leads) – a lot ends up resting on the DRR Focal Persons

Dynamic impact data is critical – timely updates to impact data are needed throughout the monsoon, as landslide activity increases, cracks develop, road erosion creates new gullies, bridges damaged, or riverbeds aggrade. Extreme precipitation events can come in waves.

Better leverage existing data: DHM can utilize the **updated Geohazards Assessment data,** complemented **by updated hazard inventory data** collection from PIN (Survey123) and IHRR (Victory)

Increase Engagement of Local Communities in Data Collection & Localized Hazard Monitoring

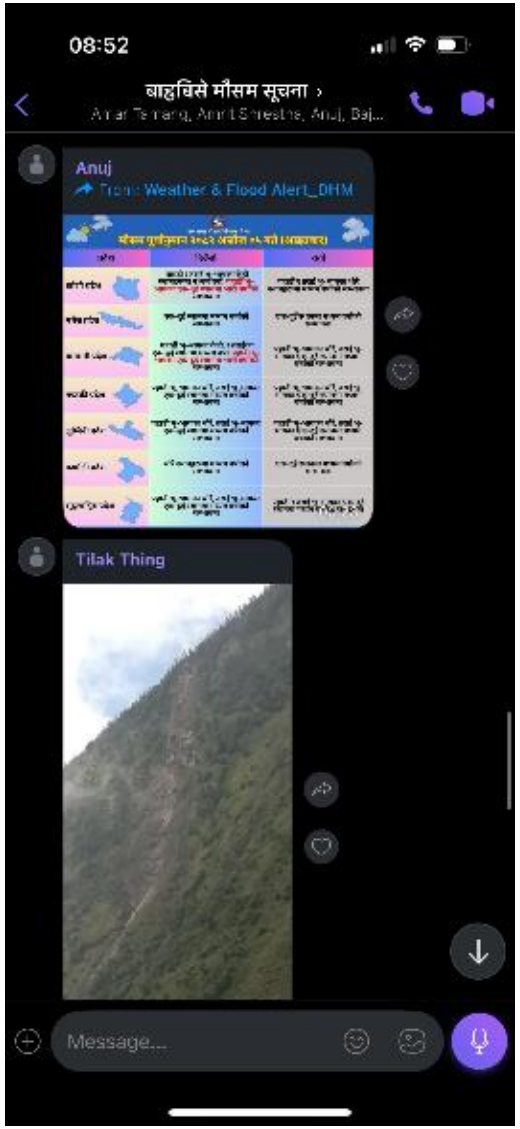
***Critical to establish channels of two-way communication that enable timely risk assessment and alerting chains**

***Engaging people in the process and improving early action plans can be just as important as issuing early warnings**

Creating opportunities for local communities to actively contribute to monitoring processes can help:

- Enhance data on localized hazards and potential impacts
- Improve social data on exposure and vulnerability – beyond assets to consider livelihoods and mobility
- Calibrate risk communication for local audiences – focus groups to test messaging and develop lexicon
- Support maintenance and troubleshooting for monitoring systems
- Build knowledge networks for “citizen science”

Building dialogue and trust is a process that takes time and space – work with trusted partners and start now!



Understanding Vulnerability is Critical for Linking IBF & AA

VULNERABILITY DATA is a CHRONIC PROBLEM (… and when people talk about vulnerability they are often just talking about exposure, and not uneven patterns of social vulnerability)

The resolution of impact data varies considerably between different program sites; and some available data is not incorporated - **HOW TO SCALE?**

- Collecting the vulnerability data on necessary to assess potential impacts **takes time, energy, and effective lines of communication** – it also requires **localized validation to be credible** and considered by IBF alerting authority.

- We have some great examples where impact data is high-resolution and highly nuanced (e.g. Bhotekoshi or Kanchanpur) but **how to scale these resource-intensive approaches**?

- **So what is appropriate?:** UKMet (2020) suggests that vulnerability data should be collected to reflect the specific kinds of impacts an IBF program is concerned with…

UPDATE: In 2026 Stimson plans to convene a Vulnerability Working Group in Nepal to discuss and co-develop new approaches to vulnerability assessment – targeting benefits within and beyond the IBF program

Improving Dissemination & Communication

- **Implement the Common Alerting Protocol (CAP)** for IBF message dissemination and consistency (underway)
- **Expand the widely used 1155 system to include sharing of IBF information to increase reach** (currently 1155 only reports observed weather conditions, providing limited opportunities for early action)
- **Continue to use a blend of different methods** – radio and IVR have different strengths and audiences
- **Increase IBF reach by assigning and training focal persons within small at-risk communities in IBF areas that lack formal CDMCs – this** can help with timely bulletin dissemination and effective coordination of early actions (an approach already practiced in some areas)
- **Enhance accessibility to improve reach to persons with disabilities (PwDs)** – working in consultation with disability experts and disabled persons organizations (e.g. National Federation of Disabled-Nepal) on communication tech
- **Install voice-recorded siren systems in selected areas** –such as the one installed in places like Bahrabise, which can be include alert messages in minority languages

Develop a Monitoring & Evaluation Framework

Evaluating Hydromet Forecasts: Reviewing forecast accuracy; identifying trends in over/underestimate of forecasts; improving ensemble modeling and integrated forecast SOPs

Monitoring IBF Program Function: Evaluating distribution and dissemination – timely receipt, reach (spatial and social), clarity. Collecting data on stakeholder understanding and behaviors; documenting user feedback; workshopping language for risk communication

Evaluating Impact Data: Validating impact data and following up after events of all sizes, checking on impact forecast; creating case studies and updating the lexicon of potential impacts with geolocations.

Calibrate and Validate Thresholds: Improve risk matrix decision-making and manage datasets to support ML training

Create Case Studies & Info Products: Document past events (positive and negative) based on collective MFD and partner review of select events; create internal docs and also public-facing info products for outreach and awareness

Facilitating Trainings: Trainings for DRR Focals – onboarding and pre-monsoon refresher trainings for LGs and CDMCs. Synchronize trainings with periodic reporting and quality control efforts.

Enhance Coordination: facilitate monthly MFD forecaster meetings for collective review and evidence-based learning; harmonizing decision making and building SOPs; coordinate meetings with DRR Focal Persons (monthly; biweekly during monsoon)

Strengthen Connections Between IBF & Early/Anticipatory Action Programs

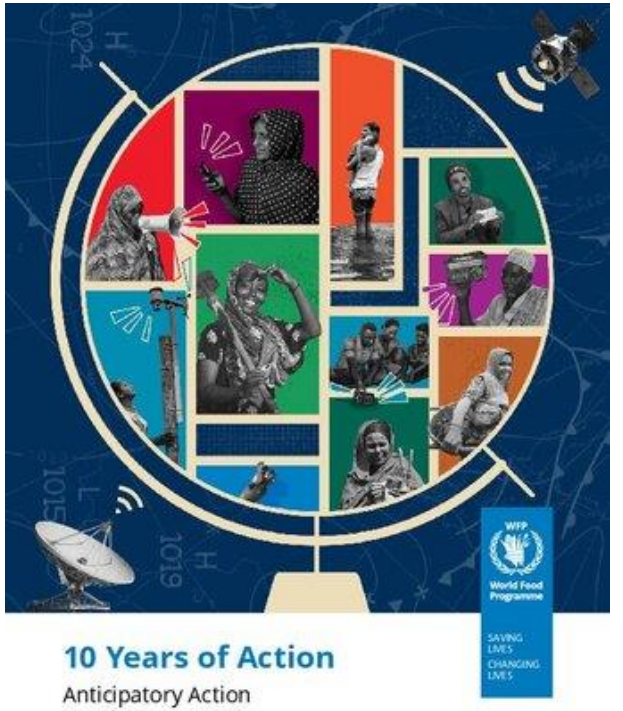
The effectiveness and success of IBF also hinges on the rapidity of response and early actions

Lead time required to enable early action is partly determined by the time it takes to coordinate and execute interventions (Coughlan de Perez 2016) – and Nepal's terrain creates friction and delays

Working with NGOs implementing anticipatory action projects is critical to ensure that IBF translates into tangible interventions and impacts - this work is already ongoing in select areas, but expansion and formalization is needed

Connections with new NGO partners can help identify user needs, design new IBF information products for trainings, and identify additional sources for impact-related data

Working with AA NGOs can enable strategic geographic expansion into new IBF program sites and enable IBF program expansion to new hazard types (we recommend heat waves and lightning)



Connecting IBF and Anticipatory Action: Takeaways from the 4th National Dialogue on AA

How to ensure IBFs are formally integrated into planning and response?

- Need a regular DHM–NDRRMA- NGO forum for structured dialogue and broader conversation.
- Hold regular coordination events (e.g., IBF partners workshop) to **link impact data with early action thresholds**
- Improve impact data quality through collaboration (examples: PIN, IHRR)

Dr. Archana Shrestha, DHM:
"Impact-based forecasting (IBF) has helped reduce human and economic losses by enabling timely preparedness in response to heavy rainfall, as seen in areas like Dodhara Chandani."

Bibhuti Pokharel, DHM:
"The most important thing is to move from forecast to action. Actions are scattered, and we need to channelize them effectively from the central level."

Stimson Webinar on Anticipatory Action in Nepal (Jan 26, 2026)

- Stimson recently hosted a webinar on "**The Evolving Landscape of Anticipatory Action in Nepal**"
- Discussed 10 years of AA efforts and policy progress
- Shared key takeaways from the 4th National Dialogue on AA (Dec 22–23, 2025)
- Explored future opportunities and next steps
- Follow-up **webinar on "Operationalizing Anticipatory Action"** will also focus on **connections to IBF** (March/April 2026)

What Might Future of IBF in Nepal Look Like?

Key Questions about the Future of IBF in Nepal

1. What approaches to geographic expansion seem appropriate and effective for Nepal now?

- Patchwork of strategic priority areas? Methods for site selection (e.g. past events, NGO or donor focal areas, priority infrastructure)? Coordinated with strategic expansion of station network?
- Can IBF be scaled to create a proof of concept at the provincial scale? Is a national IBF system a necessary goal?

2. How can IBF be expanded to other hazard types? In 2025, Stimson recommended expanding IBF to focus on heat waves and lightning – these are timely issues, new models and sufficient data and within DHM technical capacity (funding needed).

3. Alternative strategies for evidence gathering and forecast validation? Can we consider private sector/IHRR model for station network for model validation? Would creating more sector-specific IBF information products help enrich the data landscape?

4. What levels of automation are possible and appropriate to help improve IBF? How can we develop both SOPs, impact tables, and ML training data sets to support these efforts?

5. On Risk Communication & Outreach: How can DHM meet public demand for forecasts while managing expectations?

Dialogue & Knowledge Exchange is Essential

Bringing together IBF partners and stakeholders is critical to improve IBF systems and program outcomes – **coordination is critical**

The work of IBF has broader positive impacts on DRM and planning – **effective impact analysis and dialogue benefits all**

Our goal is **to help facilitate discussion and knowledge sharing** among different actors – to gather findings and synchronize efforts – because **there is still much to learn**

Improving IBF in Nepal requires both integrating international best practices and sharing on-the-ground experiences that reflect the Nepal context

Additional IBF Partner Workshops are planned for 2026, with activities continuing into 2027.

Helping Strengthen Regional IBF Dialogue & Knowledge Exchange

How can we enhance connection and knowledge exchange on IBF between Nepal and other Countries?

- Stimson plans to host **a public webinar event on "The State of Impact-Based Forecasting Challenges in Monsoon Asia"** -- highlighting IBF approaches, challenges, and lessons learned across South and Southeast Asia (~4-5 different countries represented – **targeting May 2026)**

- We recently **co-organized an IBF Workshop with the Lao PDR Department of Meteorology & Hydrology in Vientiane, Laos in December 2025** – and we plan to follow up with other technical support in the coming year

- **We propose hosting knowledge-sharing workshops** between Nepal and other countries (e.g., Laos, Bangladesh) – and we are seeking both interested participants and co-organizers

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Thank You

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