Needs and uses of scientific information for earthquake and monsoon contingency planning by humanitarian clusters in Nepal

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ABSTRACT

Embedding scientific knowledge in policy and practice is crucial for effective disaster risk reduction and planning, but key barriers remain in using science effectively for these purposes. In countries like Nepal, subjected to frequent multi-hazards like earthquakes and landslides, science is acutely needed but not always utilized for risk planning. Here we explore the current uses and requirements for science-based risk information in earthquake and monsoon contingency planning by the government-led, UN-coordinated humanitarian clusters in Nepal. Through a series of structured focus group discussions, we identify the information currently used in disaster preparedness and when that information is required. We find that all clusters share key information needs, including caseloads in terms of number of affected people or households and multi-hazard risk information, particularly around landslides. Information needs for anticipated but uncertain hazards like earthquakes are focused on large-scale vulnerability and risk mapping. In contrast, shorter-term needs for impending hazards, like impacts from the monsoon, are more detailed and cluster-specific. Respondents highlighted that scientific knowledge is well integrated into earthquake planning but less for monsoon planning. A significant barrier to this integration is the availability of data at appropriate spatial resolutions and with adequate lead times. For initial monsoon planning, long-term seasonal forecasts aggregated at district or provincial scales are preferred, but as the monsoon approaches, most clusters preferred higher spatial resolution data despite increased uncertainty. Improved multi-hazard risk information, including landslide, and better support for caseload determination are critical outstanding knowledge gaps that could be filled by new research.

Keywords
Multi-hazard risk, humanitarian contingency planning, disaster risk reduction, Nepal, earthquakes and related hazards, monsoons and related hazards

INTRODUCTION

The Sendai Framework for Disaster Risk Reduction (SFDRR) 2015-2030 has emphasised the use of science-based methodologies and tools to inform decision-makers about their disaster risk and to develop and implement appropriate preparedness and effective responses to disasters (UNDRR, 2015). The SFDRR has also identified the critical need for an interlinkage between science, policy, and practice to embed scientific knowledge and data within decision-making frameworks. From a humanitarian perspective, it is important that preparedness efforts are underpinned as much as possible by scientific evidence to improve ability to save lives and contribute to greater resilience (Southgate et al., 2013; Calkins, 2015).

One major use of scientific advice is to support disaster preparedness by decision makers within the government and humanitarian communities (e.g., https://evidenceaid.org/). Southgate et al. (2013) summarized several examples where science has been used effectively to inform policy and practice for preparedness, including tsunami warning and mitigation for the Indian Ocean region; earthquake early warning for high-speed trains in Japan; and flood and tropical cyclone early warning in Bangladesh. Implementation of science-based seismic building codes in Pakistan and Chile have also been cited as successful examples of science-informed preparedness measures (Maqsood & Schwarz, 2010; Brzev et al., 2010). These kinds of collaboration between the scientific community and government or humanitarian response agencies can help reduce the gaps between the science, policy makers and practitioners (Beaven et al., 2017; Woods et al., 2017; Barton et al., 2020). Critically, these examples of interlinkage and knowledge sharing depend to some extent upon a shared understanding of both the scientific information that can be made available, and the key information needs of decision makers (ISAC, 2013).

From the policymaker's side, some of the major challenges to integrating science effectively into disaster preparedness include: gaps in understanding of which types of information are available and relevant; lack of understanding on how to apply available scientific and expert knowledges for disaster risk reduction planning; effectively comprehending what can and cannot be said on the basis of current knowledge; and lack of institutional capacities for the integration of science in the preparedness and planning process (Albris, Lauta, & Raju, 2020). From the research side, gaps include: a lack of understanding on what the actual information needs of policymakers are and how that information could be used by specific groups; difficulties with effective communication and visualization of often complex concepts and methods; and difficulties in communicating uncertainty and its relevance. It is also important to acknowledge that there are often different priorities between researchers and decision makers; while the former typically prioritise robust methodologies and time for analysis, reflection, and thoroughness, the latter demand speedy information for immediate planning and resource allocation (Calkins, 2015).

Nepal is an exemplar of a country that is exposed to frequent, widespread and damaging multi-hazards triggered by both annual monsoon rainfall and frequent smaller to occasional large earthquakes. As a result, significant time and effort have been invested in contingency planning by both the government and humanitarian agencies. Within the framework of the SFDRR, it is instructive to understand the barriers to and opportunities for the use of scientific information on multi-hazard events for contingency plans. Humanitarian clusters, a sectoral coordination mechanism comprising UN and non-UN organisations for humanitarian assistance during emergencies, are widely recognized for their role in contingency planning and preparedness actions. Thus, this paper aims to explore the current use of scientific information within the co-led (government and UN) humanitarian cluster system in Nepal for earthquake and monsoon contingency planning. In particular, we focus on identifying both cross-cluster and cluster-specific needs in terms of scientific data and knowledge for planning purposes. By understanding the requirements of each cluster, we aim to demonstrate how the science and research community can develop and tailor scientific knowledge to ensure that critical information is useful, useable, and used by the humanitarian clusters to inform their preparedness. Doing so is critical for achieving the goals of the SFDRR before 2030, reducing the losses from future major events, and ensuring increased resilience in high-risk locations such as Nepal. Our positionality reflects our identities as natural hazard and risk researchers from Nepal, the UK, and New Zealand, including both physical and social science perspectives, as well as members of the UN Resident Coordinator's Office. Importantly, we target this research primarily at the scientific community to identify and highlight what the users of the science consider to be the barriers to its use and how it can be tailored to their real-world requirements.

THE HUMANITARIAN CLUSTER SYSTEM

The sudden onset of large-scale environmental disasters poses considerable challenges to local and national capacity for emergency response (Wolbers et al., 2016; Boersma et al., 2016; Lai & Hsu 2019; Fekete et al., 2020; Ogra et al., 2021). In cases where disasters overwhelm affected governments' response capacities to properly address immediate needs, they may request international humanitarian assistance through the United Nations Office for the Coordination of Humanitarian Affairs (UN OCHA), which serves as the focal UN agency on complex emergencies and disasters. Typically, this assistance is applied through the humanitarian cluster system (Figure 1) which was developed by the UN Inter-Agency Standing Committee (IASC), with the aim of strengthening partnerships and ensuring more consistency and accountability in international responses to humanitarian emergencies. The cluster system clarifies the division of labour among organizations and better defines their roles and responsibilities within the key sectors of disaster response and recovery (OCHA, 2005). The clusters involve humanitarian organizations, both UN-affiliated and non-UN affiliated, in each of the main sectors of humanitarian needs, with clear responsibilities of coordination. The cluster coordination mechanism along with cluster activation and deactivation procedures have been clearly defined by the IASC. The formal activation of clusters is based on functionality gaps in the national emergency system and resources due to the impacts of a large-scale disaster; in turn, clusters are deactivated once the humanitarian need is reduced and national response and coordination capacity are (re-)established (IASC 2015). At the country level, the clusters are also responsible for informing decision makers of humanitarian needs through coordination, needs assessments, gap analysis, contingency planning, preparedness, and sector-based strategy development.

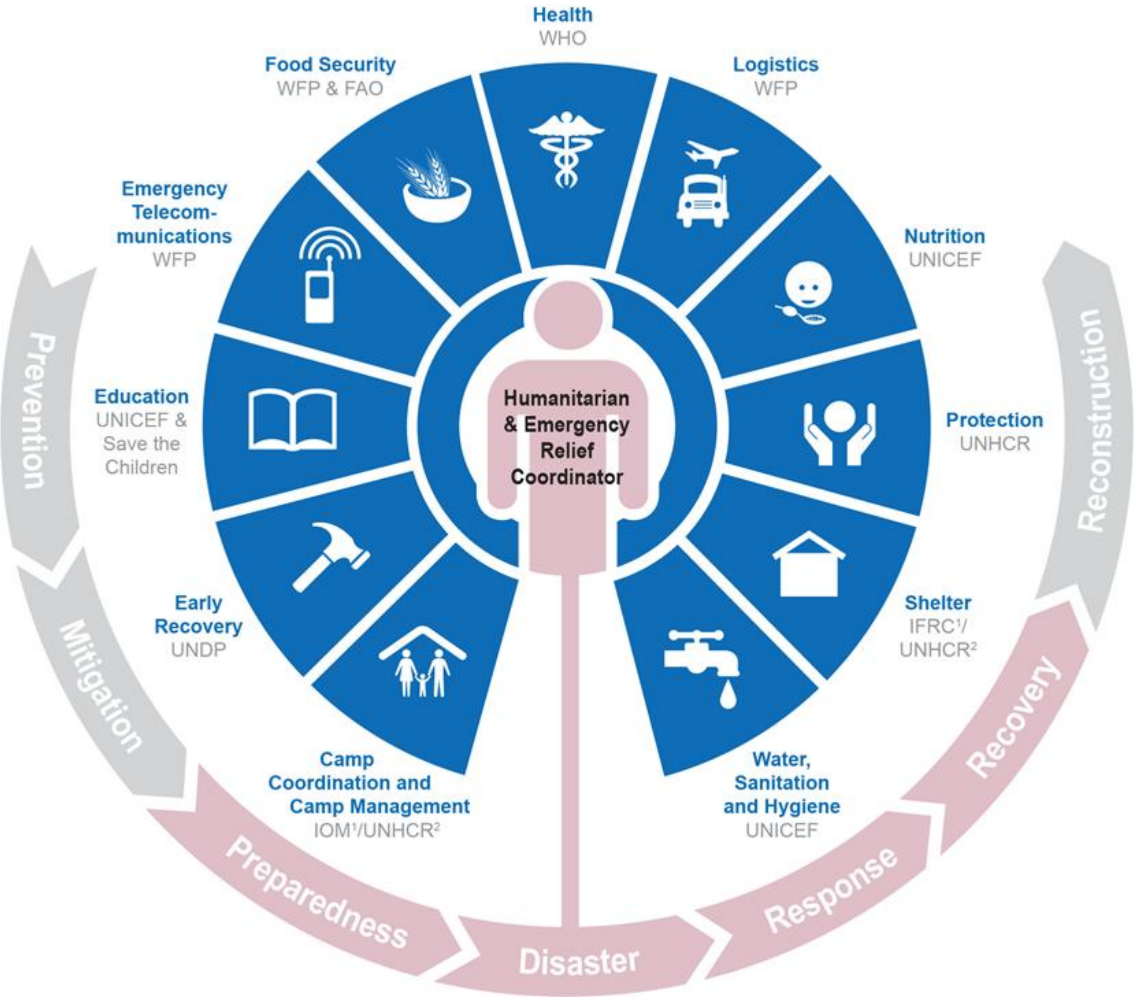

Figure 1: Schematic diagram of the humanitarian cluster system, showing the co-lead agencies for each cluster (IASC, 2015).

The cluster system in Nepal

In Nepal, the humanitarian cluster system is led by the Government of Nepal via 11 thematic clusters (Figure 1, Table 1) plus inter-cluster working groups on information management, community engagement, cash, and gender in humanitarian action. Each cluster has a government lead ministry, with co-leads drawn from the UN agencies and representatives from the Association of International NGOs and the International Red Cross and Red Crescent Movement (MoHA, 2019b).

Table 1: Humanitarian clusters in Nepal. Cluster focus group number refers to the organisation of clusters into focus groups for this study.

Cluster	**Lead (Government)**	**Co-lead (Humanitarian agencies)**	**Cluster focus group number**
Logistics	Ministry of Home Affairs (MoHA)	World Food Programme (WFP)	1
Emergency Telecomm. (ETC**)**	Ministry of Information and Communication (MoIC)	World Food Programme (WFP)	1
Early Recovery	Ministry of Federal Affairs and General Administration (MoFAGA)	United Nations Development Plan (UNDP)	1
Shelter	Ministry of Urban Development (MoUD)	International Federation of Red Cross (IFRC)	2
Camp Coordination and Camp Management (CCCM)	Ministry of Urban Development (MoUD)	International Organization for Migration (IOM)	2
Nutrition	Ministry of Health and Population (MoHP)	United Nations Children’s Fund (UNICEF)	3
Health	Ministry of Health and Population (MoHP)	World Health Organization (WHO)	3
Water, Sanitation, and Hygiene (WASH)	Ministry of Energy, Water Resources, and Irrigation (MoEWI)	United Nations Children’s Fund (UNICEF)	4
Food Security	Ministry of Agriculture and Livestock Development (MoALD)	World Food Programme (WFP); Food and Agriculture Organization (FAO)	5
Protection	Ministry of Women, Children and Social Welfare (MoWCSW)	United Nations Population Fund (UNFPA)	6
Education	Ministry of Education, Science and Technology (MoEST)	United Nations Children’s Fund (UNICEF) and Save the Children	6

Clusters in Nepal are activated in consultation with the government and the Humanitarian Country Team, a strategic coordination body led by the UN Resident Coordinator and consisting of UN agencies, the Red Cross, INGOs, and donors. Once the Council of Ministers has declared a disaster emergency, the National Disaster Risk Reduction and Management Authority (NDRRMA) in coordination with the Ministry of Home Affairs make an appeal for humanitarian assistance. The UN Resident Coordinator then leads the Humanitarian Country Team in assessing the disaster situation and recommending cluster activation, ensuring alignment with the government’s response (MoHA, 2019b). Bhandari et al. (2020) have documented the interactions among various agencies during the emergency response phase in Nepal. The cluster system was first formally activated in Nepal in 2008 as a part of the response to widespread flooding along the Kosi River, which caused displacement of more than 70,000 people in the southeastern part of the country (Table 2). Despite the coordination provided by the cluster system, subsequent analysis highlighted the lack of a disaster preparedness plan (Kellett, 2009) and limited scientific evidence in the form of flood scenarios or calibrated models to inform about potential flood risk (Devkota et al., 2009). The cluster system was also prominent during the 2015 Gorkha earthquake, when all 11 clusters were formally activated as a large-scale international humanitarian response under the leadership of the Government of Nepal (UNDP, 2015). There were noticeable improvements in preparedness prior to the 2015 earthquake, including awareness-raising and strengthening school buildings and critical facilities, but there remained limited use of scientific data or knowledge (Bothara et al., 2018; Datta et al., 2018).

Table 2: Cluster activation record in Nepal

Disaster type	**Year**	**Impacted area**	**Clusters activated**
Flood	2008	Sunsari District	Nine clusters were activated (Health, Nutrition, WASH, Food Assistance, Education, Protection with a subgroup on child protection, CCCM, Emergency Shelter, and Agriculture and Livestock)
Flood and landslide	2014	23 districts, out of which Banke, Bardiya, Dang and Surkhet districts were the worst affected	Five clusters were activated (Food/Nutrition, Health, Shelter, WASH, and Protection)
Earthquake	2015	32 districts with 14 worst affected districts across Central and Western Region, including Kathmandu Valley	All 11 clusters were activated

Flood and landslide	2017	31 districts with 18 severely affected, including Kailali, Bardiya, Banke, Dang, Nawalparasi, Chitwan, Makawanpur, Parsa, Bara, Rautahat, Sarlahi, Mahottari, Dhanusha, Siraha, Saptari, Sunsari, Morang, and Jhapa	All clusters were activated except ETC. The presence of the clusters varied across affected districts depending on the sector wise caseload.

Disaster governance in Nepal is guided by the Constitution of Nepal 2015 and the Disaster Risk Reduction and Management (DRRM) Act 2017, which is in part focused on minimizing disaster risk. The National Disaster Response Framework amendment in 2019 was intended to provide for the effective coordination and implementation of disaster preparedness and response activities by developing a National Disaster Response Plan that clarifies the roles and responsibilities of government and non-government agencies, including the humanitarian clusters (MoHA, 2019a). The IASC-developed Emergency Response Preparedness (ERP) approach is used to enable humanitarian clusters in Nepal to support emergency planning. The major elements of the ERP approach are risk analysis and monitoring and continency planning, and include hazard identification, risk ranking based on impact and likelihood, and definition of thresholds to provide information for the contingency plans (IASC, 2015).

Emergency Response and Preparedness Plans

Under the guidance of the UN Resident Coordinator, the Humanitarian Country Team (HCT) is responsible for the implementation of the international community's inter-agency disaster preparedness and response activities in Nepal. The HCT in Nepal mainly focuses on monsoon and earthquake Emergency Response and Preparedness Plans (ERPPs) to guide the response of each cluster to a disaster. The ERPPs are intended to include information on disaster risk and to facilitate efficient planning by the humanitarian community to support the National Disaster Risk Reduction and Management Authority (NDRRMA), which is responsible for national preparedness and response. The ERPPs are based on available scientific information and historical trend analysis, and provide the clusters with information on potential affected areas, potential caseloads in terms of the number of people or households likely to be affected, required budget, and pre-defined response actions (MoHA, 2019b). The ERPP process supports humanitarian actors and government to develop a common understanding of risk, establish a minimum level of preparedness, and develop a shared HCT response strategy for humanitarian emergencies.

Preparation of the annual monsoon ERPP begins with the seasonal monsoon rainfall outlook, which is published in Nepal by the Department of Hydrology and Meteorology (DHM) in late April, c. 2 months prior to the onset of the monsoon. This outlook is used by the UN Resident Coordinator's Office, in conjunction with historical patterns of flood and landslide impacts as well as population data, as the basis for development of an impact scenario, potential caseload, and potential impact areas in the coming monsoon. This process is well-established for flood impacts but is somewhat hampered by the lack of robust national-scale data on landslide occurrence and susceptibility (Kincey et al., 2023). The ERPP has been prepared jointly by the Resident Coordinator's Office and the NDRRMA since 2021. In contrast, because the occurrence of earthquakes is impossible to anticipate, the earthquake ERPP is based on an ensemble of potential future earthquake scenarios that was co-produced by Robinson et al. (2018) in collaboration with the Resident Coordinator's Office and the humanitarian clusters. This ensemble examines the variation in impacts across 90 different possible future earthquakes. The earthquake ERPP is updated at least once a year or when new information becomes available, with the latest version being published in February 2022 (UNCT, 2022). The contrasting use of co-produced scientific models in the existing earthquake and monsoon ERPPs therefore presents an important opportunity to identify how scientific information can be developed and tailored for the HCT and clusters.

METHODOLOGY

This paper aims to understand how science has previously been and could be used in future by the humanitarian clusters in Nepal in the preparation of the earthquake and monsoon ERPPs. To explore this, we undertook a series of focus group discussions with representatives from all 11 humanitarian clusters across two rounds in April and September 2022. We chose to use focus groups because they enable dynamic discussion among multiple participants at the same time, allowing those participants to explore and develop ideas together with the research team (e.g., Kitzinger, 1995). This is particularly relevant given that clusters comprise multiple organisations and that all clusters are charged with preparing for similar events, meaning that there are both synergies and differences between clusters that can be explored within the focus group setting.

The individual clusters were arranged into six focus groups, each consisting of two or three clusters, based on thematic similarities, tasks, organization, and actions undertaken by each cluster as part of their corresponding ERPP (Table 1). Members of each group participated in one 2-hour focus group session in both April and September.

Focus group participants came from a range of international and non-governmental humanitarian organizations, including UN agencies, the International Federation of Red Cross and Red Crescent Societies (IFRC), and I/NGOs, with the individuals themselves representing various technical fields of expertise such as general coordination, engineering, information management, education, and health. Each participant had experience in responding to sudden-onset disasters, information management and humanitarian aid and coordination, and was an active member of their relevant cluster. Not all participants were in their current or comparable roles at the time of the 2015 Gorkha earthquake, and consequently participants had varying levels of experience with major disasters. Where possible, the same participants took part in both focus group sessions (April and September), although in some instances participants were only available for one of the sessions. All 11 clusters were represented by multiple participants across both sessions.

Focus group round A (April 2022): The first round of six focus groups aimed to develop an understanding of their decision-making procedures, as well as the methods, challenges, and scientific data needs of the clusters around preparation of their ERPPs. This included a deeper understanding of the decisions each cluster must make following a disaster, and importantly the resolution and type of data required to prepare the ERPPs in advance of an event. In total, the six focus groups had participation of 53 people (40 men, 13 women) representing cluster lead and co-lead organizations as well as other members.

Focus groups in round A were conducted in two complementary sessions:

1. Moderated discussion session: The discussion focused on a set of key questions around the decision-making mechanism within the cluster, as reflected in the ERPP. This included: division of responsibilities among the cluster members following a disaster;

current cluster decision-making and information used; assumptions made around impact, severity, and caseloads; and whether the cluster preparedness and response activities were bespoke to any type of disaster event. The broad questions posed to the group to facilitate discussion were:

   i. What decisions do you need to take following a natural hazard-triggered disaster? When do you need to make these? Who is responsible for making those decisions?
   ii. What information do you currently use to inform those decisions? Where does the information come from? How and to what extent is the information used or implemented?
   iii. What assumptions do you have to make – for example, around impact, severity, caseload, or the worst or average-case scenario?
   iv. How do preparedness, response, and specific activities vary depending on the event you are responding to?

2. Timeline exercise: This exercise aimed to map the temporal resolution of the cluster's preparedness and response activities along with the information needed for cluster planning. The purpose of the timeline exercise was to visualise the points made in the previous discussion session and plot the decisions being made at different temporal resolutions. The timeline was adapted from the National Disaster Response Framework (MoHA, 2019b), the monsoon ERPP (NDRRMA, 2021), and the earthquake ERPP (UNCT, 2022). A period of one year before and after a disaster – for example, before and after the onset of the annual monsoon, or before and after a large event that leads to cluster activation – was divided into finer time intervals as shown in Figure 2, based on the key response timescales outlined in the ERPPs. Because earthquake timing is unpredictable, we used the annual review and update of the earthquake ERPP by the UN Resident Coordinator's Office as the basis for the discussion. The participants were asked to provide their inputs on the types of information that would be needed and useful for their cluster in both the pre- and post-disaster phases.

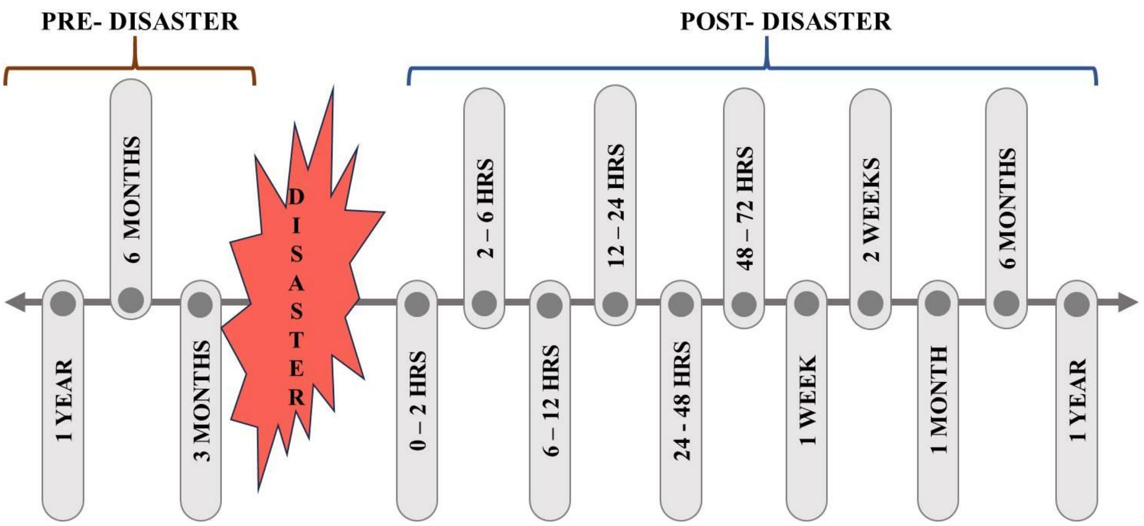

Figure 2: A schematic diagram of the timeline and key intervals relative to the occurrence of a disaster. The disaster event could be the onset of the annual monsoon, or the occurrence of a large earthquake or rainstorm. These intervals were used to structure the collection of data on cluster information needs in focus group round A, with the time windows reflecting the critical timings listed in the ERPPs Note that these timings are clearly defined in the case of the annual monsoon, which has a predictable onset; for discussion of earthquakes, we used the annual review and update of the earthquake ERPP as the basis for discussion. The timeline was adapted from the National Disaster Response Framework (MoHA, 2019b), the monsoon ERPP (NDRRMA, 2021), and the earthquake ERPP (UNCT, 2022).

Focus group round B (September 2022): The second round of six focus groups focused on identifying the most relevant spatial and temporal resolutions for understanding and anticipating monsoon-related impacts, and the specific types or forms of information needed by the individual clusters. This round focused exclusively on the monsoon ERPPs because the timing of the monsoon is predictable, allowing us to consider the implications of pre-event timing of the availability of risk information. It also allows for a comparative analysis with the earthquake ERPPs, where co-produced scientific information is already well-used by the clusters. The focus groups had total participation of 36 people (29 men, 7 women).

As before, focus groups in round B were conducted in two complementary sessions:

1. Risk modelling sharing and moderated discussion: The initial session focused on determining the format and type of information about impacts arising from monsoon rainfall that would be most useful to help plan, and what new capacity or ability the

clusters would gain from this information. To facilitate this discussion, we presented the clusters with examples of monsoon impact forecasts using a novel graph theory approach (Dunant et al., 2024). The forecasts took the form of an impact scenario (Davies et al., 2015) based on probabilistic network modelling of potential impacts to all buildings and road segments in Nepal, given a particular rainfall forecast. These impacts could then be averaged to produce a map of relative risk at different spatial scales. We chose three potential spatial scales and three potential temporal scales or 'lead times' at which impact information could be made available. The spatial scales for impact forecasts were: (i) at the level of individual buildings, as a high-resolution proxy for exposure of the people in those buildings to hazard; (ii) the same impact information averaged to the level of districts (of which there are 77 in Nepal), thus enabling a ranking of the districts which would be more or less likely to suffer impacts; and (iii) the impact information averaged to the level of provinces (of which there are seven in Nepal), again to enable ranking of impact-prone areas. Importantly, the inferred uncertainty within these modelled impact forecasts is inversely proportional to the resolution, such that the highest-resolution model contains the highest uncertainty and vice versa. The temporal scales were chosen to reflect the time windows over which monsoon rainfall forecast information is currently made available. These were: seasonal, corresponding to the long-term monsoon rainfall outlook released by DHM in April each year and indicating likely monsoon rainfall over the period June-September relative to decadal averages; fortnightly, corresponding to sub-seasonal (14 day) rainfall forecasts issued, for example, by the S2S project (Vitart & Robertson, 2018); and 72 hours, corresponding to the standard 3-day weather forecast issued by DHM. Each cluster mapped out their preferred spatiotemporal resolution pairing of the impact information and specified how and why the indicated information would be valuable for preparing their monsoon ERPP.

2. Voting exercise: The purpose of the second session was to capture a semi-quantitative record of the previous discussion and to understand the spatial and temporal resolutions of impact information that would be most useful for each cluster. Each individual participant was able to vote up to a maximum of six times for their preferred combination of temporal and spatial resolutions. This was done to allow participants, if they wished, to identify what they considered to be the most useful and second most useful spatial resolutions for each of the three time windows, with participants able to

vote for an individual pairing multiple times if they deemed it especially useful for their planning purposes.

With the participants' consent, these focus group discussions were recorded to ensure accuracy and completeness in capturing the data. These recordings were then transcribed. The transcripts were analysed to extract information relevant to each of the four exercises described above. We extracted selected anonymised quotes to illustrate key points or arguments made during the discussions.

RESULTS

Use of scientific evidence to inform risk preparedness

The need to use science as effectively as possible to inform about potential risk, identify impacted areas, and determine the possible caseload in a future disaster was raised by all clusters as a major step towards more effective ERPPs. This is not surprising, as both the current monsoon and earthquake ERPPs already make use of available scientific information to different degrees. The value of scientific information was highlighted by one participant, who said that *"with the potential scenarios, all the clusters will have a very good inject in their preparedness plan and improvement of already existing plan, more evidence-based scenario would mean more realistic planning depending on the hazard like monsoon and earthquake"*.

Despite this experience, however, there were disagreements between clusters about the extent to which scientific information is currently used and the understanding that exists about different hazards. One participant noted that, at present, *"[monsoon] contingency planning is not research based but prepared on the basis of experiences. The total caseload is determined based on the past records, which is divided among different agencies who actively contribute to the contingency plan"*. Another participant drew a contrast between the relatively sophisticated understanding of past flood impacts that is used by the Resident Coordinator's Office with the comparative dearth of information available on landslide impacts (Kincey et al., 2023), noting that *"We have data on the flood affected area from so many years, so we can pinpoint the area where the flood impact is high and build a contingency plan based on the existing information and the scientific evidence available through research"*. A third participant contrasted the level of understanding between monsoon-related and earthquake-related impacts, stating that "*In case of flood, the river system and the flood scenarios are well* *understood as it is a recurring event, but in case of earthquake the level of impact, exposure and vulnerability is not always known"*. Caseload determination in particular was highlighted in the discussion as an area of some uncertainty; all clusters were aware that caseload estimates for the earthquake and monsoon contingency plans were derived from analysis by the Resident Coordinator's Office and the Ministry of Home Affairs (MoHA), but cluster representatives were not always clear on how these figures were derived or the information that had been used as the basis for the figures.

Importantly, several participants commented on how hazard scenarios are changing, with a perceived rise in the occurrence of flash flooding and landslides in the hill and mountain areas of Nepal. One participant said that *"the [monsoon] caseload is determined based on the past year experience and 10 years trend is used to calculate the value. But in the past 2 years the scenario and nature has changed and there are more landslides than floods, so, we may need to see the context and analyse. We need support of the experts on determination and analysis of the caseload"*. This viewpoint highlights the need for dynamically-updated hazard information on which to base contingency plans (e.g., Rosser et al., 2021; Kincey et al., 2024; Arrell et al., 2024).

Spatial and temporal resolution of information

A key component of the information needs of the clusters for disaster preparedness planning is the spatial and temporal resolution of available data on hazards or their potential impacts. These resolutions determine whether or not those hazard or impact data are usable, in the sense of supporting specific decisions by the clusters, and can be used, in the sense of being available at appropriate points during the planning cycle. Understanding these constraints is thus critical for anyone wishing to provide underpinning information for use by the clusters.

There was general agreement that risk information based on the seasonal monsoon outlook – the longest lead time considered here – would be primarily useful for preparedness planning, and there was a preference for this to be averaged at provincial level rather than at higher spatial resolutions (Figure 3). In contrast, fortnightly and 72-hour risk information were seen as more valuable for immediate readiness and response activities, including anticipatory action, mobilization of resources, and potential relocation, and therefore were preferred at progressively higher spatial resolutions (Figure 3). One participant summarised this view by stating that "*the seasonal forecast at provincial level is OK, at that time the forecast is not* *certain, so planning, preparedness and relocating the relief item strategically can be planned. When it comes to the two-week forecast, district level will be appropriate to be focused on a particular area, and when it comes to 72 hrs the information must be of high-resolution including buildings, roads".* The potential for risk information at very high spatial resolution, such as the locations of individual buildings such as health facilities or schools, was seen by some cluster members as a major potential advance on currently-available information.

This overall agreement on the trade-off between spatial resolution and lead time, however, masks some important differences between clusters (Figure 3). It is notable that several clusters saw value in provincial-level risk information, especially at longer lead times – this is particularly true for Logistics, WASH, and Protection. Other clusters, however – especially Food Security, Early Recovery, Health, and Nutrition – tended to prioritise finer-resolution risk information, and to some extent valued information at shorter lead times. These differences are important for providers of risk information to be aware of, and we return to this point in the discussion.

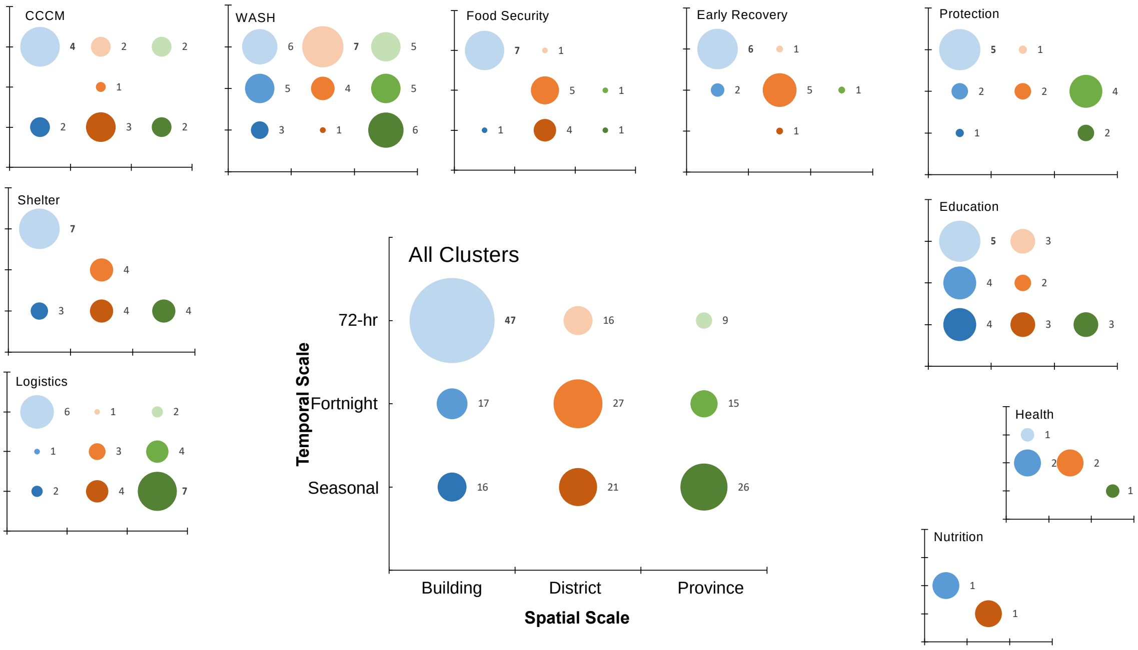

Figure 2: Summary of voting preferences on temporal and spatial resolution of risk information across all clusters. Circle colour indicates the spatial scale (blue: building-scale; red: averaged by district; green: averaged by province), while circle intensity indicates the temporal lead time (dark: seasonal; light: 72 hours). The size of the circles is scaled by the number of votes received by each combination of scales, indicated also by the numbers.

The inherent uncertainty in the seasonal monsoon rainfall outlook, which is produced by DHM on a spatial grid of 0.25 x 0.25 degrees (on the order of 10 x 10 km), was generally viewed as acceptable by the clusters, because the information has been used for years to guide preparedness planning to identify the potential impact areas (e.g., WFP, 2023). There was a clear sense that seasonal outlooks are not necessarily very reliable and should only be used as a guiding principle. One participant explained that *"for seasonal information uncertainty is OK because based on that we are not actually responding to people. But for the 72 hrs response, certain level of accuracy is needed as we are really responding or planning like evacuation. In case of two weeks, the certainty of 90-95% would be enough. For 72 hrs we need more accuracy".* Another participant clarified the potential costs of not knowing which specific buildings would be impacted, adding that *"the level of investment might be the issue. The scale of disaster matters – if the level of impact is small then it's OK but if the level of disaster is high then the question arises on the prediction of the disaster and its preparedness".* Importantly, some clusters suggested that district-level rather than provincial-level impact and relative risk information was inherently more useful because suitable disaster response and management structures for disaster response already exist at the district level in Nepal but are still being developed by the provincial governments (Vij et al., 2020). Others, however, noted that provincial-level information was preferred as this better matched with pre-monsoon contracting arrangements and response planning.

Multiple clusters highlighted the potential usefulness of risk information based on fortnightly or 72-hour forecasts for humanitarian response in particular. The clusters were familiar with the seasonal outlooks and 72-hour forecasts published by DHM, but fortnightly forecasts were seen as a new and potentially useful time scale that would allow them to take action and raise alerts at different governance levels. One participant commented that "*if we have fortnightly information, we can double check our preparedness plan, develop operation team at the potential risk area and also minimize duplication as partners can support in different sectors and it will be better coordinated response*". Another participant added that *"the 72 hrs information to understand the damage/impact scenario, the impact in the human lives based on which each cluster can decide their response plan is essential".* Importantly, almost all clusters indicated that decisions on these shorter sub-seasonal time scales were more focused on mobilisation of resources and capacity as well as anticipatory action, rather than contingency planning. For example, one participant highlighted the distinction between seasonal risk information, which is useful for pre-positioning of supplies and estimating material needs, and shorter-term information during the monsoon, which can be used to identify key partner organisations who could be involved in a response. Another participant noted that fortnightly risk information would allow the cluster to identify trained people in those areas and pass that information to the district government. A third participant agreed, arguing that 14 days would allow sufficient time to coordinate with the provincial government, inform district-level authorities, and assemble an operational team with clear responsibilities. It is thus important to recognise that information on potential impact areas and risks at sub-seasonal time scales has inherent value, but would not necessarily lead to changes in the ERPPs.

Evolution of information needs over time

The preparedness and response time intervals in Figure 2 were used to map out what decisions were made and when, as well as the types of information that would be considered useful for the clusters before and after a disaster. There was a consensus among the clusters on the evolution of the response during the post-disaster period, and so much of the discussion in the timeline exercise focused on the time period before a disaster or before the onset of the annual monsoon. The need for more scientific information to inform preparedness was highlighted by multiple clusters, especially including information on the road network and the locations of the most vulnerable areas along with disaggregated demographic information. At the longest time interval considered (one year before disaster onset), clusters tended to emphasise more strategic needs, such as contingency plan updates, overall caseload determination, and vulnerability and risk mapping (Figure 4). At shorter lead times, the range of information needs grew and became both more targeted and more cluster-specific. These included more detailed information on populations at risk, weather information in the case of the monsoon, and information on specific types of infrastructure such as roads, evacuation centres, and open space (Figure 4).

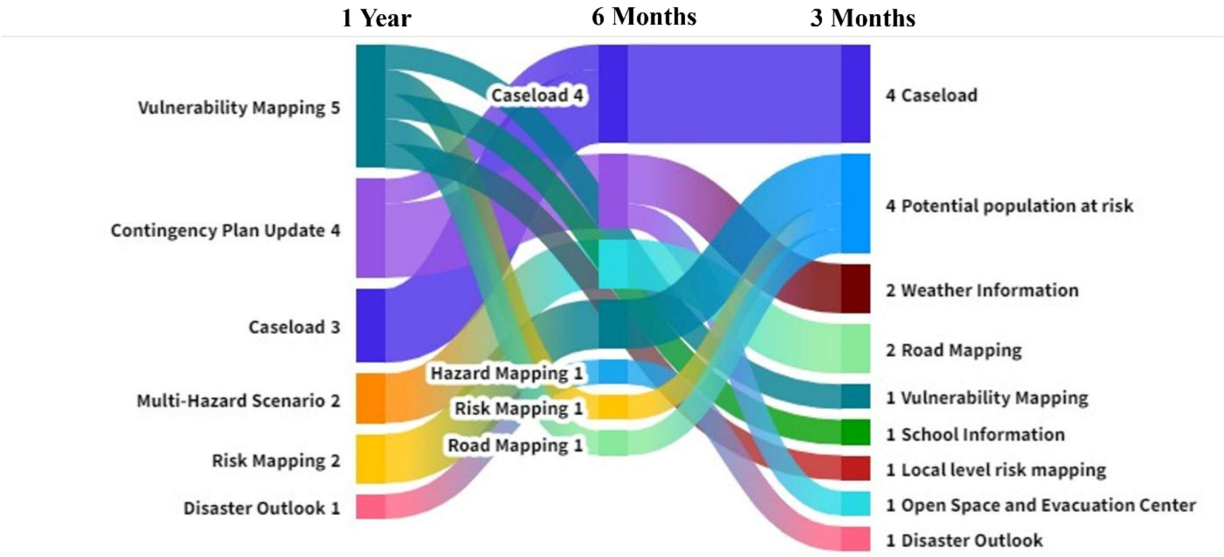

Figure 3: Pre-disaster needs identified by the clusters. Time intervals at the top indicate the time before the onset of a disaster. The numbers and width of each connecting line indicate the number of different clusters that highlighted each item during focus group round A. Note that clusters could identify multiple needs, so the totals are greater than the number of clusters.

Specificity of information needs

The 11 humanitarian clusters can be categorized into nine response areas and two service areas. While sharing a common aim to strengthen preparedness to respond during humanitarian emergencies, each cluster has a specific area of coverage and working modality. The activities of each cluster depend upon this focus as well as specific needs or phases of implementation in a disaster; some clusters may only operate during certain stages, such as the preparedness phase, while others might focus on immediate response or recovery, and others (especially Logistics) may operate through the cycle. Because of these differences, the needs for scientific evidence to inform emergency preparedness planning also varied among the clusters (Table 3).

Table 3: Cluster-specific needs for scientific evidence for emergency preparedness.

Cluster	**Area of coverage***	**Cluster-specific needs**
Logistics	Provides essential support to the other humanitarian actors with the goal of maximizing supply chain capacity and	• Multi-hazard risk information, mainly along the network of roads and trails to be used during emergency response

	ensuring the timely and uninterrupted flow of essential and lifesaving supplies and equipment across Nepal through provision of transport and storage services	• Multi-hazard risk information on the locations of existing humanitarian staging area (HAS) warehouses, and safe(r) area for construction of temporary warehouses and pre-positioning of critical relief items
ETC	Provides communications services, voice, and internet connectivity to assist the response community in their life-saving operations during humanitarian emergencies.	• Multi-hazard risk information on the locations of repeater towers and mobile towers to understand potential impacts to these facilities • Multi-hazard risk information on the road network to plan for distribution of fuel and team mobilization, to ensure that communication services remain intact during disaster
Early Recovery	Provides essential support to ensure the livelihood/economic restoration of the affected populations and rehabilitate essential community infrastructures, offering local employment opportunities through cash for work mechanisms and unconditional cash transfers where needed	• Information on high-risk locations to identify livelihood/cash support needs for the affected population • Identification of potential volume of debris to allocate budget and resources for debris management • Correlation of available social data with the disaster scenario to determine exposure and other vulnerability factors
Shelter	Coordinate with all shelter actors, including local and national governments and humanitarian agencies, to ensure a predictable, effective shelter response including emergency and intermediate solutions	• Data on building-level impact, regardless of hazard type Multi-hazard risk information to identify safe(r) locations for temporary shelters, hub offices, and warehouses to store non-food relief items
CCCM	Coordinate between different humanitarian actors to provide service and support the internally displaced population within communal settings	• Information on open spaces as locations for temporary shelter and supply pre-positioning • Multi-hazard risk information on open spaces

	(i.e., camps, informal settlements, collective centres)	• Analysis of the population at risk in the impacted area so that the number of support materials needed can be identified beforehand
Nutrition	Safeguard and improve the nutritional status of crisis-affected populations by enabling coordination mechanisms to achieve timely, quality, and appropriate nutrition response to effectively and accountably meet the needs of people affected by humanitarian crises.	• Analysis of risks to health posts, hospitals, medical sectors, and warehouses where food supplies are stored • Information on landslide and flood risk areas along with information on rainfall forecasts at community level
Health	Coordinate and manage the health response to disasters and public health emergencies and facilitate the establishment and strengthening of hub and satellite hospital networks, formation and orientation of Emergency Medical Deployment Teams, stockpiling of emergency medical supplies, and conduction of Emergency Care System Assessments	• Information on impacts on logistical and medical warehouse, district health offices, provincial medical centres, and hub hospitals • Multi-hazard risk information on the impacted, exposed, and vulnerable population • Safe(r) areas for pre-positioning, establishment of the temporary health hub, and clinics during an emergency
WASH	Strengthen the humanitarian response through effective and accountable humanitarian coordination for WASH to result in timely, predictable, and high-quality WASH outcomes that are inclusive and equitable, for the people most affected by and vulnerable to crisis	• Levels of exposure, vulnerability, and potential impacts, mainly due to earthquake • Multi-hazard risk information on the locations of water supply points for the immediate WASH response • Information on impact to the water supply schemes.
Food Security	Coordinate the food security response during humanitarian crisis by addressing issues of food availability, access, and utilisation for the most vulnerable and food insecure population	• Updated earthquake scenarios with information on severity, impact at household level, numbers of displaced households, and disaggregated family information (age, gender, disability information) at ward level

	while supporting in the repair of assets and the restoration of livelihoods	- Information on potential damage to land, agriculture production and household stock and impact on the land-use pattern
Protection	Coordinate with governmental and non-governmental organisations to ensure the vulnerable populations are protected from the risk of violence, abuse, exploitation and discrimination, neglect arising due to the crisis	- Information on safe(r) locations for pre-positioning of non-food items and dignity kits, as well as location of temporary shelters - Information on displacement and mobility of the population
Education	Coordinate and collaborate with NGOs, UN agencies, academics, and other partners to ensure predictable, well-coordinated and effective response to education need for populations affected by humanitarian crises	- Multi-hazard risk information on the locations of individual schools, as well as open spaces for transitional and temporary schools - Scientific basis for determining caseloads for pre-disaster planning at municipality level - Mapping of vulnerable infrastructure and hazard mapping

* Taken from https://un.org.np/humanitarian-coordination-and-clusters

A striking feature of Table 3 is that nearly all clusters (eight of 11) explicitly mentioned the need for multi-hazard risk information. In particular, the need for multi-hazard scenarios (especially those covering monsoon-related impacts such as landslides and flooding) to allow more accurate caseload determination was highlighted repeatedly as an urgent requirement. Differences between clusters emerged in terms of where this information was required – for example, for specific sites such as open space (for CCCM) or schools (Education). Unsurprisingly, individual clusters also outlined distinct information needs relating to their sectoral responsibilities, such as specific types of infrastructure or particular details of exposed populations. It is also important to recognize differences in the level of spatial aggregation of risk information that was seen to be important. For example, Shelter and ETC highlighted the need for building-level risk data, whereas Food Security focused on the ward level and Education focused on the municipality level.

Several clusters (Logistics, Shelter, CCCM, Health, Protection, and Education) focused on the importance of identifying ‘safer’ locations in the landscape for post-disaster activities, and we return to this point in the discussion. There was recognition of the fact that these safer locations can only be identified by taking an explicitly multi-hazard approach. For example, one participant shared the experience of building a transitional learning centre in Dolakha district after the 2015 Gorkha earthquake, approximately 130 km east of Kathmandu, and indicated the need for information on safe areas to be incorporated in the ERPP. They added that *"the transitional centre was constructed in the playground and when 90% of the work was completed the ground about 2m ahead fell off and a retaining wall had to be built. So, information on safe area from different hazard is essential"*.

DISCUSSION

Variability in information needs

The ERPP process in Nepal, being based on a global model with wide applicability and acceptance, provides a clear starting point for disaster preparedness across the humanitarian clusters. Because it is intended to be underpinned by scientific evidence, the ERPPs also provide a natural 'entry point' for a wide range of information on the hazards and risks associated with both the annual monsoon and infrequent but damaging earthquakes. Providers of that scientific information must, however, recognize that there are both similarities and important differences between clusters in terms of their particular information needs and the spatial and temporal scales over which that information is needed – and indeed usable by the clusters. This is especially true in the pre-disaster phases of Figure 2, which are less prescribed than the post-disaster phases (e.g., as defined in the NDRF; MoHA, 2019b) and where there is considerable variability among the clusters. There is, therefore, no 'one-size-fits-all' model for how or when to make hazard and risk information available to the clusters in support of their ERPPs.

The clear preference by some clusters for information at particular spatial or temporal scales, as evident in Figure 3, can be linked to their focus or sectoral responsibility regardless of the hazard type. Clusters such as Logistics, WASH, Shelter, and CCCM are concerned with identification of safer locations in the landscape as well as threats to existing infrastructure such as roads or water-supply lines, and thus tended to value longer lead times and more synoptic risk information at district or even provincial levels. In contrast, Food Security, Early Recovery, Nutrition, and Health tended to emphasise responsiveness to the needs of affected people during a particular disaster event, and were less concerned with provincial-level or seasonal-level planning (Figure 3; Table 3). For those latter clusters in particular, data on displaced households and disaggregated information on exposed people, down to the level of an individual house, if possible, was seen as particularly important.

We also note an important distinction among the clusters in terms of whether larger-scale risk information was more valuable at district or provincial level. Coupled to this were clear differences between clusters in terms of the importance that they attached to contingency planning in the provinces. Provincial-level planning was particularly emphasized by Logistics, Protection, Shelter, and CCCM, but was seen as less critical by WASH, Nutrition, and Health. We speculate that this distinction appears to reflect the uneven development of cluster operations at the provincial level in Nepal, which are continuing to evolve following the shift to a federal system in 2017. This shift has created new opportunities for provincial and local governments to exercise greater control over their disaster preparedness and management strategies. Bhandari et al. (2020) showed that provincial and local structures still lack institutional capacity for effective planning and implementation of disaster risk reduction and management. To address this gap, the federal government requested the Humanitarian Country Team to establish Provincial Coordination Focal Point Agencies (PCFPA) in 2019 to enable coordinated preparedness and response at sub-national levels (UN-Nepal, 2019). It is also noteworthy that efforts are now underway to extend contingency planning to the provincial level. For example, the UNDP-led Strengthening Urban Preparedness, Earthquake Preparedness, and Response (SUPER) project has sought to enhance earthquake preparedness within municipalities in the three western provinces of Nepal (Gautam & Pyakurel, 2023) (Gautam and Pyakurel, 2023) and serves as a potential model for how risk information at the national scale – in this case, the earthquake scenario ensemble developed by Robinson et al. (2018) – could be used to support sub-national plans.

Spatio-temporal data resolution and uncertainty

The trade-offs between spatial resolution and lead time visible in Figure 3 are important for providers of scientific information to consider, but may not be immediately obvious without consultation with cluster members or clear understanding of how risk information will be used. Particularly for monsoon-related hazards, the emphasis on seasonal forecasts at the largest spatial (provincial) scale in Figure 3 likely reflects the long lead time (3 months or more) but low certainty of the seasonal forecast information; such information cannot reliably be used to pinpoint specific areas that are likely to be affected, but can still be used to prioritise planning and preparation in one or more provinces compared to others. In this way, these long lead time forecasts fit nicely with the generic, high-level overview required from the ERPPs. In contrast, anticipated risk based on fortnightly or 72-hour forecasts was seen by most participants to be potentially useful at the scale of districts or individual buildings; some clusters also cited municipalities as a potentially useful scale, although municipality-level information was not explicitly presented to the clusters in the workshops. In Nepal, the monsoon ERPP is prepared well ahead of the onset of the monsoon. While this plan is updated annually based on the seasonal monsoon forecast released in April, there is no existing mechanism to revise the plan during the monsoon season based on forecasts over shorter sub-seasonal time scales, as doing so would require reiterating the entire process. Instead, the clusters were clear that they utilise shorter-term forecasts to adjust their response strategies, which are informed by the ERPP, relying on the resources and capacities available at the time. Notably, the actions that such shorter-term data were likely to inform were more closely associated with anticipatory action and early response, acting ahead of predicted hazards to prevent or reduce acute humanitarian impacts before they fully unfold, rather than contingency planning per se.

The general preference for lower spatial resolutions at longer lead times, as visible in Figure 3, also indicates that risk information at the highest-possible resolution might not be necessarily needed, or even usable, by all cluster members at all stages of the planning process. It is therefore important to match the spatial resolution to the cluster focus; for example, our discussions indicated a clear desire for building-level risk information by Education and Health, because of their focus on ensuring service provision at discrete locations. Comparatively, WASH and Logistics showed a preference for increasing spatial resolution with decreasing lead time (Figure 3), highlighting their focus on early pre-positioning of relief materials, transitioning to more focussed anticipatory action with shorter-term forecasts. Importantly, higher spatial resolutions often lead to greater uncertainty and increased data size and processing requirements, which further complicates the use of risk information by humanitarian actors. This finding mirrors, for example, work by Reichenbach et al. (2018), who showed that information on landslide hazard is often generated at a spatial resolution that is set by the input data rather than by end-user requirements. These issues ideally need to be understood by scientists and other information providers before undertaking hazard assessment or risk modelling.

Somewhat surprisingly, most cluster representatives were relatively relaxed about the inherent uncertainties in impact or risk models in the context of planning. It remains unclear, however, whether the perceptions of uncertainty in cluster members match with the perceptions of researchers. This was notable by one cluster member highlighting that model accuracies of 90-95% would be 'enough' when in reality very few risk models are able to reliably achieve such accuracy. Misinterpretation of scientific information across different phases of a disaster can led to severe consequences, and thus a shared understanding of the information, interpretation, ownership, and accountability becomes crucial (Alexander, 2014). Without clear and common appreciation of uncertainties, however, this understanding may be difficult to reach. In focus group round B, we found that it was useful to discuss the trade-off between spatial aggregation and uncertainty and spatial averaging. For example, for a given earthquake or rainfall scenario, it is very difficult to determine whether any individual building will be affected or not; this depends upon detailed hazard and exposure information which cannot be known in advance of an event. For the same scenario, however, it becomes progressively easier to anticipate and prioritise the affected areas at larger and larger scales of integration: municipality, district, and province. To follow this up, it would be useful to develop a shared understanding with the clusters about the consequences of the impact scenarios being 'wrong'. It would also be helpful to establish the relative importance of different types of errors in the impact scenarios, especially the effects of 'false alarms' (false positives) versus missed events (false negatives). This is because standard measures of risk model performance, such as receiver operating characteristic or precision-recall curves, assign equal weight to false positive and false negative results. Humanitarian organisations or other users of that risk information may prioritise these errors differently, however, and knowledge of their relative importance could guide choices that are made in the design of the risk models. Further work to understand the minimum viable levels of uncertainty that clusters can tolerate for planning, compared to what uncertainties are realistically possible for modelled risk data, also remains a key need for providers of risk information.

Trust in data and models

The importance of trust in supplied data and models was clear across all clusters, and reflects the long-understood importance of trust between different actors for risk planning (Alexander, 2014). Across both of our focus group rounds, it was also clear that there was a wariness amongst many cluster members about the usefulness of monsoon impact data based on historical information in the face of a changing climate. Participants noted that, while they had long experience of responding to annual monsoon disasters, recent monsoons have presented notably different challenges, and that anecdotally impacts appear to be shifting from flooding towards flooding and landslides. Building trust within the clusters that models, particularly those built on past observations, remain relevant is therefore a critical task.

We also note that several cluster members were unclear on how current monsoon caseloads were determined, despite the Resident Coordinator’s Office having a clearly defined methodology that is made available to the clusters. While understanding how the data were derived is not strictly necessary for clusters to develop their ERPPs, it is clear that cluster members want to know these details as part of the ERPP process. Given that the Resident Coordinator’s Office already shares their methodology, this finding highlights the difficulty in ensuring that this information reaches and is understood by all members of the clusters, which can be challenging given the large number of organisations and individuals involved. Researchers working with cluster members to embed scientific information therefore need to consider how to communicate this information effectively.

Outstanding opportunities

We close with some summary recommendations and priorities for further research drawn from our results:

- The importance attached by all clusters to multi-hazard risk information highlights the need to generate new knowledge around multi-hazard cascades in Nepal and their potential impacts. In this respect, the government’s current emphasis on development of a Multi-Hazard Risk Assessment Framework is especially timely. The current division of the ERPP process into planning for the monsoon on the one hand, and large earthquakes on the other, remains a useful distinction because it emphasises both annually-recurring and infrequent events. Both plans can usefully be adapted to account for a wider range of monsoon-related or earthquake-related hazards.
- A recurring point in the discussions related to the importance of identifying ‘safer’ locations – not necessarily safe areas, but areas where relative risk from earthquake- or monsoon-related hazards was seen to be lower, and that could therefore act as temporary or long-term resources for affected people. Most research has tended to focus on identification of high-risk areas, but it may be beneficial to re-frame risk information

around relative risk, as well as the extent to which those lower risk areas are insulated from multiple hazards.

- While impact or risk modelling can be done at the scale of individual buildings (Dunant, et al., 2024), it is not clear from the conversations with the clusters that this level of detail is always needed for national-scale contingency planning, especially at seasonal or annual time scales. Instead, municipality-, district-, or even province-level rankings of relative risk – that is, the likelihood that different areas will be impacted by a future event – can still be useful. Scientists should be aware that, beyond trade-offs between uncertainty and resolution, higher resolutions are not always desirable for end-users. Instead, it is important to match risk information to its purpose and to the capacity and organisational level of the intended users.
- Caseload determination is a critical concern for all clusters before an event, but it remains an inexact exercise. Scenario ensembles, as developed by Robinson et al. (2018) for earthquake planning in Nepal, may be a promising way forward and could be extended to monsoon planning. There is a particular need to continue to move beyond static population measures – for example, via census results – to generate estimates of the population that is actually exposed. In this respect, new approaches to estimating population mobility, whether through large-scale anonymized records (e.g., Wilson et al., 2016; Yabe et al., 2022) or detailed participatory mapping, may be valuable.
- The focus group discussions revealed a pressing need for cluster-specific risk information rather than one-size-fits-all products. It is important to stress that producing such information requires dialogue and a significant investment in time from both scientists and cluster members. For scientists, this also requires long-term commitments to data production and sharing rather than one-off provisions, especially for the annual monsoon. This is particularly difficult given the relatively short duration of most research funds and grants, which complicates the establishment of long-term relationships between scientists and practitioners. We encourage scientific funding agencies to consider the need for longer-term partnerships to ensure maximum research impact.

CONCLUSIONS

Nepal is exposed to frequent multi-hazard events driven by both annual monsoon rainfall and infrequent large earthquakes. Adequate planning for these events requires comprehensive information on their occurrence and impacts, as well as the consequent risks that they pose. This research explores the current needs and uses of scientific information within the government-led humanitarian clusters in Nepal for their earthquake and monsoon contingency planning, with a particular focus on identifying similarities as well as cluster-specific data requirements.

Focus-group discussions with representatives from all 11 humanitarian clusters show that there is a major cross-cutting need for scientific evidence on multi-hazard occurrence or likelihood to inform estimates of potential risk, impacted areas, and caseloads of affected people. At the same time, there were important differences between clusters in terms of sector-specific information needs, and the timing of when this information is required for planning. While post-disaster response and information needs are largely prescribed and agreed, there is considerably more variability among clusters in the pre-disaster planning phase, and this is clearly an area where providers of risk information could focus their attention.

We also explored different combinations of spatial and temporal scales over which risk or impact information could be provided to clusters for planning purposes. In terms of monsoon planning, seasonal impact forecasts at low spatial resolution were preferred by most clusters for preparedness planning, whereas forecasts with shorter lead times (14 days and 72 hours) were preferred at higher spatial resolutions – down to the scale of individual buildings for some clusters – and seen as important for activities such as anticipatory action and early response. Importantly, there was no one-size-fits-all solution in terms of either spatial or temporal resolution or the type of risk information provided, and dialogue with the clusters is required to properly understand their data requirements and uses.

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DATA AVAILABILITY

The data used to generate the results in this paper, including specific information needs expressed by the clusters and the preferences expressed for different spatial and temporal resolutions, are available on request from the authors.

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APPENDIX A. TABLE OF ACRONYMS AND ABBREVIATIONS

CCCM	Camp Coordination and Camp Management
DHM	Department of Hydrology and Meteorology
DHO	District Health Office
DRRM	Disaster Risk Reduction and Management
ERPP	Emergency Response and Preparedness Plan
ERPP	Emergency Response and Preparedness Plans
ETC	Emergency Telecommunication
FAO	Food Agriculture organization
FGD	Focus Group Discussion
HCT	Humanitarian Country Team
HSA	Humanitarian Staging Area
IASC	Inter-Agency Standing Committee
IFRC	International Federation of Red Cross, and Red Crescent Societies
IOM	International Organization for Migration
MoALD	Ministry of Agriculture Land Development
MoEST	Ministry of Education, Science and Technology
MoEWI	Ministry of Energy, Water Resources and Irrigation
MoFAGA	Ministry of Federal Affairs and General Administration
MoHA	Ministry of Home Affairs
MoHP	Ministry of Health and Population
MoIC	Ministry of Information and Communications
MoUD	Ministry of Urban Development
MoWCSW	Ministry of Women, Children and Social Welfare
NDRRMA	National Disaster Risk Reduction and Management Authority
PLMCC	Provincial Level Medical Centers
SFDRR	Sendai Framework for Disaster Risk Reduction
UNDP	United Nation Development Programme
UNDRR	United Nation Disaster Risk Reduction
UNFPA	United Nation Population Fund
UNICEF	United Nation Children Education Fund
UN-OCHA	United Nations Office for the Coordination of Humanitarian Affairs
UNRCO	United Nation Resident Coordinator’s Office
WFP	World Food Programme
WHO	World Health Organization

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