Workshop on Landslide Risk Reduction and Mitigation Strategies

POST EVENT REPORT

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Executive Summary

The *Workshop on Landslide Risk Reduction and Mitigation Strategies*, held on 13–14 February 2025 in Wayanad District, Kerala, was organized by the Kerala State Disaster Management Authority (KSDMA) as part of its ongoing commitment to enhancing disaster risk governance and building technical capacities across key departments. The workshop served as a continuation and expansion of the *Field Workshop on Landslide Mitigation and Risk Assessment* conducted in February 2024, with an increased focus on practical applicability, regulatory coherence, and inter-departmental synergy.

Recognizing the increasing frequency and impact of landslides in Kerala—particularly in ecologically fragile and densely populated hill regions such as Wayanad—the workshop aimed to strengthen institutional readiness and develop a unified understanding of landslide risk assessment, mitigation planning, and sustainable intervention strategies. The programme was strategically designed to address knowledge gaps, promote best practices, and build a common platform for technical discourse among stakeholders.

Participants included Geologists from the Department of Mining and Geology, Soil Conservation Officers from the Department of Soil Survey and Soil Conservation, and Engineering Officials from the Public Works Department (PWD) and Local Self Government Department (LSGD). These officials represent the technical backbone of Kerala's risk reduction and infrastructure planning framework, and their collaboration is vital for ensuring resilient land-use planning and hazard mitigation.

The first day of the workshop comprised a series of technical sessions led by eminent experts in the fields of geoscience, civil engineering, and disaster management. Topics covered included the fundamentals of landslides and soil piping, structural and non-structural mitigation strategies, hazard-to-disaster transitions, early warning systems, and the practical application of Indian Standards (IS) codes. A special emphasis was laid on the *Orange Book* guidelines, promoting uniformity in investigation protocols and reporting standards.

The second day was dedicated to a field visit to the Mundakkai landslide site, providing participants with critical hands-on exposure to field assessment techniques and slope characterization in a real-world context. Participants engaged in geomorphological and geotechnical observations, examined damage patterns, and reviewed mitigation needs based on site-specific conditions.

A particularly impactful segment of the second day was the interactive session with the local community and Aapda Mitra volunteers, who had actively participated in the rescue and relief operations during the Mundakkai landslide event. This engagement provided attendees with grounded insights into the human dimensions of disaster response—highlighting the courage, coordination, and challenges encountered on the ground. Survivors and affected families shared their experiences, concerns, and perspectives on early warning efficacy, communication gaps, and rehabilitation support. These interactions reinforced the importance of community-centric approaches in disaster risk reduction and emphasized the need to integrate local knowledge, volunteer training, and public trust into formal planning mechanisms.

"Disaster resilience begins where science meets community – this workshop exemplified that union by bringing together expertise, empathy, and action."

Background and Rationale

Landslides remain one of the most complex and recurring natural hazards affecting Kerala's ecologically sensitive hill districts, particularly Wayanad. The state's unique physiography—marked by steep slopes, intense monsoonal precipitation, deforestation, and unregulated construction—has rendered several regions highly vulnerable to slope failures. The tragic Mundakkai landslide of 2024, which caused significant destruction to homes, farmland, and road infrastructure, served as a stark reminder of the urgent need to improve scientific assessment, planning, and institutional preparedness.

In the aftermath of the Mundakkai event, detailed field inspections and post-disaster assessments revealed critical gaps in slope stability evaluation, inter-departmental coordination, and community-level awareness. These findings echoed the broader patterns observed across Kerala, where high hazard exposure is often compounded by localized planning deficiencies and inadequate implementation of regulatory norms.

Recognizing this, the Kerala State Disaster Management Authority (KSDMA) identified the need for a comprehensive capacity-building intervention that would not only address the technical aspects of landslide risk but also promote sustainable, locally appropriate mitigation measures. This approach aligns with the broader mandates of the Sendai Framework for Disaster Risk Reduction (2015–2030), which advocates for strengthened disaster risk governance, enhanced knowledge sharing, and the integration of disaster risk reduction into sectoral planning and development policies.

The Workshop on Landslide Risk Reduction and Mitigation Strategies was thus conceptualized as a direct response to these identified needs. By bringing together technical officers and decision-makers from key implementing departments—Geology, Soil Conservation, Public Works, and Local Self-Government—the workshop aimed to:

- Enhance practical capabilities in field-based landslide assessment, including mapping, hazard classification, and failure mechanism interpretation;
- Improve understanding of Indian Standards (IS) codes relevant to slope stability, building practices, and geotechnical evaluation;

- Foster departmental synergy and knowledge integration, enabling more responsive and collaborative interventions;
- Encourage adoption of bio-engineering and eco-sensitive measures to ensure long-term slope rehabilitation without ecological degradation;
- Ground participants in community-centric disaster management, through interaction with affected populations and trained local volunteers like Aapda Mitra.

Furthermore, the workshop built on the momentum of the earlier Field Workshop on Landslide Mitigation and Risk Assessment (February 2024), expanding the scale and deepening the content focus to support district- and state-level strategy formulation.

In essence, this workshop marked a crucial step forward in Kerala's ongoing journey toward building a resilient, technically competent, and people-focused disaster management ecosystem.

Programme Details

Participants and Workshop Design

The Workshop on Landslide Risk Reduction and Mitigation Strategies is carefully structured to foster interdepartmental synergy and ensure the dissemination of technical competencies across all key stakeholders involved in landslide risk management. Recognizing that landslide mitigation demands a multi-sectoral approach, the workshop targets core personnel responsible for planning, execution, and field-level decision-making.

Target Participants:

To ensure state-wide representation and effective knowledge transfer, participants are nominated from the following departments:

- **Department of Mining and Geology:** One Geologist from each district
- **Soil Survey and Soil Conservation Department:** One Soil Conservation Officer from each district
- **District Disaster Management Authority:** All **District Hazard Analysts**, who plays a key role in coordinating emergency preparedness and technical assessments at the district level.
- **Local Self Government Department (LSGD):** Five Engineers representing various LSG institutions involved in infrastructure planning and construction oversight.
- **Public Works Department (PWD) – Roads and Buildings Section:** Five Engineers from Roads and Building section

> *Note: District authorities are advised to nominate officials who have not participated in previous workshops of similar nature to broaden institutional capacity and encourage wider dissemination of skills and knowledge.*

Resource Persons

The workshop was enriched by the insights and guidance of a panel of eminent experts and practitioners from the fields of geology, disaster risk reduction, geotechnical engineering, and urban planning. Their combined academic excellence, field experience, and policy-level engagement brought deep value to the sessions and interactions.The following resource persons will facilitate the technical sessions:

1. **Shri. John Mathai**
   Scientist (Retired), National Centre for Earth Science Studies (NCESS), Thiruvananthapuram
2. **Shri. C. Muraleedharan**
   Chairman, Advisory Committee for Landslide Risk Reduction, Kerala State Disaster Management Authority (KSDMA)
3. **Dr. D. Nandakumar**
   Member, Advisory Committee for Landslide Risk Reduction, KSDMA
4. **Dr. Sajinkumar K. S**
   Member, Advisory Committee for Landslide Risk Reduction, KSDMA
5. **Shri. Pradeep G. S.**
   Hazard and Risk Analyst and Convener, Advisory Committee for Landslide Risk Reduction, KSDMA
6. **Ms. Anna John**
   Urban Planner, Kerala State Disaster Management Authority (KSDMA)
7. **Dr. Vijith H**
   Former Senior Consultant, Disaster Risk Reduction (DRR), Kerala State Disaster Management Authority

Detailed Schedule

The *Workshop on Landslide Risk Reduction and Mitigation Strategies*, held from 13th to 14th February 2025, featured a comprehensive two-day schedule aimed at enhancing the capacity of key stakeholders in landslide risk management. Day one was dedicated to technical sessions, covering fundamental topics such as landslide mechanisms, mitigation strategies, advances in early warning systems, and the role of KSDMA in landslide risk reduction. Expert speakers from KSDMA and other relevant organizations led in-depth discussions and interactive sessions on best practices, regulatory frameworks, and the latest updates in landslide management. Day two shifted focus to practical exposure with a field visit to the Mundakkai landslide-affected area in Wayanad, where participants observed real-world landslide dynamics and engaged with local communities and Aapda Mitra volunteers involved in rescue efforts. The workshop concluded with a summary of key learnings and the distribution of certificates, reinforcing the participants' understanding of landslide risk assessment and mitigation.

Day 1 - February 13, 2025 - Technical Sessions			
Time	**Session Title**	**Speaker**	**Overview**
09:30 AM – 09:45 AM	***Registration***		
09:45 AM – 10:00 AM	Inaugural Session	District Collector, Wayanad	
10:00 AM – 11:00 AM	Fundamentals of Landslides and Soil Piping & Lessons from Kerala	Shri. John Mathai	Understanding the basics, terminologies, and mechanisms of landslides and soil piping. Analysis of past landslides in Kerala to understand challenges and responses.
11:00 AM – 11:15 AM	***Tea Break***		
11:15 AM – 12:15 PM	From Hazards to Disasters – A Paradigm Shift	Dr. D. Nandakumar	Exploring the transition of hazards into disasters and their implications for risk management.
12:15 PM – 01:15 PM	Comprehensive Landslide Mitigation Strategies	Shri. C. Muraleedharan	Techniques like hazard zonation and soft/hard engineering measures for landslide mitigation.
01:15 PM – 02:00	***Lunch Break***		

PM			
02:00 PM – 03:00 PM	Advances in Landslide Early Warning and Wayanad Landslide Overview	Dr. Sajinkumar K. S	Recent advancements in prediction systems and an in-depth review of the 2024 Wayanad landslide.
03:00 PM – 03:30 PM	The Role of KSDMA in Landslide Risk Reduction	Shri. Pradeep G. S.	Contributions of KSDMA in mitigation, preparedness, and policy implementation.
03:30 PM – 04:00 PM	A Review of Landslide IS Codes and Recent Updates	Ar. Anna John	Overview of Indian Standards related to landslides
04:00 PM – 04:15 PM	***Tea Break***		
04:15 PM – 05:30PM	Panel Discussion & Group Presentations on Landslide Risk Reduction	Participants will be divided into groups to discuss the application of IS codes, best practices, and evaluation of landslide risk assessment checklists. Each group will present their key findings and recommendations.	
Day 2 - February 14, 2025 - Field Visit and Practical Exposure **Breakfast (07.00 AM to 07.30 AM)**			
Time	**Activity**	**Overview**	
07:30 AM – 08:00 AM	Departure from Meeting Venue to Mundakkai Landslide Area	Travel to the field site to observe and analyze the landslide-affected area.	
08:00 AM – 08:15 AM	***Briefing at site, Breaking into groups***		
08:15 AM – 12:30 PM	Field Visit to Mundakkai Landslide Area, Wayanad	Practical exposure to risk assessment techniques and a hands-on approach to understanding the landslide dynamics.	
12:30 PM – 01:15 PM	***Lunch Break***		
01:15 PM – 01:30 PM	Interaction with Local Communities	Participants engage with local communities to understand their perspectives, experiences, and challenges.	
01:30 PM – 03:30 PM	Conclusion of Field Training and Certificate Distribution	Wrap-up session summarizing key learning's, followed by the distribution of certificates.	

Technical Sessions

The first day of the workshop commenced with a warm welcome and systematic registration of participants at the WMO women's college Auditorium, Kalpetta. Sixty five officials from various departments—including the Department of Mining and Geology, Soil Survey and Soil Conservation, PWD, LSGD, and district-level hazard analysts and technical experts from academia—assembled for a full-day technical workshop focused on understanding, assessing, and mitigating landslide risks in Wayanad. The attendees were provided with a workshop kit, field inspection templates, and relevant technical material. Early interactions among officers helped foster a collegial atmosphere, setting the tone for the day's proceedings.

Inaugural Session

The Workshop on Landslide Risk Reduction and Mitigation Strategies commenced with welcome remarks by **Shri. Pradeep G. S.,** Hazard and Risk Analyst at KSDMA and Convener of the Advisory Committee for Landslide Risk Reduction. Shri. Pradeep extended a warm welcome to all participants, resource persons, and distinguished guests present at the workshop. He emphasized the importance of collaboration across various sectors to effectively tackle landslide risks in Kerala.

Following the welcome remarks, the workshop moved to the inaugural address delivered by **Smt. Meghashree D R IAS, the District Collector of Wayanad**. In her address, Smt. Meghashree highlighted the persistent challenges faced by Wayanad due to recurring landslides, particularly in the Meppadi, Mundakkai, and Padinjarathara regions. She emphasized the vulnerability of these areas and stressed the importance of shifting from reactive disaster management to proactive, preventive measures.

The Collector underscored the need for institutional coordination and evidence-based planning in reducing landslide risks. She highlighted the significance of integrating hazard mapping, land-use regulation, and community preparedness into the district's disaster management frameworks. Smt. Meghashree also called for stronger governance

frameworks that proactively address the risks of landslides, ensuring that both state and district authorities collaborate in creating sustainable and resilient solutions.

Shri. John Mathai, Scientist (Rtd.) from NCESS, and **Smt. Devaki,** Additional District Magistrate (ADM) also addressed the gathering. Shri. John Mathai focused on the role of scientific research and data-driven methods in advancing landslide risk mitigation. He highlighted the importance of collaborative efforts to improve both scientific research and practical application in landslide management. The ADM reinforced the necessity of local authorities actively engaging in risk reduction strategies and urged participants to integrate their expertise for long-term resilience.

The inaugural session concluded with a vote of thanks delivered by **Ms Anaswara Devi B. R.,** Hazard Analyst (Geology) at KSDMA and the Coordinator of the workshop. She expressed her gratitude to the esteemed guests and participants, calling for greater inter-departmental collaboration in addressing landslide risks.

Technical Session 1: Fundamentals of Landslides and Soil Piping & Lessons from Kerala

The first technical session of the workshop, led by Shri. John Mathai, Former Scientist at NCESS, Thiruvananthapuram, provided an in-depth exploration of the geological processes that contribute to slope instability, particularly in Kerala's vulnerable regions. Shri. Mathai began by explaining the fundamental causes of landslides, focusing on various types of slope failures such as debris flows and shallow slips. He also introduced a lesser-discussed but critical phenomenon: soil piping.

Soil piping occurs when underground water pathways gradually erode subsoil, resulting in delayed and often unpredictable collapses of the surface layer. Shri. Mathai elaborated on how this process, driven by water seepage, can lead to significant structural damage over time, particularly in areas with weak subsoils or excessive groundwater flow. Using case studies from Wayanad and Malappuram, he showcased real-world examples of soil piping and its impact on both infrastructure and human settlements.

The session prompted stimulating discussions among participants, particularly between geologists and engineers, regarding the early visual indicators of landslide and soil piping risks. Attendees emphasized the importance of identifying ground fissures, water seepage zones, and changes in vegetation as early warning signs during field inspections. The interaction highlighted the need for a multidisciplinary approach, integrating geomorphological and hydrological indicators to better assess landslide-prone areas. This session was crucial in fostering a shared understanding of the intricate factors contributing to landslide hazards and the role of early identification in reducing disaster risks.

Technical Session 2: From Hazards to Disasters – A Paradigm Shift

The second technical session, led by Dr. D. Nandakumar, a Member of KSDMA's Advisory Committee for Landslide Risk Reduction, focused on the critical transition from natural hazards to full-fledged disasters. Dr. Nandakumar introduced the Risk Triangle framework, which encompasses hazard, exposure, and vulnerability. This framework is instrumental in understanding how natural events, when compounded by human interventions, escalate into catastrophic disasters. Dr. Nandakumar illustrated how unplanned and unsustainable development practices, such as unscientific land use changes, road cutting without support structures, and poor drainage management, have significantly heightened the exposure of communities to landslides and other natural hazards. He specifically referenced incidents like the Puthumala landslide in 2019 and the Mundakkai landslide, which highlighted how poor land management practices in steep, unstable terrains and debris fan areas exacerbate the risk of landslides. These events underscored how the intersection of human vulnerability, environmental degradation, and hazard exposure contributes to the escalation of disasters.

Dr. Nandakumar emphasized that many communities, especially those in high-risk zones, have become structurally vulnerable due to the lack of consideration for geotechnical stability and sustainable development. He stressed that developmental activities—such as haphazard construction on unstable slopes or improper drainage systems—are not only inadequate in mitigating risks but actively increase vulnerability. His presentation served as a wake-up call for participants, urging them to rethink

development strategies that consider both technical slope classification and land-use regulation.

Technical Session 3: Comprehensive Landslide Mitigation Strategies

The third technical session, conducted by Shri C. Muraleedharan, Chairman, KSDMA's Advisory Committee for Landslide Risk Reduction, focused on the diverse strategies available for landslide mitigation, presenting a balanced review of both structural and ecological approaches. Shri Muraleedharan began by outlining various engineering interventions, including retaining walls, sub-surface drainage, rock bolting, and catch fences, all of which are commonly used to stabilize slopes and prevent landslides in high-risk areas. He explained how these methods are employed to reinforce unstable terrains by controlling surface water, preventing soil erosion, and ensuring long-term slope stability. In addition to traditional engineering techniques, Shri Muraleedharan also emphasized the growing importance of eco-engineering solutions, which harness natural systems to stabilize slopes and reduce landslide risks. He discussed techniques such as vetriver grassing, bamboo grid planting, and the use of coir geo-textiles, which provide ecological benefits by improving soil structure, enhancing water absorption, and reducing erosion. These green solutions, which complement structural measures, help in maintaining the ecological balance while addressing the underlying causes of slope instability.

A key takeaway from the session was the recognition that there is no one-size-fits-all approach to landslide mitigation. Context-specific interventions are crucial, with the selection of mitigation strategies depending on factors such as slope characteristics, soil type, land use, and environmental conditions. This tailored approach ensures that interventions are not only effective but also sustainable over the long term. The session also featured an in-depth discussion with officers from the Soil Conservation Department and engineers from PWD, who shared insights on the feasibility of implementing various mitigation strategies, the maintenance challenges associated with them, and the integration of structural and ecological approaches into comprehensive mitigation plans. It was emphasized that effective mitigation requires a multidisciplinary approach, where technical and ecological experts collaborate closely.

The consensus among the participants was the critical need for joint slope inspections and detailed geotechnical assessments prior to implementing any infrastructural or ecological mitigation strategies. This approach ensures that all factors—such as geological conditions, potential risks, and land-use patterns—are fully considered before proposing any interventions. The session concluded with a reinforced understanding that successful landslide mitigation relies on collaboration, thorough assessment, and context-aware strategies that integrate both technical and ecological solutions.

Technical Session 4: Advances in Landslide Early Warning and Wayanad Landslide Overview

The fourth technical session, held post-lunch, was led by Dr. Sajinkumar K. S., Member, KSDMA Advisory Committee for Landslide Risk Reduction and expert from the University of Kerala, who presented an insightful case study on the Mundakkai landslide that took place in 2024. His session aimed at breaking down the complex factors that contributed to the landslide, with a focus on rainfall threshold patterns, soil saturation levels, and pre-event signals that could have provided early warnings. Dr. Sajinkumar started by examining the environmental conditions leading up to the landslide, emphasizing that subtle signs of ground movement, such as small fissures and slight tilting of trees, had been present in the days preceding the event but were overlooked. He used satellite imagery and field photographs to visually demonstrate the variations in soil moisture, rainfall intensity, and the movement of the slope before the collapse. His analysis illustrated that while conventional warning signs were missed, advances in technology could have significantly improved early detection.

The session further introduced the participants to cutting-edge early warning systems, which could provide more accurate predictions and allow for better preparation. Dr. Sajinkumar discussed the use of rainfall intensity-duration thresholds, soil moisture sensors, and slope monitoring instruments. These tools can monitor critical indicators such as soil saturation and slope movement in real-time, offering crucial data that can inform both authorities and the local community of imminent landslide risks. The session concluded with an engaging discussion on the potential for integrating these advanced early warning systems into the existing disaster risk management

frameworks. Participants emphasized the importance of a collaborative approach between government bodies, technical experts, and local communities to create a more robust and resilient early warning infrastructure for landslides.

Technical Session 5: A Review of Landslide IS Codes and Recent Updates

The final technical session of the day was delivered by Ar. Anna John, Urban Planner, KSDMA, who focused on the application of relevant Indian Standards (IS codes) for slope stability and mitigation structures. She provided an in-depth analysis of how the IS codes are essential tools in ensuring uniformity and rigor in landslide risk assessments and mitigation strategies. Ar. Anna John walked participants through the recent updates to the IS codes, highlighting important additions related to visual inspection checklists, structural categorization of slopes, and guidelines for engineers when designing mitigation measures. She emphasized that the IS codes are an authoritative set of standards, particularly in the context of landslide risk management, and should be rigorously followed to achieve consistent and scientifically-grounded interventions.

The session also touched upon the critical need for engineers and field officers to adhere strictly to the guidelines laid out in the IS codes to ensure the safety and resilience of slope stabilization measures. Ar. Anna John clarified that while the Orange Book provides supplementary guidance, the IS codes themselves should be the primary reference for technical and structural design related to landslide mitigation. The importance of mandatory incorporation of these IS codes into all landslide mitigation proposals was strongly emphasized, ensuring that every technical estimate and work proposal aligns with national standards. Participants acknowledged the vital role of IS codes in establishing a uniform approach to landslide risk assessment and mitigation across Kerala, and many urged for these standards to be integrated into state and district-level planning for enhanced resilience against landslide hazards.

Technical Session 6 - Panel Discussion

The day concluded with a participatory panel discussion moderated by Dr. Vijith H, Former Senior Consultant, DRR, KSDMA, where officers engaged in an open discussion on real-world landslide cases—such as Meppadi, Padinjarathara, and Mundakkai. The session focused on analyzing key landslide triggers, exploring suitable mitigation interventions, and proposing mechanisms for effective interdepartmental coordination.

An important aspect of the discussion was the effective drafting of field inspection reports for landslide areas. Experts emphasized the need for a structured and standardized approach in documenting field observations, ensuring that all relevant data—such as site conditions, landslide characteristics, potential triggers, and recommended interventions—are clearly outlined. Participants discussed how to incorporate visual data, such as photographs and geospatial maps, to enhance the accuracy and comprehensiveness of reports. The importance of including hazard assessment results, geotechnical findings, and collaboration with other departments in the report was also highlighted as crucial for informed decision-making.

Each case was thoroughly examined with input from various participants, including engineers, geologists, and disaster management experts. Discussions were centered around integrated approaches and context-specific solutions to tackle the challenges of landslide risk reduction in vulnerable areas. The session concluded with a renewed commitment to collaborative efforts and practical application of the insights gained, setting the stage for the field visit and community interaction scheduled for the second day of the workshop.

Field Visit

The second day of the workshop commenced with a comprehensive field visit to the Mundakkai region in Wayanad, an area that has recently experienced significant landslide events. The field visit allowed participants, including engineers, geologists, and other relevant stakeholders, to observe firsthand the geological vulnerabilities and infrastructural weaknesses that contribute to slope instability in the region.

During the field visit, experts provided detailed explanations of the geomorphological features, including slope steepness, soil composition, and hydrological factors that have contributed to the landslide events in the area. This on-site observation allowed participants to assess the environmental conditions and discuss practical mitigation strategies tailored to the specific characteristics of the region.

Following the field visit, the workshop included a significant interaction session with Aapda Mitra volunteers who had been actively involved in rescue operations during the landslides. The volunteers shared their firsthand experiences of the challenges they faced in evacuating affected individuals and providing immediate relief. This interaction underscored the critical role of community-based disaster response and the need for well-coordinated efforts between local volunteers, authorities, and technical teams during disaster events.

Additionally, residents who were affected by the recent landslides engaged with the attendees, offering valuable insights into the socio-economic and psychological impacts of the disaster. These discussions provided a deeper understanding of the real-life consequences of landslides on vulnerable communities and emphasized the importance of creating more effective risk reduction and preparedness strategies to mitigate such impacts in the future.

The day concluded with a question-and-answer session that facilitated further discussions on the implementation of disaster risk reduction strategies at the community level. Participants emphasized the necessity of inter-departmental coordination, community engagement, and ongoing capacity building to ensure the long-term success of landslide mitigation efforts. In summary, the second day of the workshop effectively connected theoretical knowledge with practical, real-world applications, strengthening the need for a collaborative, community-oriented approach to landslide risk reduction and disaster management.

Strategic Recommendations

1. Institutionalize the Workshop as an Annual Capacity-Building Platform

Formalize the workshop as an annual programme under KSDMA's capacity-building calendar, with rotating locations in high-risk districts to ensure localized relevance and wide geographic coverage.

2. Develop a Modular Training Curriculum

Design a structured, multi-tiered training framework that includes foundational, intermediate, and advanced modules on landslide risk assessment, IS code application, and slope stabilization techniques, enabling consistent upskilling across departments.

3. Establish a Cross-Departmental Task Force on Landslide Risk Mitigation

Create a standing task force comprising representatives from Mining & Geology, PWD, LSGD, Soil Conservation, and KSDMA to streamline data sharing, coordinate field interventions, and jointly review mitigation plans.

4. Leverage Community-Based Approaches and Volunteer Integration

Systematically integrate *Aapda Mitra* volunteers and local community representatives into pre-disaster planning, early warning dissemination, and post-disaster evaluations to strengthen last-mile connectivity and trust.

5. Mainstream Landslide Risk into Development Planning

Advocate for mandatory inclusion of landslide risk screening in all infrastructure and housing projects in hilly areas through policy advisories, checklists, and approval protocols.

6. Monitor and Evaluate Impact through Follow-up Field Audits

Conduct periodic post-workshop audits at previous field visit sites to assess the implementation of proposed mitigation measures and gather lessons for future capacity-building efforts.

Post-Event Evaluation

Event Surveys and Feedback

To systematically assess the effectiveness of the workshop and obtain constructive suggestions for future programs, a structured feedback form was circulated online via Google Forms to all participants at the conclusion of the training. The questionnaire was designed to capture both quantitative ratings and qualitative responses, covering multiple dimensions such as content relevance, facilitator effectiveness, field utility, and overall satisfaction.

Key Findings from Participant Responses

An overwhelming majority of participants rated the workshop highly, with 83% assigning it the highest possible rating of 5 out of 5, and the remaining 17% rating it 4 out of 5. No responses recorded a rating below 4, indicating near-universal satisfaction with the program's content, delivery, and practical relevance.

Participants across departments affirmed that the workshop was timely and immensely beneficial in enhancing their understanding of landslide dynamics and the critical early indicators of slope instability. Several respondents noted that the sessions helped them connect the dots between on-ground observations and theoretical explanations, a linkage that had previously been lacking in their field experience. This shift in perception is especially significant in a state like Kerala, where frequent landslides demand a sound technical grounding among ground-level officers.

Moreover, the workshop's alignment with the real-world challenges faced by field officials was repeatedly emphasized in the feedback. From understanding the impact of drainage issues and unscientific land use on slope stability to the classification of landslide typologies, participants found the content directly relevant to their day-to-day responsibilities. The multi-stakeholder composition of the training further enriched the learning environment, allowing for cross-departmental knowledge sharing and collaborative problem-solving.

Evaluation of Resource Persons

The pedagogical approach adopted by the facilitators was widely appreciated for its clarity, interactivity, and relevance. Participants specifically praised the depth and accessibility of technical insights provided by Dr. Sajin Kumar, whose sessions on geomorphological processes and structural interventions were highlighted as particularly valuable. Likewise, the field narratives and practical inputs shared by Shri John Mathai received commendation for being grounded in lived experience and operational feasibility. The facilitators were noted to have fostered an open and inclusive atmosphere, encouraging active participation, questions, and reflections from all attendees.

Effectiveness of the Field Component

Among all components of the workshop, the field visit emerged as the most impactful according to participant feedback. Being able to observe live and historical landslide sites, examine geological features, and evaluate the performance of mitigation measures in situ helped consolidate the theoretical aspects discussed in the classroom sessions. Participants reported a newfound confidence in identifying slope failure risks and engaging in informed decision-making when faced with ground realities. The site discussions also provided space for department-specific queries, allowing each participant to relate the observations to their unique functional contexts.

Recommendations for Future Workshops

A significant portion of respondents expressed the desire for an extended workshop duration, ideally spanning three or more days. This, they argued, would allow for deeper engagement with technical topics, more extensive field documentation, and structured inter-departmental planning exercises. Many also recommended the inclusion of additional technical modules covering structural design aspects, GIS-based landslide mapping, ecological engineering, and hydrological modeling for landslide-prone regions.

There was also strong advocacy for expanding the participant base in future sessions to include personnel from other critical departments such as the Indian Meteorological Department (IMD), Forest Department, and research institutions like CWRDM. This would facilitate more holistic discussions around slope dynamics, early warning, and integrated mitigation planning. Participants further emphasized the need for developing structured field manuals or digital toolkits, which they could use as reference material in the course of their duties.

Administration and Governance

Background and Institutional Coordination

In accordance with the recommendations outlined in the Minutes of the Landslide Advisory Committee Meeting held on 16 January 2025, it was advised that a follow-up workshop be organized as a continuation of the previous capacity-building programme on landslide risk reduction. The Committee emphasized the need for sustained engagement with field-level functionaries and technical experts, particularly in regions with recurring geohazard vulnerabilities.

Following this directive, a detailed proposal for the workshop, including the programme schedule, estimated budget, and operational framework, was prepared and submitted by Ms. Anaswara Devi B. R., Hazard Analyst (Geology), State Disaster Management Authority (SDMA). She led the core planning and coordination activities from the state level, ensuring that the workshop was in line with the broader objectives of the Landslide Risk Reduction Strategy. Communication with resource persons, and other operational requirements were comprehensively managed under the supervision of Mr. Pradeep G. S.

Coordination with the Wayanad District Disaster Management Authority (DDMA) was overseen by Mr. Arun Peter, District Hazard Analyst, Wayanad. He played a pivotal role in facilitating district-level arrangements, liaising with local departments, and mobilizing stakeholder participation. On-site arrangements including venue setup, logistical planning for technical sessions and the field visit, This multi-tiered coordination effort between SDMA and DDMA was instrumental in ensuring the

successful conduct of the workshop. The proactive roles played by all the key officials helped deliver a professionally organized, outcome-oriented programme aligned with the long-term capacity development goals envisioned by the Landslide Advisory Committee.

Budget Summary

The financial planning and execution of the two-day workshop were meticulously carried out to ensure the smooth conduct of all technical sessions, field visits, and logistical arrangements. A total amount of ₹4,26,904/- was expended, covering participant support, resource facilitation, field logistics, and necessary materials. The detailed expenditure is outlined below:

Sl No	Expense Category	Amount (INR)
1	Accommodation for Participants	90,000
2	Accommodation for Resource Persons	61,897
3	Refreshments (Lunch, Tea & Snacks)	1,14,500
4	Refreshments (Dinner, Tea & Snacks)	39,000
5	Conference Package	65,900
6	Local Logistics	60,320
7	Training Kit	55,000
8	6 Jeeps	18,000
9	Certificates	899
10	Miscellaneous	35,888
Total		**426,904**

Conclusion

The two-day Workshop on Landslide Risk Reduction and Mitigation Strategies, held in Wayanad from 14th to 15th February 2025, successfully fulfilled its objectives of capacity building, interdepartmental coordination, and field-based learning. The event provided a comprehensive platform for geologists, engineers, disaster management

professionals, and local administrators to share knowledge, review recent interventions, and explore innovative and community-centric approaches to landslide risk mitigation.

Through engaging technical sessions and an impactful field visit to the landslide-prone Mundakkai region, participants gained critical insights into hazard zonation, risk-sensitive planning, and eco-engineering solutions. The workshop also emphasized the importance of collaborative governance and field data integration in disaster resilience planning. This workshop marks a significant step forward in fostering a multi-disciplinary and participatory approach to landslide disaster risk reduction in Kerala. The outcomes and recommendations from the event will inform future policy decisions and operational strategies under the broader framework of the State's disaster risk governance.

Appendix

The first day of the workshop at WMO women's college Auditorium, Kalpetta.

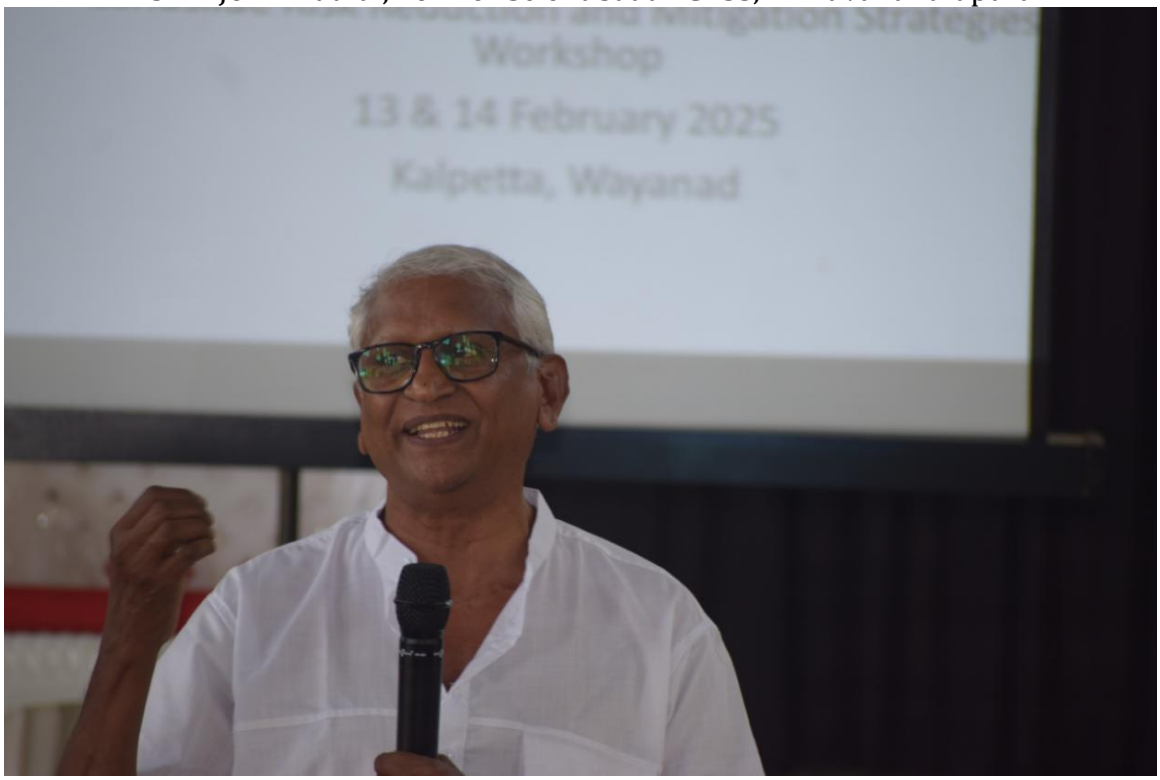
Officials from various departments

Inaugural address delivered by Smt. Meghashree D R IAS, the District Collector of Wayanad

Shri C. Muraleedharan, Chairman, KSDMA's Advisory Committee for Landslide Risk Reduction

Smt. Meghashree D R IAS, the District Collector of Wayanad interacting with participants

Shri. John Mathai, Former Scientist at NCESS, Thiruvananthapuram



Dr. D. Nandakumar, a Member of KSDMA's Advisory Committee for Landslide Risk Reduction

Dr. Sajinkumar K. S., Member, KSDMA Advisory Committee for Landslide Risk Reduction

Ar. Anna John, Urban Planner, KSDMA

Pannel Discussion

Field visit to the Mundakkai region in Wayanad

Participants at field

Logistics for facilitating field visit

Interaction with Aapda Mitra Volunteers and residents

Participants , Resource persons and Coordinators of the workshop