

Building Resilience to Geohazards in the Face of Uncertainty

Geological Society, 7-8 September 2017

Conference Summary Report

Foreword

Understanding geohazards and building resilience in the face of uncertainty of their timing, location and magnitude present major challenges that require coordinated and collaborative action. Responding to opportunities for research from the UK Natural Environment and Economic and Social Research Councils (NERC and ESRC), natural and social scientists moved out of their respective comfort zones to work together to form transdisciplinary challenge-focussed research programmes co-produced with international partners and stakeholders aiming to increase economic and social resilience to earthquake, volcanic and related hazards based on reliable knowledge of the fundamental physical and social processes involved and full understanding of prevention and mitigation of the associated risks. UK research capacity has been strengthened in the field and new ways of working and collaborating have been established. These programmes paved the way for the broad engagement of earth scientists in large-scale programmes under the £1.5 billion UK Global Challenges Research Fund, which has become a cornerstone of current UK research. I think the researchers also enjoyed the working in new relationships and on challenging questions with real societal impact. The conference at the Geological Society, London, show-cased these great case studies and complementary research on building resilience to geohazards in the face of uncertainty, demonstrating how open modern earth scientists are to transdisciplinary collaboration.

Peter Sammonds, February 2018

Overview

The purpose of the meeting was to bring together earth scientists and researchers from other disciplines and sectors with whom they collaborate to discuss the ways in which research and researchers are able to contribute to the resilience-building process. There was a mix of oral and poster presentations as well as panel discussions. The panels tackled two key issues: stakeholder engagement and innovation in interdisciplinary research.

The two-day meeting was attended by 65 researchers from 30 institutes and representing the physical sciences, international development, social sciences and the humanitarian sector. Presentations and discussion sessions were filmed and were also live-scribed by a cartoonist.

This document provides a summary of the meeting and highlights the main points from the discussions.

Talks and posters

The first day of the conference focussed on the outward-facing, challenge-led aspects of research for resilience building. The opening keynote for the conference ('Enhancing Disaster Resilience for Nepal) was given by Dr Amod Mani Dixit from the National Society for Earthquake Technology – Nepal (Fig 1). Further oral and poster presentations were given by researchers based in the UK, the Caribbean and Ecuador on wide ranging topics including: risk resilience efforts in the Eastern Caribbean, adaptation in volcanic environments, cascading hazards, urban resilience, risk communication,

landslide risk reduction, and improving support to self-recovery after disasters. A full list of the talks and poster titles are in an appendix at the end of this report. The presentations were complemented by the first panel discussion on 'Stakeholder engagement and the role of science in decision-making for resilience', which is summarised on page 5-6.

The second day of the meeting focussed more on the research process itself with keynotes by [Prof. Jenni Barclay](#) (University of East Anglia) and [Prof. James Jackson](#) (University of Cambridge) reflecting on results and learning from the large, interdisciplinary projects [Strengthening Resilience in Volcanic Areas](#) (STREVA) and [Earthquakes without Frontiers](#) (EwF) projects, respectively (see figures 2 and 3). There were also talks and posters on the challenges of developing resilience to post-earthquake debris flows, hazard assessment in inaccessible regions, disaster risk management, volcanic hazards landslides and earthquakes. These presentations were followed by the second panel discussion on 'Innovation in Interdisciplinary research', which is summarised on pages 6-8.

All of the abstracts, videos of the talks and cartoons are available on the meeting website: <https://www.geolsoc.org.uk/buildingresilience17>



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Fig 1. Cartoon summary of Amod Dixit's keynote presentation: 'Enhancing Disaster Resilience in Nepal' (source: Chris Shipton, Live Illustration).

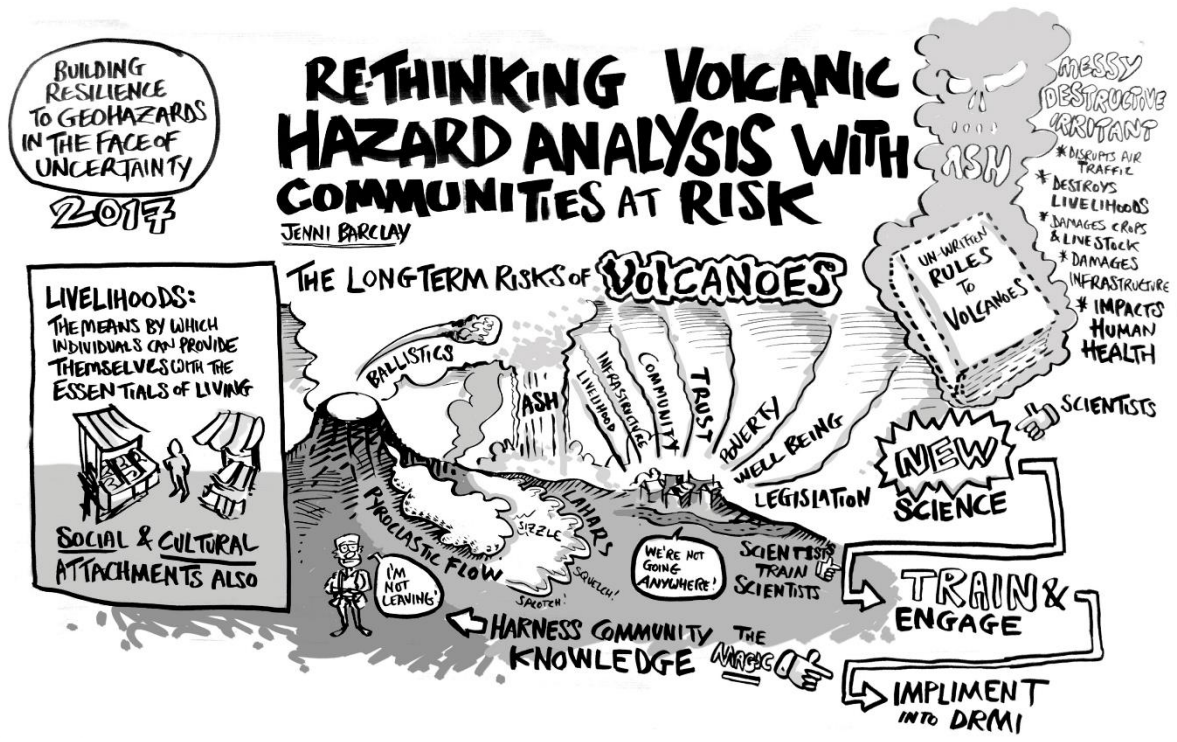


Fig 2. Cartoon summary of Jenni Barclay's keynote presentation: 'Rethinking Volcanic Hazard Analysis with Communities at Risk' (source: Chris Shipton, Live Illustration).

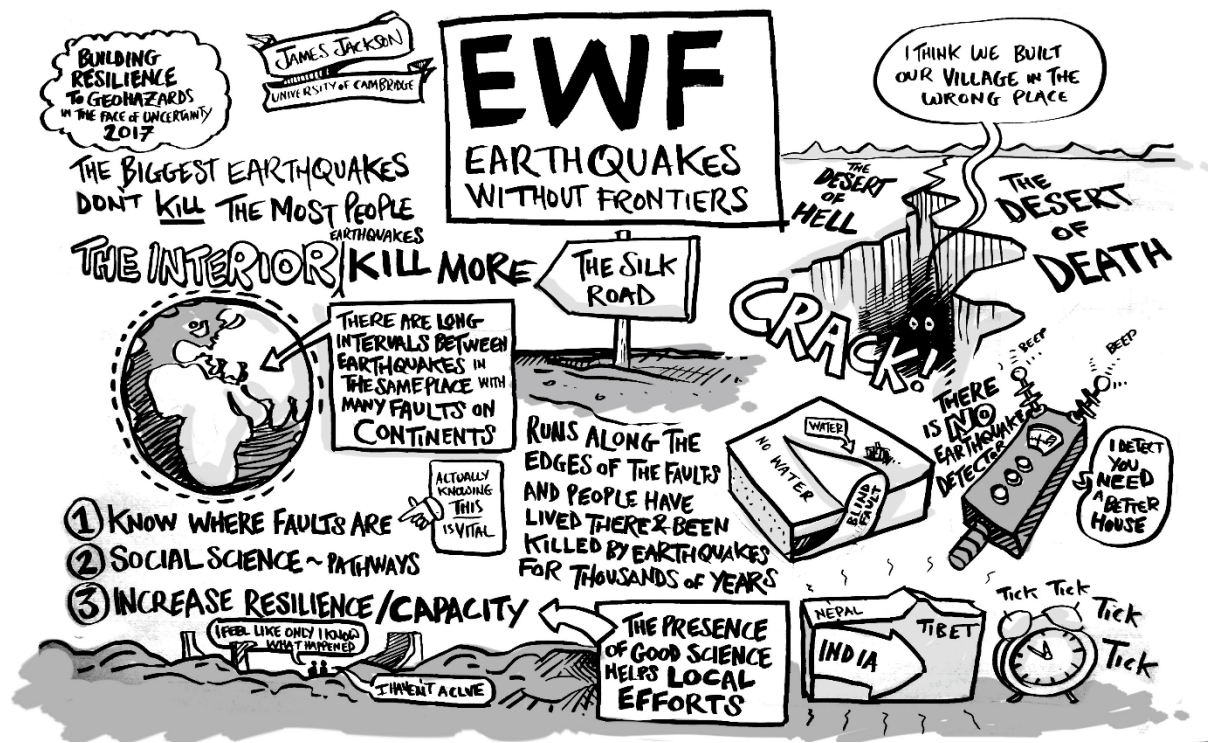


Fig 3. Cartoon summary of James Jackson's keynote presentation: 'Earthquakes without Frontiers' (source: Chris Shipton, Live Illustration).

Discussion sessions

The panel sessions consisted of opening remarks from the panel members followed by a discussion/question and answer session. We also used an audience interaction tool (www.slido.com) to encourage participation.

Panel 1: Stakeholder engagement and the role of science in decision making for resilience

Panel members: **Amod Mani Dixit** (National Society for Earthquake Technology - Nepal), **Colin Armstrong** (UK Space Agency, formerly Government Office for Science), **Richard Robertson** (University of the West Indies Seismic Research Centre), **Tom Newby** (CARE International), **Teresa Armijos** (University of East Anglia)

Chair: **John Twigg** (Overseas Development Institute)

The panel provided a range of perspectives on building resilience from their experience and within their sectors. These are the main points from the session:

- In an emergency:
 - Having a common goal helps to overcome some of the difficulties associated with bringing people from different research disciplines and sectors together to collaborate.
 - Response needs involvement of all stakeholders and this involvement needs to be started before the crisis, with new institutions developed to continue the research and take responsibility in 'peaceful times'.
 - Partnerships are best established before a crisis in order to avoid competition between different groups.
 - Coordination is important in times of crisis. Understanding who is doing what is critical **before** a crisis.
- Research for resilience building:
 - Developing the necessary collaborations requires a long-term view.
 - Researchers require funding mechanisms that give them time to build relationships, understanding of the context and research collaborations.
 - Create the right 'spaces' in which collaboration can take place, and where different types of knowledge are valued equally.
 - Make sustained efforts to maintain those spaces for collaboration to help initiate co-design of research so that progress can be made.
 - Reach out to national organisations to find out what challenges they face in delivering their work.
 - Find people in the communities who are already engaged in building resilience, work with them and build on what they are already doing. Working locally and building local capacity is critical to achieving sustainable outcomes.
 - Develop a common language and shared understanding of the problem in order to collaborate effectively.
 - Need to understand risk from the point-of-view of the affected people rather than an individual or disciplinary point-of-view.



Fig. 4. Some of the points raised in the working with stakeholders panel discussion (source: Chris Shipton)

Panel 2: Innovation in interdisciplinary research

Panel members: **Wendy McMahan** (University of East Anglia), **Eliza Calder** (University of Edinburgh), **David Pyle** (University of Oxford), **Katie Oven** (Durham University), **Tiziana Rossetto** (University College London)

Chair: Peter Sammonds (University College London)

Q: What do you need to make interdisciplinary research work?

At Researcher level:

- Recognise the challenges associated with interdisciplinarity:
 - What an interdisciplinary researcher does may not fit easily with established disciplinary norms and values.
 - Researchers must grapple with different literatures, ideas, and methodological and theoretical frameworks.
 - Interdisciplinary research has the potential to be very isolating and people from some disciplines may have to compromise their career objectives in order to take part in this kind of work (e.g. researchers in the arts and humanities cannot enter co-authored articles for the REF).
 - 'Pay-offs' may happen at different times for the different disciplines involved in a project, which could appear potentially risky for some individuals.
- Support:

- Support is needed at an individual level such as mentoring, membership of networks, etc. and institutional changes to support career development.
- For interdisciplinary early careers researchers (ECRs), career progression and uncertainty regarding recruitment into permanent positions was identified as a particular issue. This needs consideration by senior faculty members within universities and more relaxed university structures (perhaps with attendant interdisciplinary programmes of teaching). Interdisciplinary research fellowships and 'intellectual enterprise zones' were thought to be possible options to help address this.
- People with permanent positions should be very vocal about the challenges that ECRs and other interdisciplinary researchers face and try to tackle these.

At Project level:

- Time is a crucial ingredient for success in interdisciplinary research projects for a number of reasons:
 - Necessary to build a trusted relationship where people can challenge each other, work together and work through the uncertainty that will exist at the start of a project (the 'blank sheet of paper').
 - The pre-collaborative preparation required for researchers from other disciplines with different rules, values and norms (e.g. what is a good journal impact factor for one discipline is a risk for another) to work together.
 - It takes time to learn another disciplinary language(s) and this can be months or years. To learn another language requires honesty – if you don't know what something means then ask. It was highlighted that a glossary of terms across the disciplines would be very helpful.
 - It may take time for the pay offs/advances from an interdisciplinary research project to manifest. This can put an additional stress/burden on researchers on projects with relatively short delivery times.
 - Being innovative in interdisciplinary work is going to come once the group/project has some maturity. It does not happen from the start.
- Some discussion about funding and developing proposals:
 - There is a disconnect between the time it takes to develop and implement an interdisciplinary research proposal and the timescales that the funders require.
 - How do you get funding for a 'blank sheet of paper'? i.e. work that will be strongly shaped by the needs on the ground. Proposals may encounter 'reviewer blocks' in the review process where a reviewer might object to one disciplinary aspect of the proposal (advice – don't give up, instead find a different funding source).

The Rewards:

- Interdisciplinarity brings 'untold opportunities' for research, collaboration and engagement.
 - It helps to facilitate impact because you need various disciplines' expertise to understand a particular real-world problem and how to tackle it.
 - It brings personal rewards: those that come from refreshing your worldview and recognising problems and how they might be tackled from other perspectives.

- It's a way of making connections - recognising that people have parts of the story to tell that connect with other people's stories.



Fig. 5. Some of the points raised in the 'innovation in interdisciplinary research panel discussion (source: Chris Shipton, Live Illustration).

Closing discussion: outputs, outcomes and impacts

The meeting concluded with a short plenary discussion led by Nic Bilham (Director of Policy and Communications at the Geological Society) that focussed on potential outputs, outcomes and impacts from the conference.

The Building Resilience conference was one of a number of events taking place in 2017 as part of the Geological Society's Year of Risk. As such, the discussions at this conference are part of a much bigger conversation about risk and how it 'meets' the geosciences. Nic highlighted the need not to overlook the value of the interactions between researchers from different disciplines and sectors that take place at meetings such as this since they will influence the way we all work and therefore in some way through our research, the people who are affected by hazards.

Besides this indirect effect, there are various ways that a meeting like this can have a more direct impact – either on 'science for policy' (aiming at governments and decision making for risk internationally) or 'policy for science' (aiming to influence how the UK research environment enables excellent interdisciplinary research). The remainder of this summary of the discussion is divided into the points made relating to 'science for policy' and those made on 'policy for science'.

Science for Policy

Positive case studies of interdisciplinary research tackling resilience challenges are of great value so that the case for supporting this kind of research can continue to be made and schemes like the GCRF can be further developed. These types of case studies are also very good source material for

‘science for policy’ work. However, it is important to recognise that achieving impact can take time and there may not always be ‘quick wins’. The long-term endeavours on which relatively short duration projects capitalise are an important part of the story that must also be told when reporting case studies.

Policy for Science

There was general agreement amongst the participants that there are critical issues that must be addressed about the way in which interdisciplinary and challenge-led research is viewed and supported by the UK academic community and its institutions. The need to better support early career interdisciplinary researchers was highlighted. One idea for this was through GCRF-funded early career research-based fellowships, which would help to mitigate the potentially deleterious impact of working on a series of very short duration (of the order of months) projects.

The importance and effectiveness of training international graduate students in order to have a sustainable impact on risk and resilience was also highlighted with a call for this to be supported by the GCRF.

Acknowledgements

The convenors are grateful to NERC and ESRC for supporting their involvement through the Increasing Resilience to Natural Hazards programme. Geoscience for Sustainable Futures: the Official Development Assistance (ODA) Programme of the British Geological Survey is gratefully acknowledged for sponsoring the event. We would also like to thank the staff from the Geological Society for their considerable support before, during and after the meeting.

Prepared by the convenors (Susanne Sargeant, Anna Hicks and Peter Sammonds).

Appendix

Opening keynote address

Amod Mani Dixit, Executive Director, National Society for Earthquake Technology – Nepal, ‘Enhancing Disaster Resilience for Nepal’

Keynote presentations

Jenni Barclay, University of East Anglia, ‘Re-thinking volcanic hazard analysis with communities at risk’

James Jackson, University of Cambridge, ‘Towards earthquake resilience in continental Asia: a perspective from the Earthquakes Without Frontiers project’

Talks*

Daniel Andrade, Instituto Geofísico, Escuela Politécnica Nacional, ‘Calibrating seismic-instruments for lahar-warnings at Cotopaxi volcano’

Teresa Armijos, University of East Anglia, ‘Adapting to changes in volcanic behaviour: formal and informal interactions for enhanced risk management at Tungurahua Volcano, Ecuador’

Tristram Hales, Cardiff University, ‘Challenges of developing resilience to post-earthquake debris flows in China’

Simone Mancini, British Geological Survey, ‘Reducing earthquake forecast uncertainty in the real world’

Camilla Penney, University of Cambridge, ‘Assessing hazard in inaccessible regions: the Makran subduction zone’

Vangelis Pitidis, University of Warwick, ‘The importance of geohazards for urban resilience: a study of Thessaloniki, Greece and its participation in the 100 Resilient Cities network’

Richard Robertson, University of the West Indies, Seismic Research Centre, ‘Advances and challenges to resilience efforts in the Eastern Caribbean’

Tiziana Rossetto, University College London, ‘New insights into assessing buildings for earthquakes and tsunamis’

Susanne Sargeant, British Geological Survey, ‘Promoting safer building and improving support to self-recovery: Geohazards and the use of scientific knowledge’

Carole White, University of East Anglia, ‘Historical Trajectories of Change and Disaster Risk Management in Small Island Developing States: Vanuatu and Dominica’

Posters*

Byron Adams, University of Bristol, ‘Understanding structurally-controlled slope stability in the Bhutan Himalaya: implications for landslide hazard assessment’

Gianluca Pescaroli, University College London, ‘Geohazards and Cascading Disasters – Theory, Methodology and Applications’

Mike Andrews, University of Portsmouth, ‘A SurveyPRISM’: A tool to support people in assessing hazards, vulnerability and risks in Geohazard location’

Maria Teresa Armijos, University of East Anglia, 'Linking the social sciences, physical sciences and the humanities to manage risk and build resilience to geohazards: innovative methods and approaches'

Paul Cole, Plymouth University, 'Dynamics of the pyroclastic density current formed during the 1902 eruption of La Soufriere, St Vincent, West Indies from analysis of the photographic archive'

Ajoy Datta, Overseas Development Institute, 'The use of scientific evidence during the 2015 Nepal earthquake relief efforts'

Luca De Siena, University of Aberdeen, 'Monitoring volcanoes without humans: linking geophysics with drone imagery to understand South-Italian volcanism'

Joel Gill, British Geological Survey, 'An interdisciplinary approach to identifying potential natural hazard interactions in Guatemala'

Amy Gilligan, University of Aberdeen, 'Developing a seismic hazard model for Sabah, East Malaysia using seismic and geodetic data'

Tim Greenfield, University of Southampton, 'Identifying volcanic and tectonic hazards in the Main Ethiopian Rift'

Anna Hicks, British Geological Survey, 'Risk Communication Films: Process, Product and Potential for Improving Preparedness and Behaviour Change'

Ekbal Hussain, University of Leeds, 'Seismic Cities: An inter-disciplinary approach to understanding seismic hazard and risk in Santiago, Chile'

Sarah Jenkins, University College London, 'Maintaining Credibility When Communicating Uncertainty: The Role of Communication Format'

Emily Kawabata, University of Edinburgh, 'An automated Bayesian fitting of macroseismic intensity data for isoseismal contours and epicentre estimation'

David Litchfield, University of East Anglia, 'Decision maker perspectives on scientific information at a volcanic simulation exercise'

Anna Lo Jacomo, University of Bristol, 'Resilience in practice – a comparative case study of structural and non-structural approaches'

Arash Nassirpour, University College London, 'Multi-Hazard Vulnerability Assessment of School Infrastructure – The case of Cagayan de Oro, Philippines'

Jonathan Paul, Imperial College London, 'Landslide EVO: Citizen science for landslide risk reduction and disaster resilience building in mountainous regions'

Jeremy Phillips, University of Bristol, 'Building Resilience in Lahar Hazard: hazard and susceptibility assessment at Volcán Cayambe, Ecuador'

Jeremy Phillips, University of Bristol, 'Assessing correspondence between volcanic activity and evacuation using time series and timeline data: forensic analysis from Soufrière Hills Volcano, Montserrat, 1996 – 2009'

David Pyle, University of Oxford, 'The historical dimensions of volcanic hazards on St Vincent'

Peter Sammonds, University College London, 'Increasing Resilience to Environmental Hazards in Conflict Zones'

Mihaela Swift, Kings College London, 'Spatialising the interactions between people, animals, volcanic hazard and local perceptions and responses to Popocatépetl volcano, Mexico'

Max Werner, University of Bristol, 'Building Resilience to Earthquakes in Bhutan: Probabilistic Seismic Hazard Assessment for a National Building Code'

Carole White, University of East Anglia, 'Developing interdisciplinary research to understand exposure to natural hazards in Small Island Developing States: Methodological reflections and implications for disaster risk management'

Youbing Zhang, University College London, 'Quantitative assessment of the earthquake moment magnitude (Mw) uncertainties'

**please note that only the names of the presenters are indicated here. Full author lists are given in the book of abstracts – see <https://www.geolsoc.org.uk/buildingresilience17>*