



A fuzzy logic methodology for assessing the resilience of past communities to tephra fall: the Laacher See eruption 13,000 ka BP case study

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While volcanologists are experienced in assessing present and past volcanism, and while archaeologists are experts in understanding past societies, the study of how ancient volcanic activity has impacted contemporaneous communities remains little systematised. We here present a fuzzy logic-based methodology for bringing together expert assessments in evaluating the vulnerability and, by extension, the resilience of a group of late Pleistocene foragers to the Laacher See eruption, a large explosive eruption that affected continental Europe 13,000 years ago. Our analyses support the notion that more substantive tephra fall relates to greater human impact. Total impact increases with tephra thickness, although not uniformly across different attributes. Our explicit assessment of different experts' evaluation of the different attribute's relative importance facilitates a rigour in formulating such impact scenarios. The assessment methodology is rapid and can then be matched against existing evidence or, importantly, be used to also assess contemporary communities' potential for loss under different tephra fall conditions. The methodology can be readily transferred between case studies and, in principle, between hazards, and could contribute significantly to the design of realistic disaster scenarios, which in turn serve to build resilience in at-risk communities.