



Rich and resilient volcanic territories maintained by geoheritage

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The diversity of geological processes, resources and landforms in volcanic areas makes them a very rich geological environment. In terms of 'geosystems services', the current jargon for what is useful in them to humanity, they provide great benefit, as seen in the concentration of populations around volcanoes, and high biodiversity. This raises the problem of risk, as the volcanic diversity also concentrates hazards, not just of eruption, but of floods, landslides and the can be detrimental to water resources. It would seem, just from observing volcanic areas globally and over a millennia time scale, that the benefits still generally exceed the losses. However, the risks are sporadic and thus the negative aspects of large-scale events are probably under-represented and hard to plan for or mitigate. Notably, these events can destroy civilisations (e.g. eruptions of Santorini, Ilopango). High-frequency, smaller events can cause consistent negative impacts, but these can be dealt with by planning and strategies for reliance. To do this, a good knowledge of the volcanic environment is required, and the people need to understand the long-term behaviour of the environment in which they live. We describe work ongoing in several study areas, where we are characterising the geodiversity of the volcanic and human environment. This is being used to improve understating of people's environment and to develop ways of management of territories in an integrated way, where resilience is strengthened by the better knowledge of the natural and human environment, and where strategies are developed to maximise benefit, preserve the resource, and avoid risk. The present case study examples chosen from the Philippines, Nicaragua, Ethiopia and France.