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Volcanic risks – possibilities of mitigation

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Every year several of the 550 historically active volcanoes on earth are restless and may pose a threat to mankind; two examples are relevant for 1994-95. On 19th of September 1994, the volcanoes Vulcan and Tavurvur in the Rabaul Caldera, Papua New Guinea began to erupt. Monitoring of precursors and awareness of the population to the eruptions permitted the safe evacuation of 68'000 people. The economic damage due to ash fall was significant. On 18th of July 1995, a steam blast explosion occurred on the dormant Soufriere Hills volcano, Montserrat, West Indies. This event was followed by an ongoing activity which included a larger event on the 21st of August which generated an ash-cloud that menaced the capital Plymouth. The population of about 5,000 was temporarily evacuated. These two recent cases demonstrate that with a good perception of the hazardous phenomena, an appropriate information of the population, and an awareness of the authorities, one is able in most cases, to manage a difficult situation.

It is important to remember the definition of risk which facilitates the development of mitigation action. Volcanic risk may be defined as:

The possibility of loss of life and damage to property and patrimony in an area exposed to the threat of a volcanic eruption

This definition can be summarized by the following formula (UNDRO 1980):

Risk = Hazard • Vulnerability • Value

Volcanic hazards may be evaluated through two main complementary approaches which will lead to the prevision and prediction:

- medium and long term: volcanic hazard mapping and modelisation; volcanic hazard zonation
- short term: surveillance and monitoring of the volcano

Based on this knowledge and evaluation of volcanic hazard and vulnerability, one may build a strategy and a policy of mitigation through planning and security measures. Options for volcanic risk reduction may be pursued in three directions:

1. Hazard modification; only valid for lava flows:	
– diverting (e.g. Etna 1992-93)	Possible, but
– channeling	difficult to apply,
– cooling (e.g. Heimaey 1973)	many uncertainties.
2. Structural vulnerabilily reduction; construction code (rules):	
– appropriate roof slope; ash fall protection	Possible, important
– use of non-flammable material	for vital functions
– burying vital infrastructures such as energy and communication networks	during the crisis and for rehabilitation after the crisis
– damming; lahar protection (e.g. Pinatubo 1991)	
3. Population vulnerability reduction; changing the functional characters of settlements:	
– regulation and planning of the land use in exposed areas (depends on the type of volcanic hazards)	Direct bearing on risk reduction.

Last, but not least, mitigation includes also a good preparedness taking into account education and an effective media communication. Admitting the complexity of the problem, a successful mitigation can only be the fruit of a multi- and transdisciplinary activity and finally a major factor for success is the acceptance by the population concerned.

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