Multi-level significance of vulnerability indicators. Case study: Eastern Romania

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Vulnerability assessment aims, most frequently, to emphasize internal fragility of a system comparing to a reference standard, to similar systems or in relation to a given hazard. Internal fragility, either biophysical or structural, may affect the capacity to predict, to prepare for, to cope with or to recover from a disaster. Thus, vulnerability is linked to resilience and adaptive capacity. From local level to global one, vulnerability factors and corresponding indicators are different and their significance must be tested and validated in a well-structured conceptual and methodological framework. In this paper, the authors aim to show the real vulnerability of rural settlements in Eastern Romania in a multi-level approach. The research area, Tutova Hills, counts about 3421 sq.km and more than 200.000 inhabitants in 421 villages characterized by deficient accessibility, lack of endowments, subsistential agriculture, high pressure on natural environment (especially on forest and soil resources), poverty and aging process of population. Factors that could influence the vulnerability of these rural settlements have been inventoried and assigned into groups through a cluster analysis: habitat and technical urban facilities, infrastructure, economical, social and demographical indicators, environment quality, management of emergency situations etc. Firstly, the main difficulty was to convert qualitative variable in quantitative indicators and to standardize all values to make possible mathematical and statistical processing of data. Secondly, the great variability of vulnerability factors, their different measuring units and their high amplitude of variation require different method of standardization in order to obtain values between zero (minimum vulnerability) and one (maximum vulnerability). Final vulnerability indicators were selected and integrated in a general scheme, according to their significance resulted from an appropriate factor analysis: linear and logistic regression, varimax rotation, multiple-criteria decision analysis, weight of evidence, multi-criteria evaluation method etc. The approach started from the local level which allows a functional and structural analysis and was progressively translated to an upper level and to a spatial analysis. The model shows that changing the level of analysis diminishes the functional significance of some indicators and increases the capacity of discretization in the case of others, highlighting the spatial and functional complexity of vulnerability.