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Integrated assessment of urban vulnerability and resilience. Case study: Targu Ocna town, Romania

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Vulnerability assessment frequently emphasizes the internal fragility of a system in relation to a given hazard, when compared to similar systems or to a reference standard. This internal fragility, either biophysical or structural, may affect the ability to predict, to prepare for and cope with or to recover from the manifestation of a risk phenomenon. Thus, the vulnerability is highly related to resilience and adaptability. There is no single methodology for vulnerability and resilience analysis, their assessment can only be made by identifying and integrating indicators which are compatible with the analysis level and the geographic, economic and social features of a certain area.

An integrated model of evaluating vulnerability and resilience capacity is being proposed in this paper for Targu Ocna, a small mining settlement in the Eastern Carpathians of Romania, that became in the last years a tourist town and acts within the surrounding territory as a dynamic local pole. Methodologically, the following steps and operations were considered: identifying potential hazards, identifying elements at risk, identifying proper indicators and integrating them in order to evaluate the general vulnerability and resilience. The inventory of elements at risk (the number of people potentially affected, residential or other functionalities buildings, roads and other infrastructure elements etc.) was made based on General Urban Plan, topographic maps (scale 1:5000), ortophotos from 2003 and 2008 and field mapping and researches. Further on, several vulnerability indicators were identified and included within the analytical approach: dependency ratio, income, quality of the habitat and technical urban facilities, environment quality showing differentiated sensitivity. Issues such as preparedness and preventive measures (priority areas within the risk prevention plans), coping ability (networks' geometry and connectivity, emergency utilities and services accessibility) and the recovering capacity (the time needed to reestablish functions after a disastrous event) were also taken into account. The selected indicators were mathematically processed (standardized and normalized) in order to maximize their relevance and to unitary express the results in the spread 0–1. Then a grid with a cell size of 100 x 100 m was created in order to spatialize vulnerability indicators, that were calculated as the average vulnerability of the exposed elements in each cell. All identified indicators have been processed within a cluster analysis that permitted the identification of similar areas in terms of vulnerabilities. Finally, a general index was obtained by the integration of all vulnerability factors in an equation based on the geometric mean.

The results of the study could provide a reference basis to substantiate local correctly prioritized decisions for reducing vulnerability by mitigation and adaptation measures in order to avoid significant damages when risks materialise.