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Identify indicators for assessing urban resilience to flooding

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Flood risk estimation is a multidisciplinary task. It involves hydrological hazard linked to extreme value of discharge in urban river and network and, at the same time it requires territorial analysis in order to locate the element at risk.
Risk is a combination of 'hazard' and 'vulnerability'. We can define 'hazard' like "a threatening event, or the probability of occurrence of a potentially damaging phenomenon within a given time period and area" (WIN, 2007). When a hazardous event ('hazard') occurs, resulting damages will depend on the element at risk. The 'element at risk' is commonly considered the population, buildings and civil engineering works, economic activities, public services and infrastructure, etc... exposed to hazards.
'Vulnerability' is a recent concept, which is more and more widely used in risk analysis. It is understood as the complement to hazard, required to define risk. 'Vulnerability' ideally defines what would be the resulting damages for any possible occurrence of hazard. Vulnerability is the "susceptibility to degradation or damage from adverse factors or influences" (US-EPA, 1997).
Since the seventies; in the USA and Great Britain (Foster, 1976; Flax et al., 2002; Penning-Roswell and Chatterton, 1977), the evaluation of vulnerability has appeared like a support for study technical and financial choices of structural protection (Parker et al., 1987; Penning-Roswell et al., 1992; Blong, 2003; D'Ercole, 1994; Leone et al., 1996).
Today, risk management is an object of social debate, and the new concept of urban resilience is increasingly used for analysing the capacities to adapt and to live with disturbances. A lot of work on resilience has focused on the capacity to absorb shocks and still maintain functions. But there is also another aspect of resilience, which leads to take into account systems vulnerabilities and to aim at understanding their equilibrium and re-organization capacity.
The purpose of this work is to illustrate a set of urban resilience indicators (urban runoff and river flooding).
An integrated tool is thus provided to estimate and manage the risk.
A tool is designed to provide general information on indicators for resilience to flooding. Possible indicators will be classified in domains, sub-domains and as many sub-division as necessary. The classification will define a series of boxes, each of them containing a series of similar indicators, referring to more or less specific case-studies. A tree has been built to show the complex interactions which may exist between urban resilience indicators. Practically, the tool is a tree like a set of leafs (indicators and case study) that can be viewed on any browser. According to the decision level, the spatial scale might be different. However, the authors aim to works at urban scales and not elements scales.
Dealing with indicators leads to limits (Bouni, 1996). Indicators are not neutral neither objective, inasmuch as they are corresponding to a specific reading of reality which is based on a theoretical model or a specific knowledge. Each of them is not able to take into account the whole complexity of the resilience. But, knowledge a partial vision of résilience aspects is already a very important contribution to decrease and control the land damage caused by natural hazard.

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