

Peculiarity and vulnerability of karst settings, analyzed through a review of available environmental indices

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Karst is a unique environment on Earth, characterized by a variety of peculiar geological and hydrological features, that are expressed by typical landforms at the surface (doline, ponor, polje, etc.) and underground (single cave, sinkhole, complex hypogean systems consisting of sequences of pits and galleries, etc.). Among the main characters of karst, the direct connection between the surface and the underground is at the origin of the fragility of karst settings, and the related high vulnerability. Many different types of natural geological hazards (or geo-hazards) may potentially affect karst lands, with sinkholes and flash floods being the most frequent and typical. In addition, karst is exposed to a variety of anthropogenic disturbances as well, including loss of natural landscapes, destruction of caves and speleothems, and contamination and pollution problems. At this latter regard, it has to be reminded that karst aquifers host high quality groundwaters, that are used as source of drinking water worldwide, with estimates indicating that the supply of drinking water from karst is going to have a significant increase in the next decades. From all of this, the importance in fully defining the karst setting, and in a detail examination of all the natural and anthropogenic events that may cause negative effects on it, comes out.

Uniqueness of karst has been acknowledged since a long time, but only in recent years efforts have been made to develop approaches and methods specifically dedicated to this peculiar environment. Such approaches represent definitely a mandatory step in the correct management of karst terranes, providing useful elements to stakeholders, land managers and people living in karst lands about their fragility, and the need to safeguard them and the natural resources therein contained.

Starting from these considerations, in this contribution we review the main environmental indices dedicated to karst that have been recently proposed in the literature. They include indices as the Karst Disturbance Index (van Beynen & Townsend, 2005; North et al., 2009), the Karst Sustainability Index (van Beynen et al., 2012), as well as indices defined for protected areas (Angulo et al., 2013), and for single caves, including those open to tourists (Cigna & Forti, 1988; de Freitas, 2010; Pani & Cigna, 2013; Ramos Donato et al., 2014; Trofimova, 2014). Each index will be critically reviewed, and its main aim(s) and scales of application (national, regional, protected karst area, show cave, single cave, etc.) described, by analyzing their practical implementation, and pointing out to the problems and difficulties, as well as to their advantages.

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