Title of the symposium:

Challenges for subterranean landscape conservation in the world's karst regions

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Symposium abstract

Landscape ecology has advanced environmental conservation because it helps expand attention from single sites to larger scale patterns and processes and to understand complex interactions existing among a mosaic of elements. This has enhanced understanding of the complexity of natural systems and informed land management strategies.

Karst environments have particular hydrogeological and ecological features and are among the most fragile ecosystems in the world. They furnish valuable natural resources, such as water, and represent suitable habitat for the survival of many rare or endemic species. Despite this, the importance of these ecosystems has so far been largely ignored by the broader scientific and conservation community, leading in many cases to overexploitation of subterranean resources, degradation of the environment (both on the surface and underground), as well as habitat and biodiversity loss. Subterranean ecosystems are in many cases still poorly mapped because of limitations in exploration and therefore subterranean spatial patterns are typically less well known.

While terrestrial systems are normally represented as surficial environmental units, in the presence of karstic phenomena it is important to consider also the close relationship that exists between the surface and underground landscape systems. This has repercussions also in conservation strategies for these areas, where it is common to consider strategies for the conservation of single caves (e.g. the European Habitat Directive for the conservation of habitats defines a cave as ‘a punctual element’) or of single endemic species or taxonomic groups that are easily detectable in the surface. However, it is increasingly recognized that many conservation and land-use issues can only be tackled in a sensible way by considering broader landscape frameworks, in particular natural hydrogeologic drainage systems, within which caves are important elements. Our understanding of karst systems as a whole suffers

from of lack of large-scale, comprehensive studies that consider the subterranean ecosystem as a (three-dimensional) landscape. By changing this perspective and acknowledging the complexity of these environments, we will be able to integrate ecological processes, biodiversity patterns, energy flows, hydrological properties, and geomorphological features. In order to develop our research, it is necessary to move towards highly multidisciplinary studies that are able to link subterranean elements and features and understand the ecological processes of the ecosystem as a whole.

Because human activities strongly modify existing landscape patterns and processes, the understanding of their impacts on karst systems is essential for rational land use planning, management and biodiversity and resource conservation.

We seek original studies, conceptual works, case-studies and presentation of past, ongoing and planned research projects dealing with subterranean environments. Contributions are encouraged from fields that can contributes to advances in understanding about these peculiar ecosystems: geology, hydrology, soil science, biology, taxonomy, zoology, ethology, ecotoxicology and others. We are particularly interested in studies leading to better understanding of the composition, structure and function of subterranean landscapes; energy and material flows; functional links between patterns and processes; relationships between aboveground and belowground environments; subterranean biodiversity conservation; human impacts; valuation of services provided by subterranean ecosystems.

This symposium will stimulate interactions between researchers involved in the study of these complex and intriguing systems and promote a debate about shifting attention towards a large-scale perspective that integrates both biotic and abiotic features to understand their spatial patterns and functional links with the final aim to enhance conservation strategies.

How your symposia will improve landscape ecology science?

Landscape ecology since the early stages has focused primarily on the spatial patterns of landscape mosaics and interactions among their elements. Following a strong emphasis on human interactions with landscapes, it has mainly focused on agricultural, rural, urban, forest landscapes. However, other ecosystems would positively benefit from a landscape perspective. Subterranean environments that originate by geochemical processes represent structurally complex systems, within which ecology is not yet completely understood, in part because of the difficulty in exploration of those environments. A ‘system of ecosystems’, as the ‘landscape’ is often defined, is a conceptual model in which subterranean environments can be easily integrated. Caves and other subsurface elements represent ecosystems that are in connection within each other, as well as the surface, forming complex systems that develop in three dimensions. The fabric of these landscapes integrates both surface and subterranean elements and its inaccessibility has required the development of models to investigate them. By applying principles of landscape ecology, we would be able to better

understand the composition and configuration of subterranean elements, the functionality of the systems (relationship between structure and function), changes over time, and impacts of human alteration. We think that both landscape ecology as well as subterranean-related disciplines will benefit from reciprocal integration. From one side, a landscape perspective may help to shed light into the structure of the subterranean environment at broad spatial extent, help in understanding the relationships between structures, patterns and functions, and in the formulation and solving of real-world problems such as threats to subterranean environments caused by human activities. For landscape ecology, this would lead to broaden the field of investigation of landscape ecology by including an important, but less studied environment. As explained in the symposium abstract, we hope that focusing on landscape will help us in stressing the relevance of large-scale studies where integrated knowledge from different fields of research helps understand the functioning of the system as a whole. Importantly, many landscapes, such as agricultural, urban, of rural rely on lands impacted by karst phenomena and so there are complex human/landscape interactions. A better understanding of these subsurface system and an integration of studies would surely improve the understanding of the whole landscape of interest. We also hope that the symposium would represent an interesting occasion to present the importance and the peculiarities of the subterranean world to actors involved in landscape planning, management and resource conservation, and benefit the very broad multidisciplinarity of people attending landscape ecology meetings.

Broad thematic areas

Broad thematic areas 1st choice: Specific landscapes (i.e. Mediterranean landscapes, rice landscapes, …)

Free Keywords

Biospeleology, biodiversity, landscape conservation

Outcomes of symposium

Special issue in a scientific journal (to be negotiated)