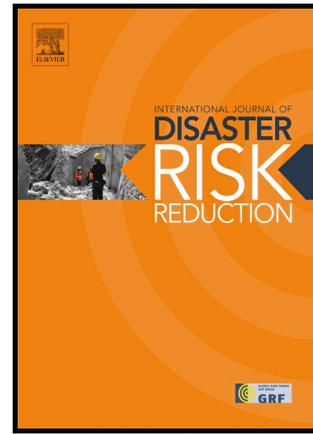


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## Cascading vulnerability scenarios in the management of groundwater depletion and salinization in semi-arid areas

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### Abstract

Meteorological droughts can have unexpected cascading consequences on social, economic, and environmental systems, which depend on the starting conditions of affected systems, and on natural and human drivers. In coastal areas, droughts propagate their effects to coastal aquifers, causing exacerbation of withdrawals with consequent groundwater quantity and quality. Considering the area of Lecce province (Salento peninsula, Apulia region, Southern Italy), the study outlines the non-linear cascading paths related to groundwater depletion and salinization in an urbanized coastal region depending quite entirely on groundwater resources of a coastal karst aquifer. The outline of cascading events is the outcome of a scenario building process carried out through semi-structured interviews to water management stakeholders. The cascading scenarios relate to different degrees of system resilience and describe chain effects and vulnerabilities. These scenarios can have significant outcomes in improving water management practices and increasing both local manager and end-user awareness about potential and unexpected cascading consequences related to droughts.

**Keywords:** scenario building, drought, coastal aquifer, water crisis, climate change.

### 1. Introduction

Nowadays, groundwater resources are more accessible than in the past thanks to technological development. However, negative implications of this improved accessibility outweigh the positive ones. On the one hand, increasing groundwater exploitation provides a wide range of opportunities for human settlements and socio-economic activities in large areas of the world, on the other hand, it triggers new issues about the quantitative and qualitative status of these concealed commons [1].

An even major threat concerns groundwater resources in coastal zones with a climate favourable to human settlement and development of tourism and agriculture. In these areas, the demographic pressure and the consequent high level of urbanization cause high water-demand increasingly met by groundwater. Unfortunately, the favourable climate for the development of human activities is not as effective for the accumulation of surface and groundwater. This, for instance, is the condition of those Mediterranean countries having a semi-arid climate. Therefore, high water-demand has often low possibility to be satisfied due to a low natural availability. Moreover, human activities cause groundwater exploitation and high pollution loads; exploitation, in turn, produces groundwater depletion, triggering seawater intrusion and pollutant dispersion.

In coastal aquifers, fresh groundwater floats on salt water of marine origin, because of the different fluid density, thus groundwater depletion and salinization are concurrent issues. A

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