



Karst groundwater pollution risk in the Mediterranean region

Key findings

This study examines karst groundwater pollution risk on a large-scale, using land use data

The Copernicus Global Land Service provides a detailed distribution of land use.

A grouping of similar land uses and its re-classification enables the definition of pollution risk

Especially in karst areas, where the soil protection function is often inadequate or completely absent, a direct input of contaminants is probable

The risk of karst groundwater pollution exists primarily in built-up and human-cultivated areas.

Karst groundwater resources are particularly vulnerable to the input of contaminants from the surface. Especially in areas with high population density and intensive land use (agriculture, livestock), but also in industrial areas, there is a contamination risk from waste, wastewater or other hazardous substances.

On a local and regional scale, the vulnerability and contamination risk of karst aquifer is generally derived from different hydrologic and hydrogeologic conditions and land use. However, at the large scale, specification of locally very heterogeneous hydrogeologic conditions is much more difficult and would need to be generalized and simplified. Parameters that express the local protective function of the aquifer, such as land cover, depth of the water table, and degree of karstification, cannot be easily regionalized and evaluated on a supraregional basis and would be very inaccurate. Furthermore, there is also often a lack of comprehensive data.

Karst aquifers are often much more

vulnerable to pollution compared to porous and fractured aquifers due to their often limited soil cover and high permeability. For this reason, it is easier to derive the groundwater quality risk in karst areas directly from a land use map and thus better estimate the pollution risk for individual regions.

For the assessment of pollution risk of karst aquifers in the Mediterranean region, Copernicus Global Land Service data (Buchhorn et al. 2020) were used and reclassified into a pollution risk map and further applied to the karst aquifer map developed in the KARMA project.

Copernicus land use data classify the land surface into different land

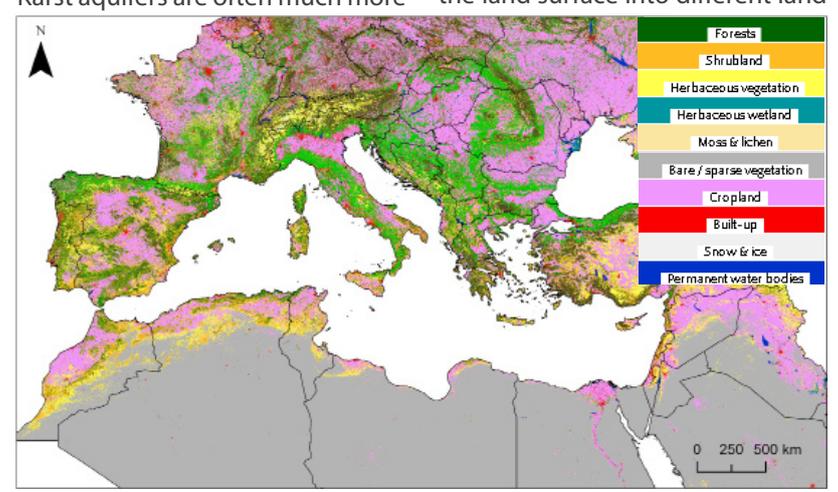


Figure 1 Land cover map from the Copernicus Global Land Service (Buchhorn et al. 2020).



Table 1 Re-classification of copernicus land use data to pollution risk.

Copernicus classification	Group	Pollution risk
Built-up	Built-up	High
Cropland	Cultivated and managed areas	Moderate to high
Herbaceous vegetation	Semi-natural vegetation	Low to moderate (comment: Manure is spread in some meadows)
Herbaceous wetland		
Shrubland		
Forests	Bare soil & sparse vegetation	Low
Moss & lichen		
Bare / sparse vegetation		
Snow & ice		
Permanant water bodies		

use classes. These range from cropland and urban areas to forests, shrublands, sparse vegetation, snow cover, and permanent water bodies. Each of these land uses classes poses a different (natural) threat to groundwater. To avoid assigning each of these individual land use classes into separate risk levels, it is easier to group similar land use classes based on a common risk level (Table 1).

High pollution risk, which is not comparable to other land use types, is therefore assigned to urban areas. Areas that are mostly intensively farmed, referred to here as „cropland“, are also potentially hazardous areas, although with lower impacts than urban areas. Herbaceous vegetation, wetlands, and shrublands are grouped here into seminatural vegetation, because in many areas they are used as farm-

land for growing livestock crops and are treated with fertilizer. The lowest risk here is expected from the classes of moss and lichens, forests, sparse vegetation and water bodies, and snow or ice cover, grouped into bare soil and sparse vegetation.

However, borderline cases in the land use classes that might be classified as higher or lower risk than indicated here cannot be distinguished on this scale.

The resulting map of the Mediterranean shows a division into four pollution risk classes for karst aquifers.

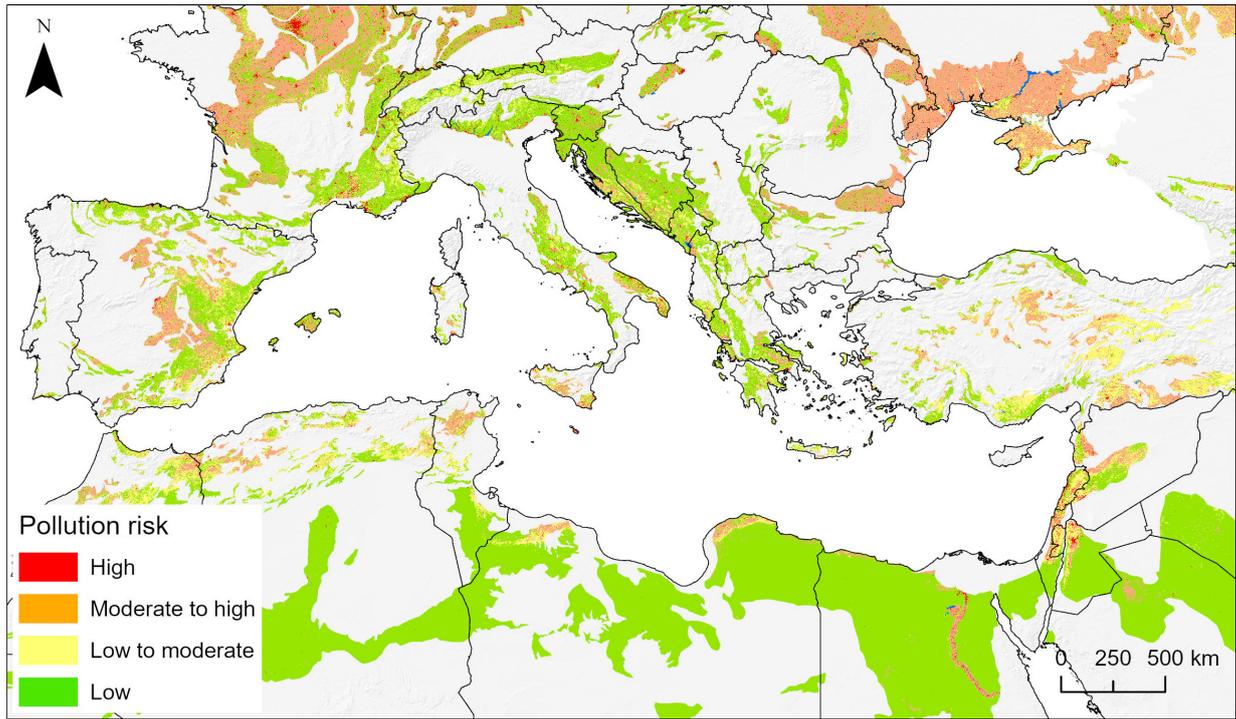


Figure 3 Karst groundwater pollution risk map of the Mediterranean region.

References and further Reading

- Buchhorn, M.; Smets, B.; Bertels, L.; Lesiv, M.; Tsendbazar, N.-E.; Masiliunas, D.; Linlin, L.; Herold, M.; Fritz, S. (2020). Copernicus Global Land Service: Land Cover 100m: Collection 3: epoch 2019: Globe (Version V3.0.1) [Data set]. Zenodo. DOI: 10.5281/zenodo.3939050