Interreg CENTRAL EUROPE

Co-funded by the European Union

PoLaRecCE

Report with the summary of the conducted survey

Identification of the main problems related to degraded agricultural land in CE regions

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Executive summary

Deliverable 1.3.1 of the PoLaRecCE project reports the outcomes of the initial survey phase, representing the first comprehensive step towards establishing a knowledge base on soil degradation in Central Europe.

The primary objective of the survey was to provide a baseline assessment of contaminated soils and related environmental and ecological issues in the participating regions. To this end, a standardized questionnaire was developed and distributed to municipalities across the project area.

The survey was designed to be accessible to local policymakers and municipal technical staff, ensuring both clarity of language and feasibility of response. This approach facilitated broad participation: ultimately, 200 completed questionnaires were collected across eight regions in six countries.

The dataset provides a robust initial characterization of regional conditions and highlights key trends in soil contamination and degradation. These findings constitute a critical foundation for subsequent project activities, including the establishment of the open electronic database (Deliverable 1.4.1) and the development of pilot actions aimed at testing and demonstrating sustainable land management and remediation practices.

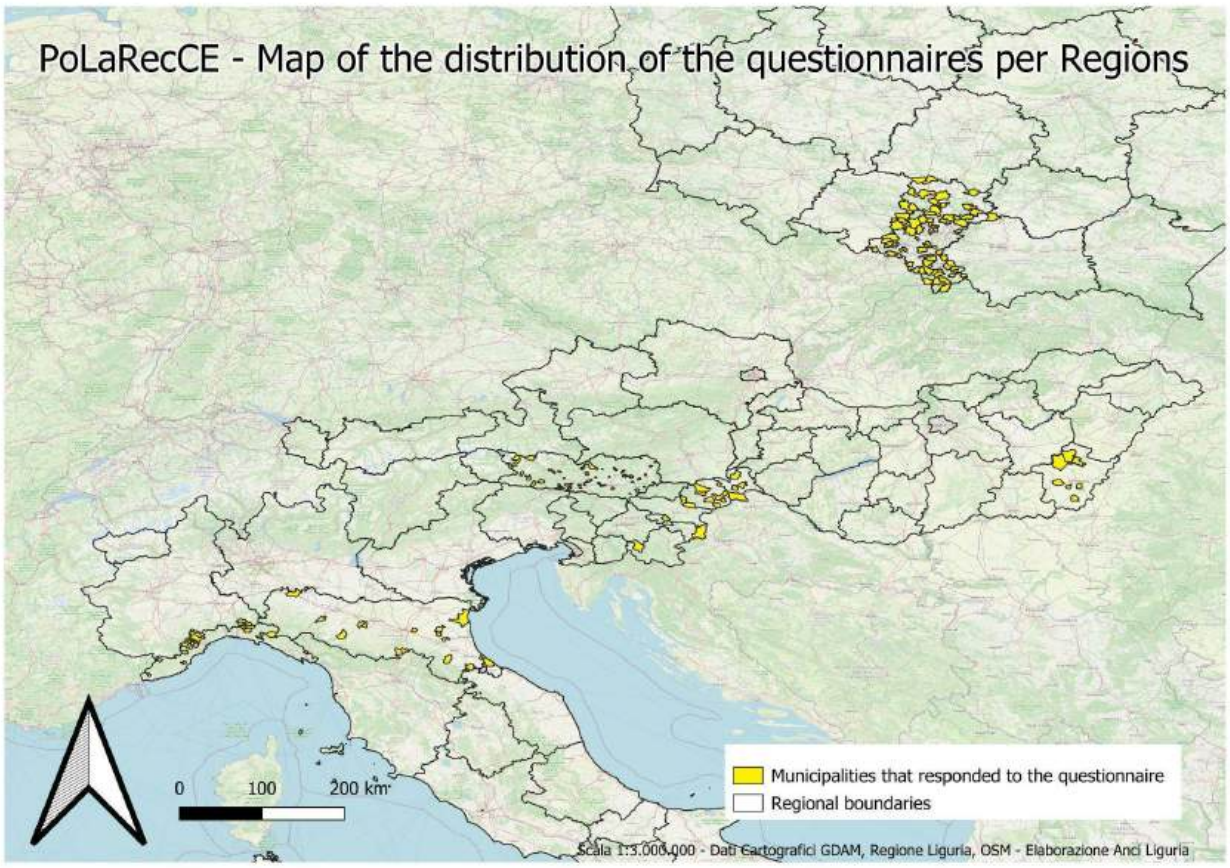

Fig. 1 - Map of the distribution of the questionnaires per Regions

1. Introduction

1.1. Objectives

The objective of Deliverable 1.3.1 is to identify and assess the principal risks associated with degraded agricultural soils in Central Europe. The report establishes the current state of knowledge on common and region-specific challenges, providing a comparative framework for evaluating soil degradation processes.

1.2. Scope

The survey addressed 18 categories of soil degradation, ranging from contamination by industrial emissions and waste disposal to natural processes such as erosion and flooding. Respondents were asked to evaluate the extent and relevance of each issue within their municipality, expressed as a percentage of surface area or in square kilometers. This structured approach enables both quantitative comparison across regions and the identification of priority issues for targeted remediation.

The 18 different problematic situations to be investigated:

1. *contamination from urban and industrial dust deposition*
2. *leakage of oil and petroleum products*
3. *leakage of waste waters or sewage sludge deposition (biological contamination)*
4. *volatile organic compounds (e.g. PAHs)*
5. *cyanides (e.g. from coking industry)*
6. *dumping of wastes materials from coal mining*
7. *dumping of wastes materials from ore mining*
8. *dumping of ashes from power industry*
9. *dumping of non-degradable trash or plastics (municipal wastes)*
10. *former quarries and areas after exploitation of natural resources*
11. *flooding areas*
12. *military areas*
13. *heavily acidified soils*
14. *saline or highly alkaline soils (e.g. from chemical, cement or ceramic industry)*
15. *long-term poor agricultural farming practices (depletion of soil organic carbon and soil nutrients, over-fertilization, contamination by pesticides)*
16. *wind or water erosion*
17. *soil sealing or compaction*
18. *others (give additional information)*

1.3. Relations to other documents

This report builds directly upon Deliverable 1.2.1, which defined the questionnaire and guided data collection. The findings also serve as the empirical foundation for Deliverable 1.4.1, which will establish an open-access electronic database of degraded soils in the participating regions. This database is expected to support future strategic planning and foster knowledge transfer within and beyond the project consortium.

1.4. Intended Audience

The document is primarily addressed to project partners as a reference for subsequent project phases. In particular, it provides a structured knowledge base to guide the design of the open database and the implementation of pilot actions.

2. The survey

2.1. Definition of the content of the survey

The questionnaire was developed to capture soil degradation data from municipalities while ensuring clarity and accessibility for non-specialist respondents, such as local policymakers and technical staff. The design emphasized simplicity in language and feasibility of estimation, with the objective of maximizing response rates without compromising data reliability. The final version was prepared by Anci Liguria in collaboration with project partners and with input from the scientific community to ensure methodological robustness (Annex 1 – Questionnaire).

2.1.1. Objective

The survey aimed to provide a regional overview of land degradation across the eight participating Central European regions. It sought to:

- identify the scale and nature of soil pollution and degradation,
- highlight region-specific and cross-regional trends, and
- inform the design of pilot activities for non-edible crop cultivation as potential remediation measures.

This effort contributes to a broader understanding of agricultural land degradation and biodiversity loss, in alignment with global assessments such as the FAO's estimate that 30% of the world's land is unsuitable for cultivation due to pollution, erosion, or nutrient depletion. Without a shift towards sustainable soil management, projections suggest that by 2050 per capita arable land will decrease to one-quarter of the 1960 level (FAO, 2011).

2.1.2. Target

The primary target group comprised municipalities, specifically mayors and technical offices responsible for local planning and land management. Their responses provide essential insights into the perception and prioritization of soil degradation issues at the local level.

2.1.3. Sample and distribution

The survey distribution followed a two-phase approach:

1. Circulation of an explanatory letter outlining the project objectives and the purpose of the survey to a broad pool of municipalities.
2. Collection of completed questionnaires.

The minimum target sample was approximately ten municipalities per partner region. Ultimately, 200 responses were collected, exceeding initial expectations and improving the credibility of the dataset. Distribution by country was as follows: Italy (51 questionnaires, with 33 from Liguria and 17 from Emilia-Romagna), Austria (48), Slovenia (17), Poland (74), Hungary (7), and Croatia (3).

3. The results

3.1. Results in Italy

Liguria Region

Liguria comprises 234 municipalities, of which three are urban (Genoa, Imperia, and La Spezia), 123 are rural, and 109 are categorized as disadvantaged rural areas. A total of 50 questionnaires were distributed, and 33 responses were collected. The results show that soil degradation is not uniformly widespread but is concentrated in specific territories with a strong industrial legacy, particularly in the Val Bormida pilot area.

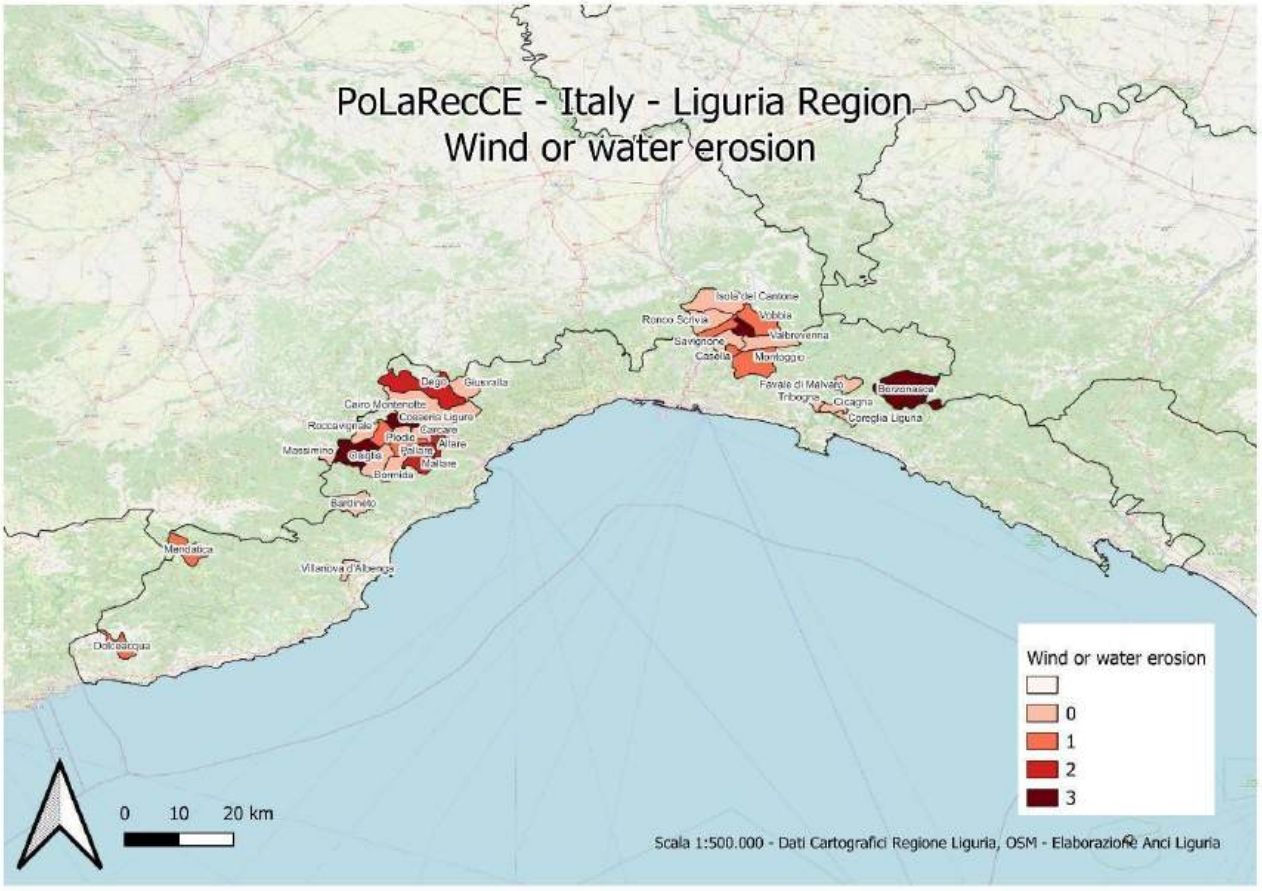

Fig. 2 - Wind and water erosion - IT - LIG

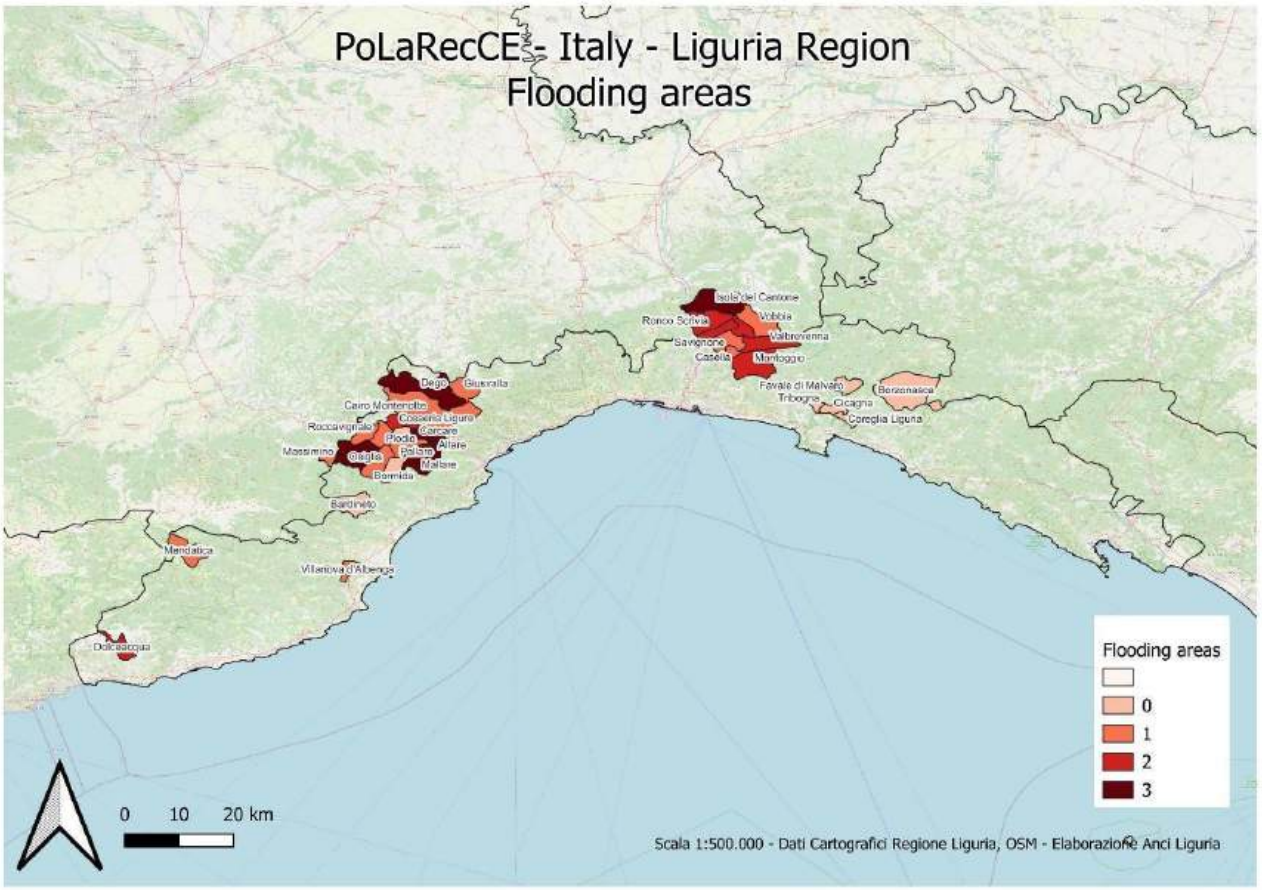

Fig. 3 - Flooding areas - IT - LIG

Flooding and Erosion

Flooding and erosion due to wind and water were the most recurrent issues, reported by almost all municipalities. These processes are deeply connected to the region's fragile geomorphology and to climatic dynamics characterized by alternating drought and heavy rainfall. This combination produces recurrent hydrogeological risks, which are increasingly exacerbated by climate change. Both mayors and technical offices emphasized these problems, recognizing them as sources of annual damage with growing impacts.

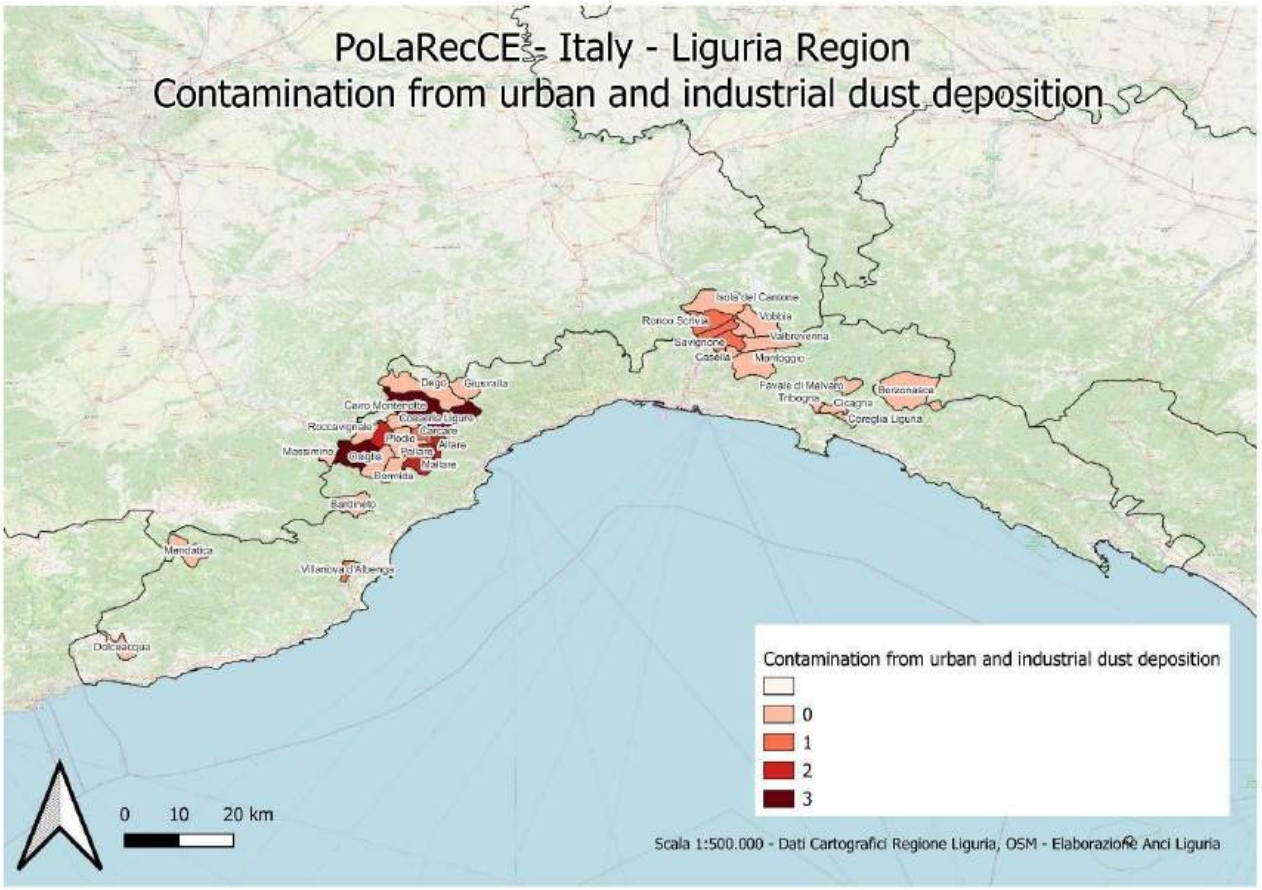

Fig. 4 - Contamination from urban and industrial dust deposition - IT - LIG

Urban and Industrial Dust Deposition

Contamination from urban and industrial dust was strongly reported in Val Bormida, particularly in Millesimo, where nearly 50% of the municipal surface is affected, and in Cairo Montenotte, where 10% of the territory is impacted. Valle Scrivia, another industrialized valley, also showed signs of this type of contamination, although to a lesser extent.

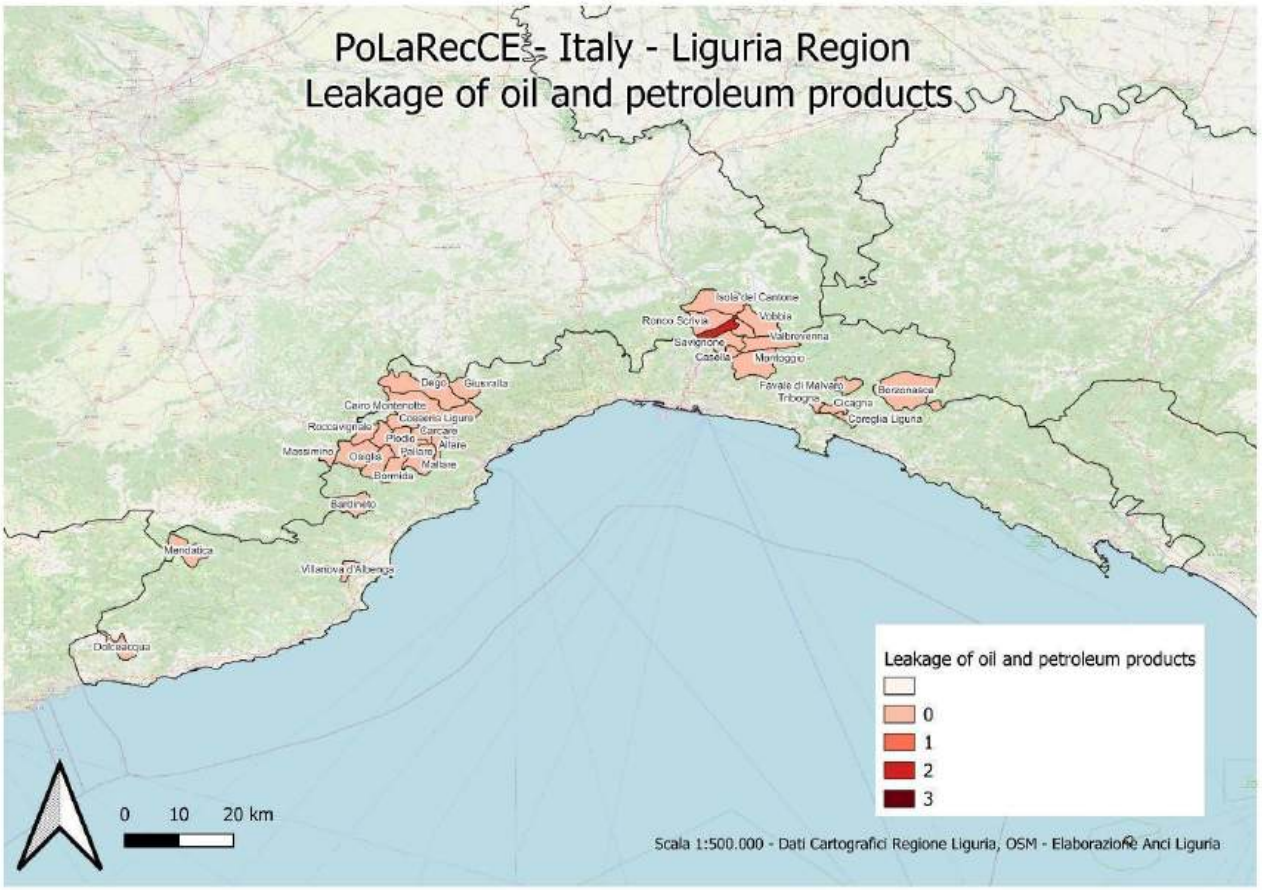

Fig. 5 - Leakage of oil and petroleum products - IT - LIG

Leakage of Oil and Petroleum Products

Evidence of oil-related degradation was identified in Valle Scrivia, an area crossed by petroleum pipelines and hosting petroleum industries. While not considered severe, these findings suggest localized vulnerability linked to industrial infrastructure.

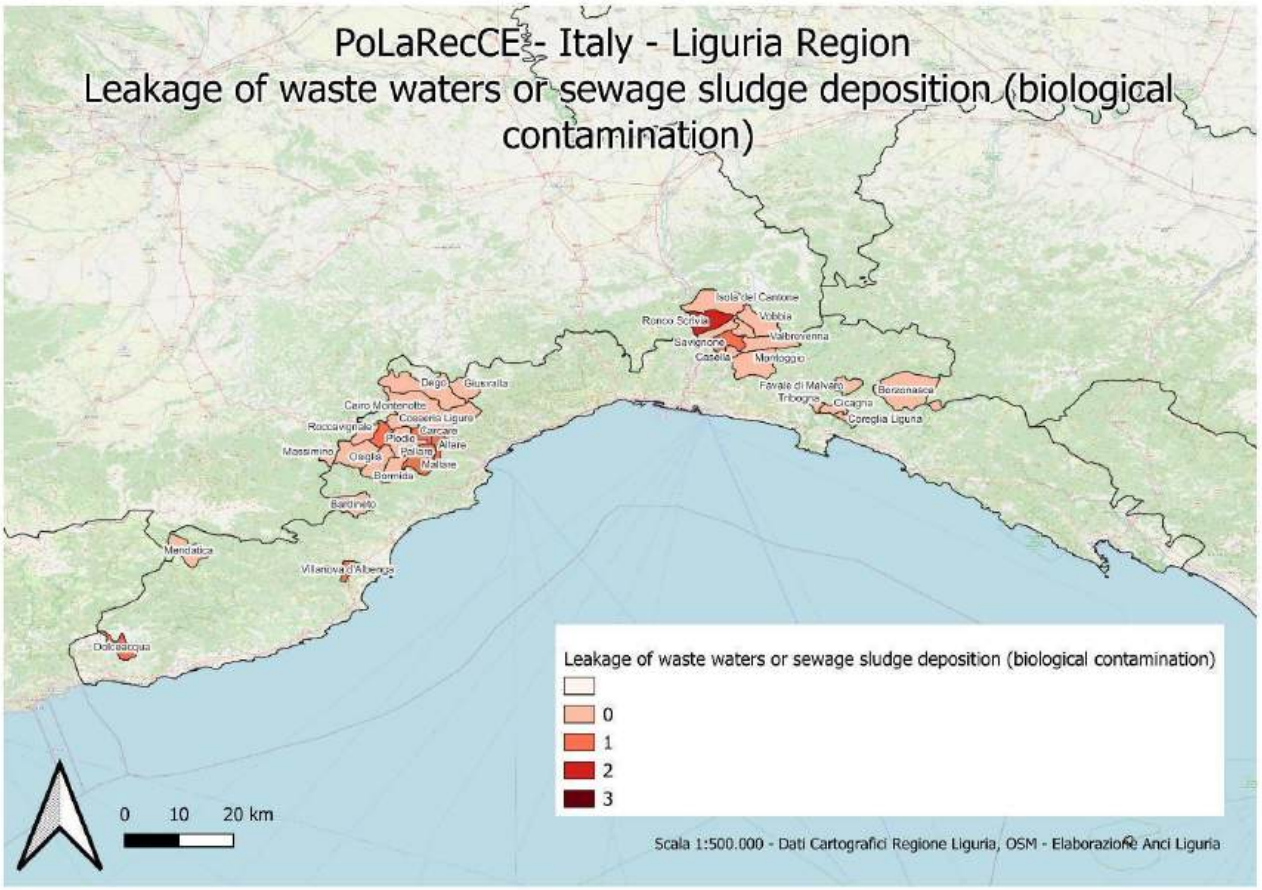

Fig. 6 - Leakage of waste waters or sewage sludge deposition (biological contamination) - IT - LIG

Leakage of Wastewater and Sewage Sludge Deposition

Biological contamination was reported in three areas: Dolceacqua, Val Bormida, and Valle Scrivia. In Dolceacqua, the issue is associated with olive oil and wine production, whereas in Val Bormida and Valle Scrivia it is connected to industrial activity.

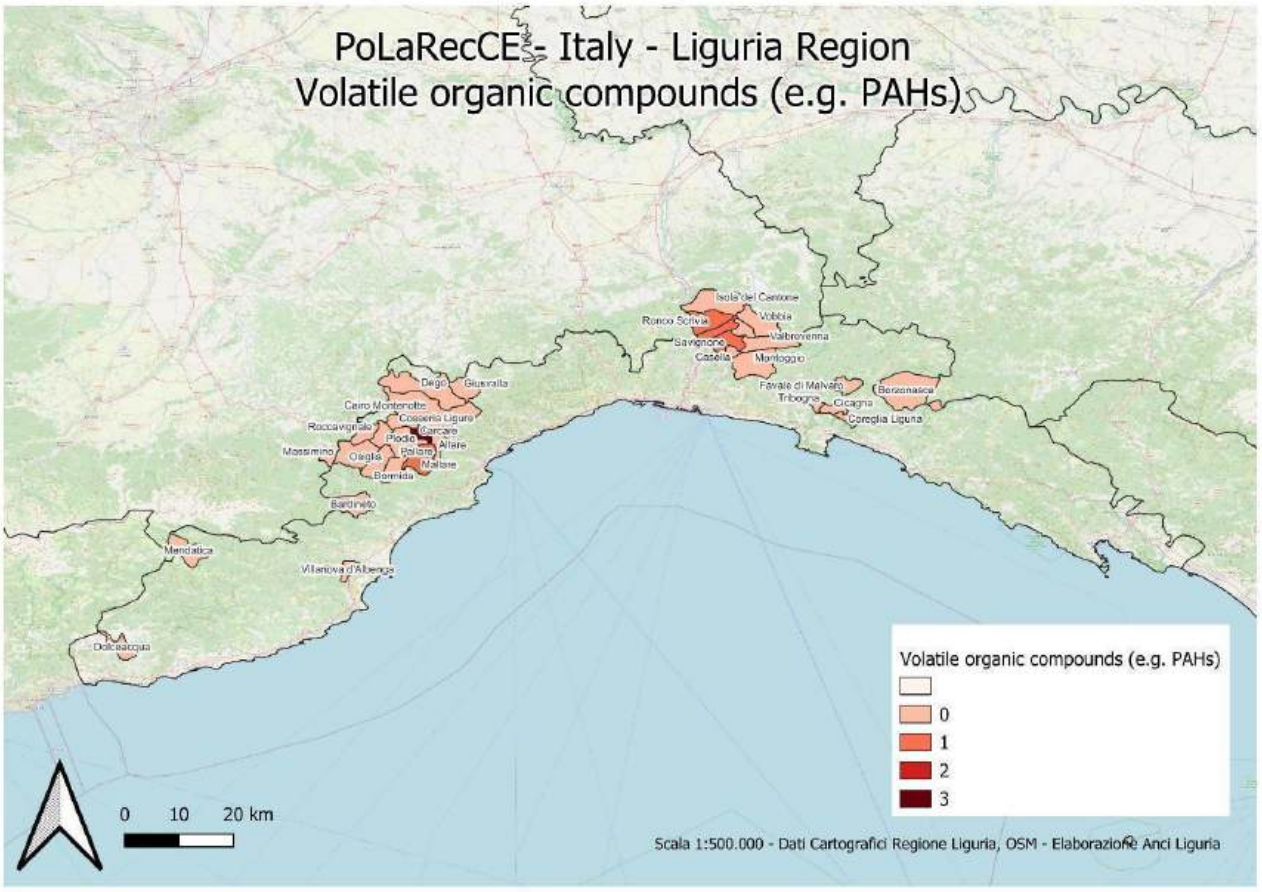

Fig. 7 - Volatile organic compounds (e.g. PAHs) - IT - LIG

Volatile Organic Compounds (VOCs, PAHs)

The presence of volatile organic compounds was confirmed in Cairo Montenotte, Mallare, and Casella, reflecting once again the legacy of the two industrial valleys. Although not extensive, this form of contamination remains relevant in localized hotspots.

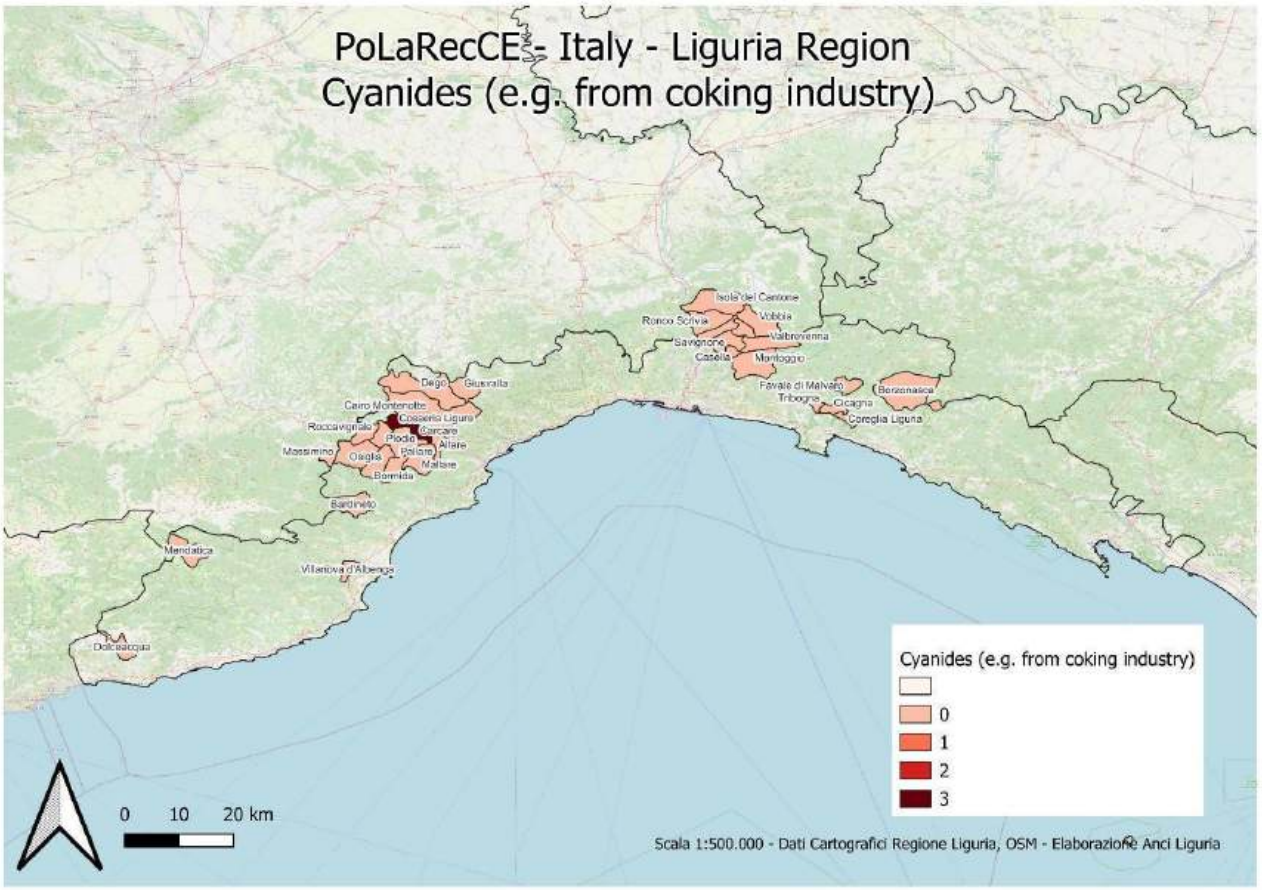

Fig. 8 - Cyanides (e.g. from coking industry) - IT - LIG

Cyanides

The municipality of Cosseria reported particularly severe contamination from cyanides, with up to 80% of its surface potentially affected. This issue is a direct consequence of historical coking industry activities and represents one of the most alarming findings in Liguria.

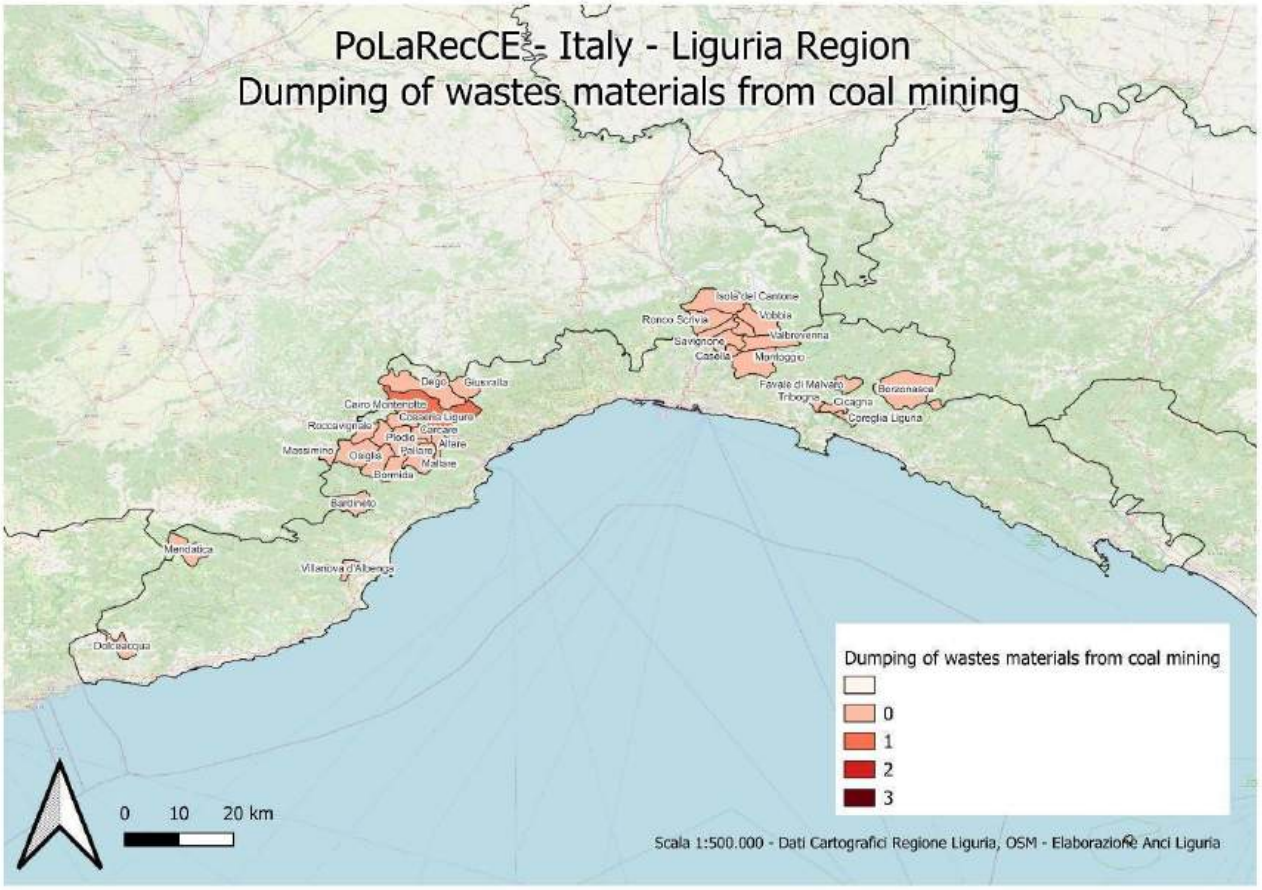

Fig. 9 - Dumping of wastes materials from coal mining - IT - LIG

Dumping of Waste Materials from Coal Mining

Residual contamination linked to historical coal mining activity was reported in Cairo Montenotte, where remnants of extraction processes are still evident.

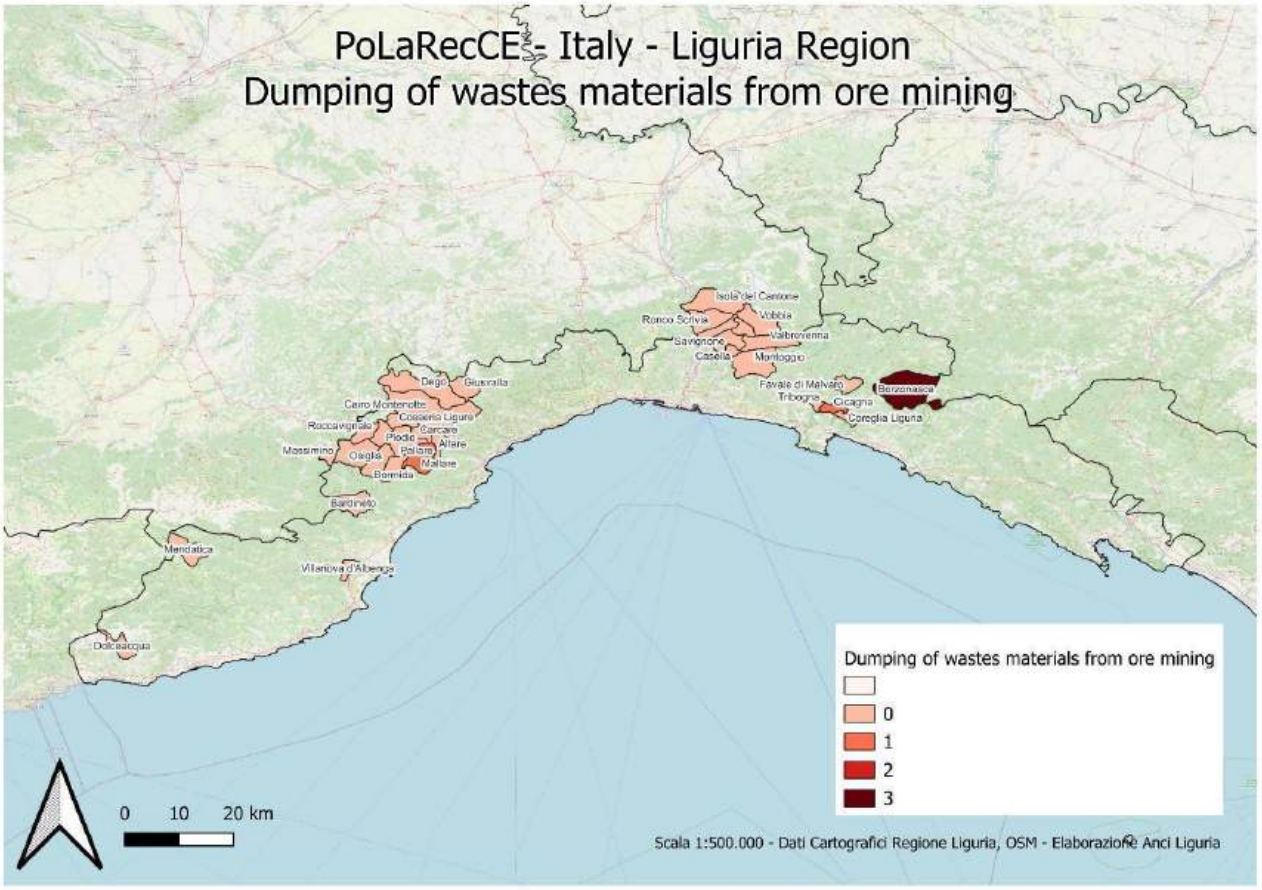

Fig. 10 - Dumping of wastes materials from ore mining - IT - LIG

Dumping of Waste Materials from Ore Mining

Although ore mining is not common in Liguria, traces were identified in Borzonasca, where economically viable ores were historically extracted.

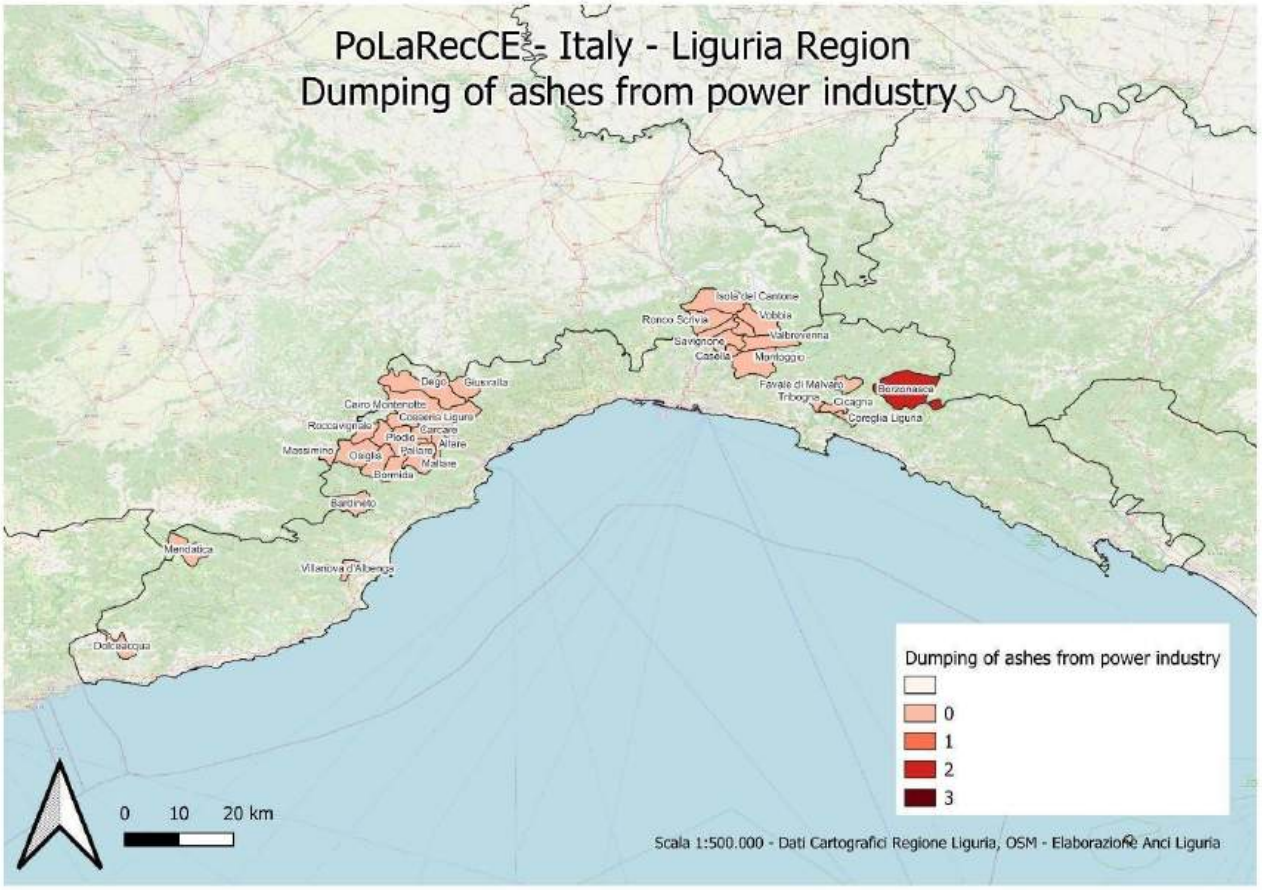

Fig. 11 - Dumping of ashes from power industry - IT - LIG

Dumping of Ashes from Power Industry

Ash disposal from the power industry was reported only in Borzonasca, where the presence of a power plant has produced localized impacts.

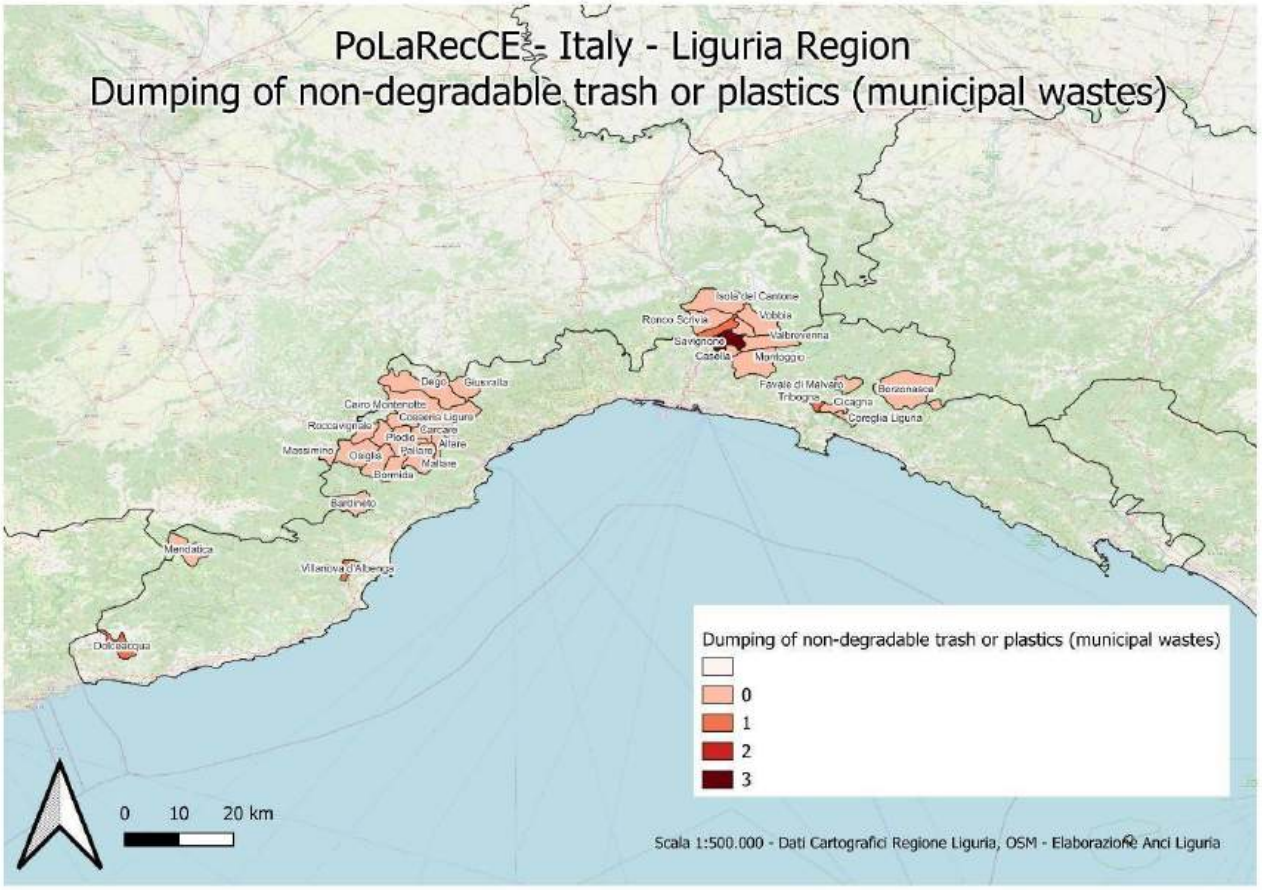

Fig. 12 - Dumping of non-degradable trash or plastics (municipal wastes) - IT - LIG

Dumping of Non-Degradable Trash or Plastics

Improper disposal of municipal waste and plastics emerged in two municipalities. In Dolceacqua, degradation extends across 80% of the surface but at a low intensity (level 1), whereas in Savignone the problem affects a smaller portion of the territory but at higher intensity (level 3).

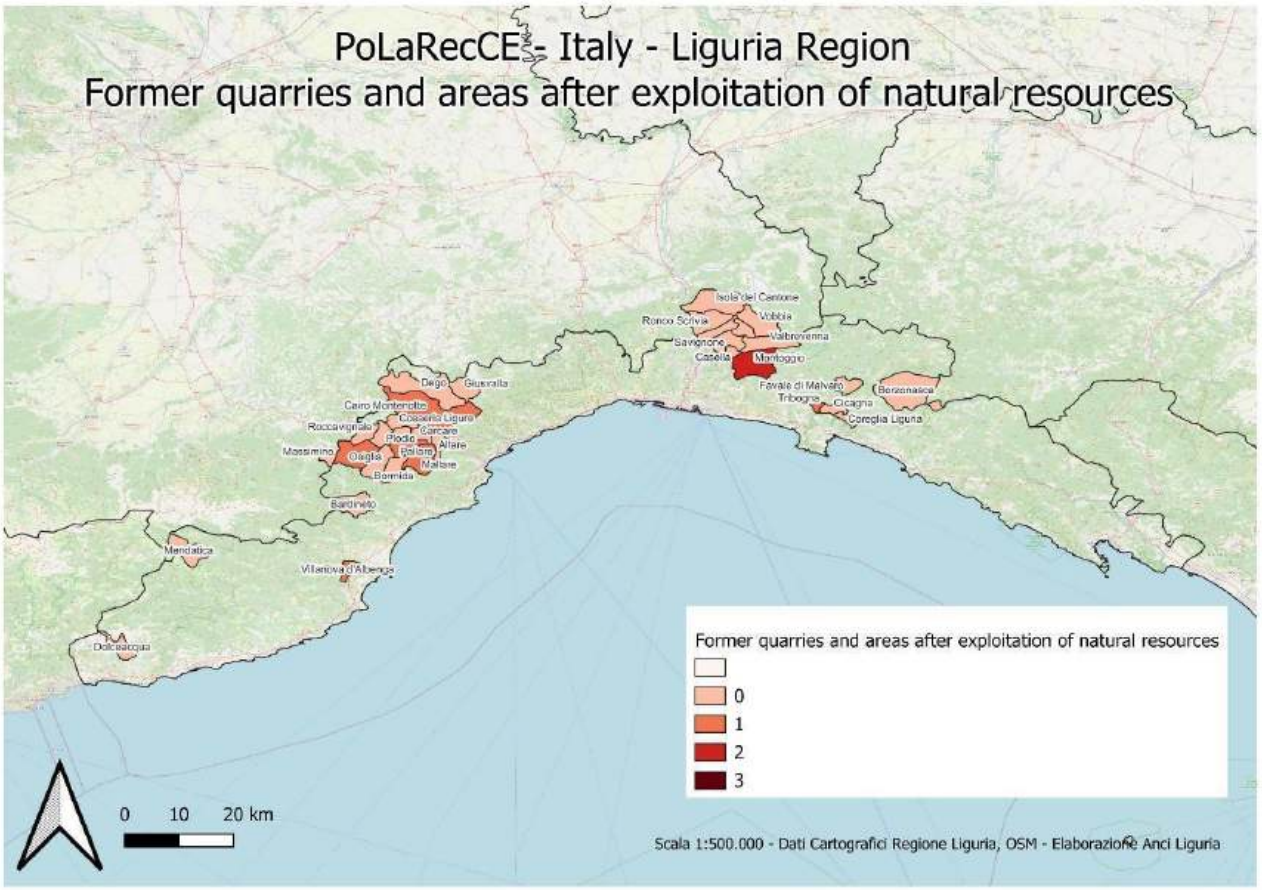

Fig. 13 - Former quarries and areas after exploitation of natural resources - IT - LIG

Former Quarries and Resource Exploitation Areas

Overall, former quarries did not emerge as a significant issue. Only Montoggio reported localized degradation linked to earthquake-related damage.

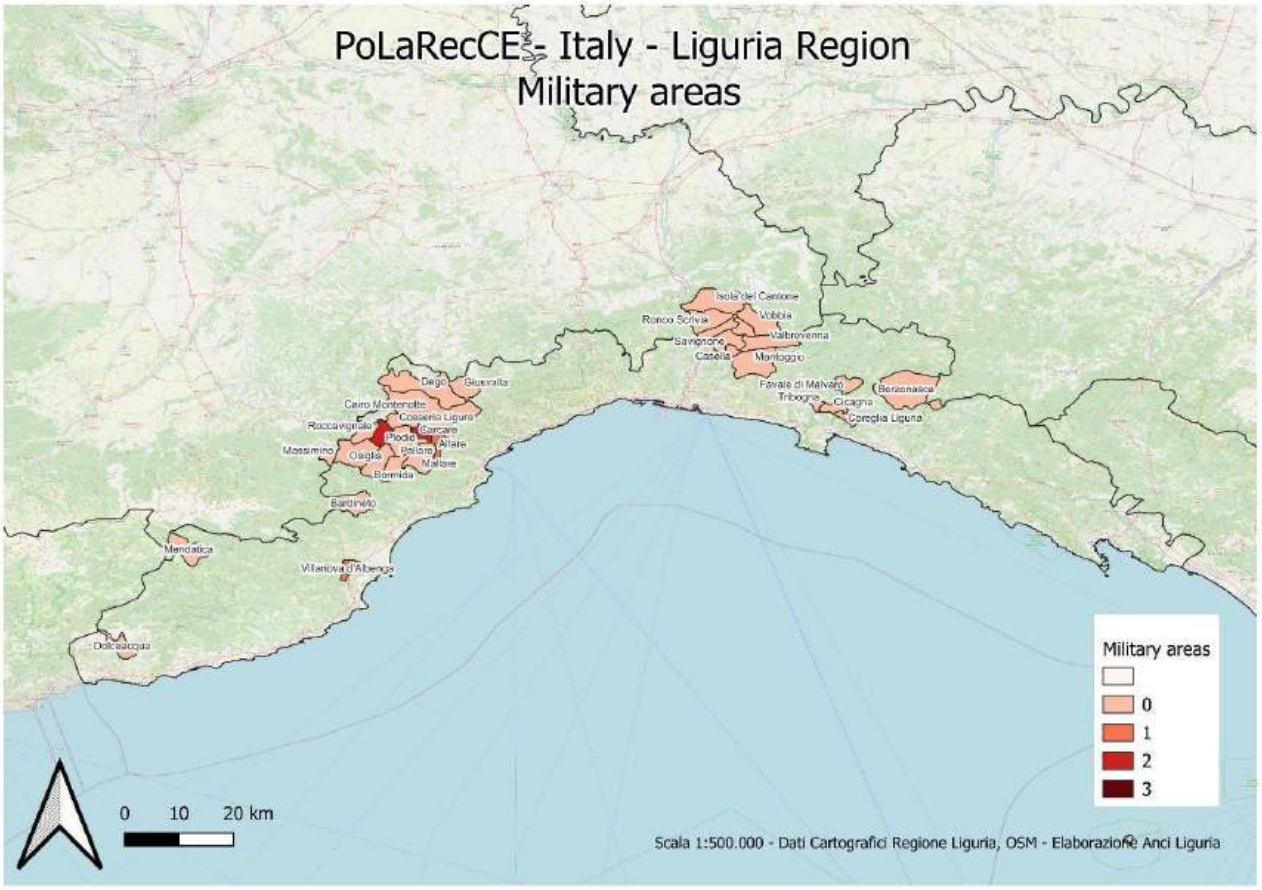

Fig. 14 - Military areas - IT - LIG

Military Areas

Military-related soil degradation is rare in Liguria but was reported in Val Bormida and in Villanova d'Albenga, where a military airport is located.

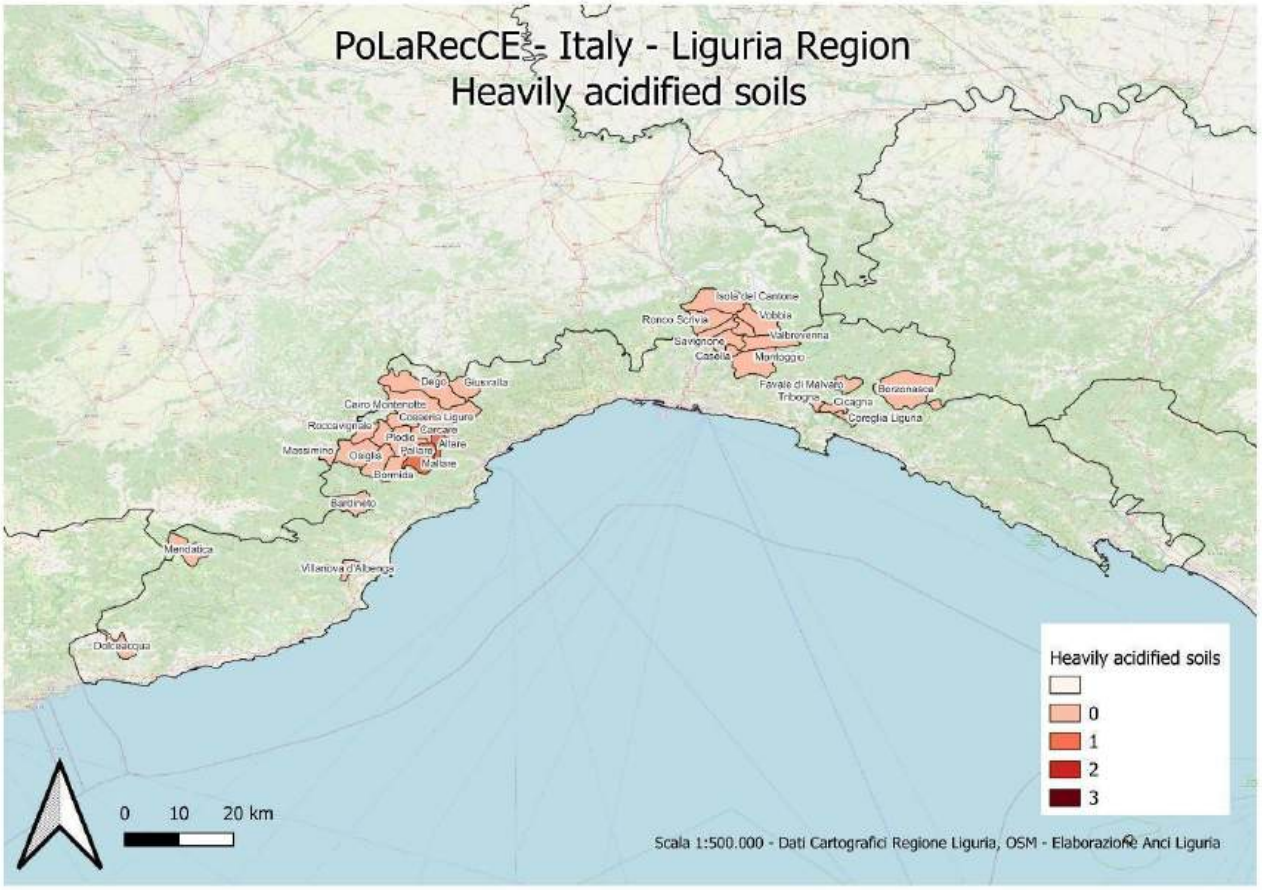

Fig. 15 - Heavily acidified soils - IT - LIG

Heavily Acidified Soils

Low-level acidification was noted in Pallare and Mallare, with degradation affecting only 1–3% of their territory.

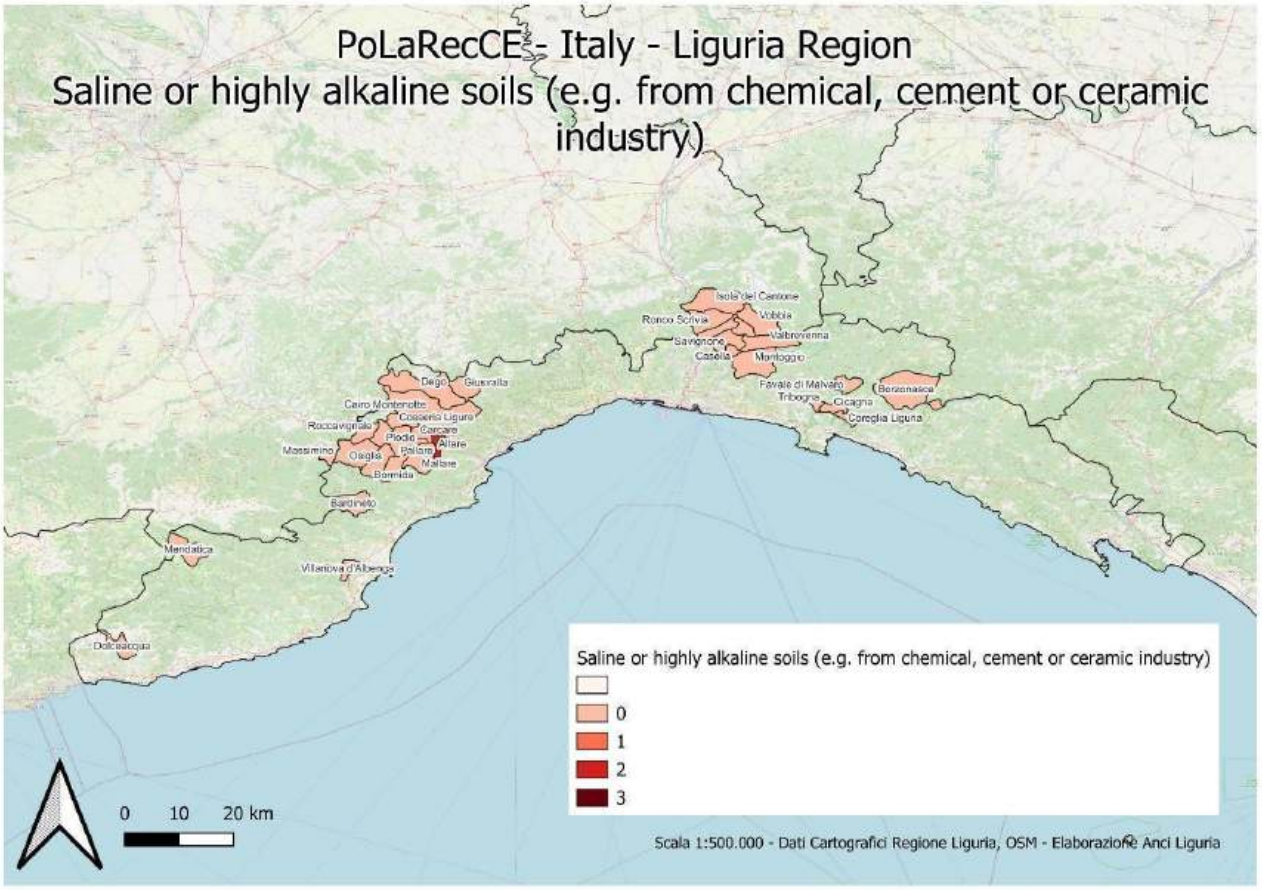

Fig. 16 - Saline of highly alkaline soils (e.g. from chemical, cement or ceramic industry) - IT - LIG

Saline or Highly Alkaline Soils

This problem is not widespread in Liguria. Minor effects were identified in Val Bormida, though they are not considered critical.

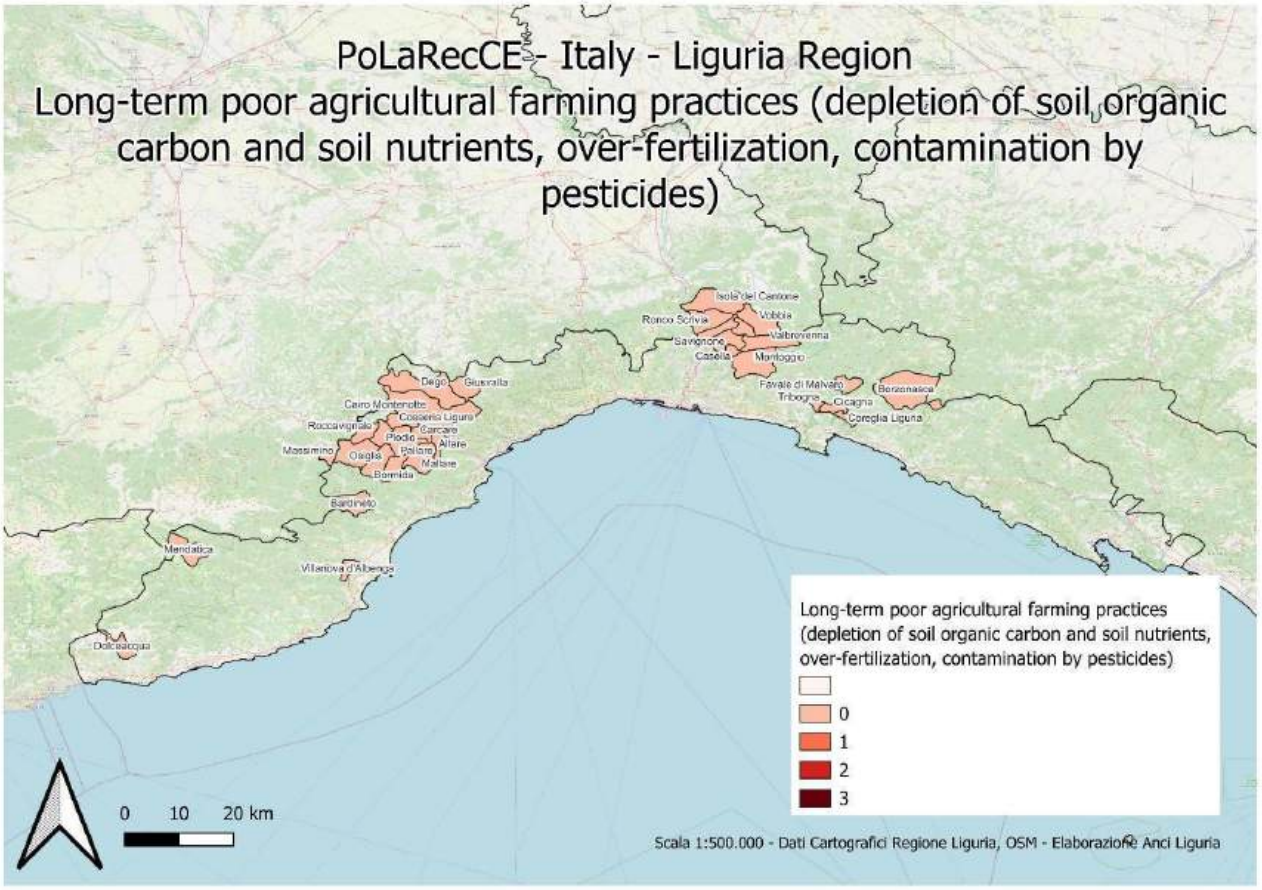

Fig. 17 - Long-term poor agricultural farming practices (depletion of soil organic carbon and soil nutrients, over-fertilization, contamination by pesticides) - IT - LIG

Poor Agricultural Practices

No significant evidence of soil degradation linked to intensive farming was reported. The regional context is characterized by less intensive agricultural practices, though uncollected data from the Albenga area may reveal additional issues.

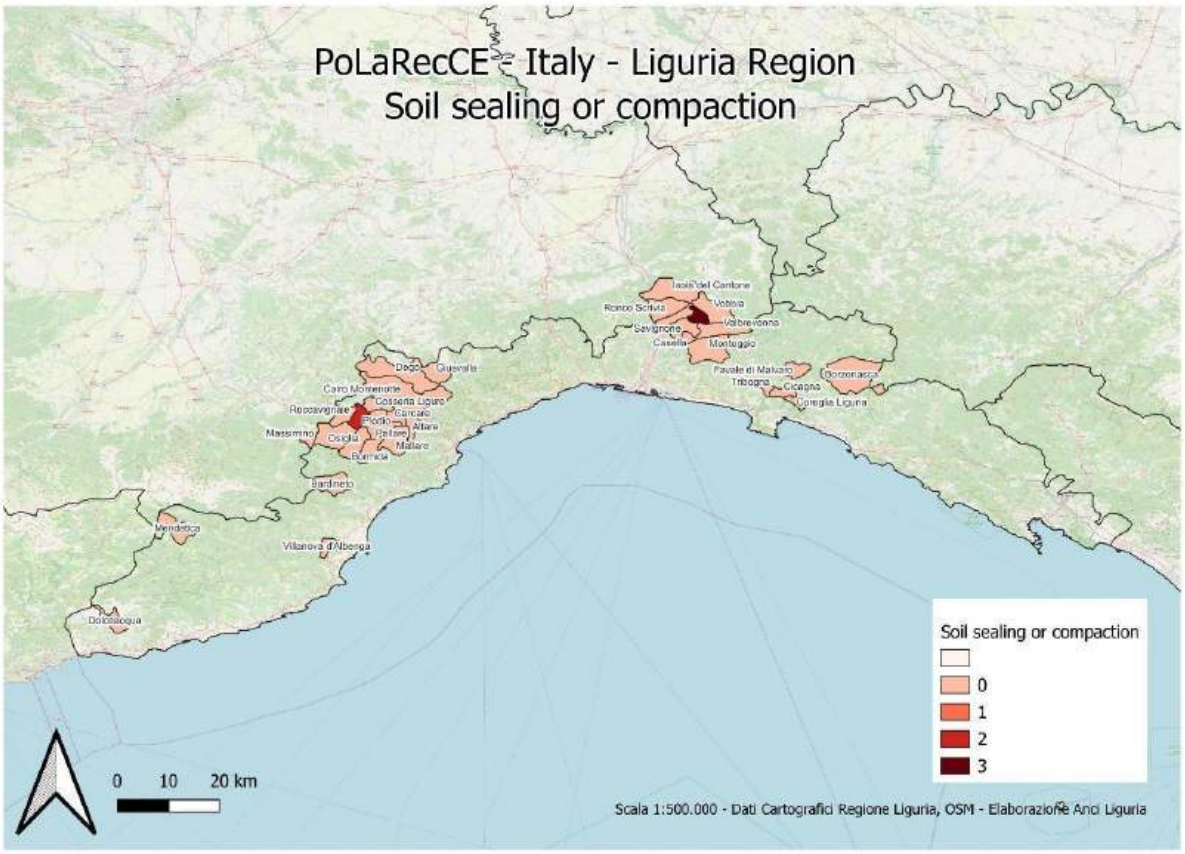

Fig. 18 - Soil sealing or compaction - IT - LIG

Soil Sealing and Compaction

This process was identified in Millesimo (Val Bormida) and Vobbia (Valle Scrivia), reflecting pressures linked to urbanization and infrastructure development.

Other Issues

Additional forms of degradation were sporadically mentioned, including land abandonment leading to slope instability, and noise pollution reported in Cosseria.

Synthesis

Overall, the Liguria survey highlights the coexistence of natural fragility and industrial legacies, resulting in localized but significant risks. The emphasis on flooding and erosion reflects the combined influence of geomorphology and climate, while industrially derived contamination—particularly in Val Bormida—illustrates the enduring impact of past economic activities. The selection of Val Bormida as a pilot site is therefore validated, as it epitomizes the intersection of historical pollution and contemporary climatic pressures.

EMILIA ROMAGNA REGION

The Emilia-Romagna Region extends over 22,453 km² and comprises 330 municipalities, of which 212 are listed in the regional register of contaminated sites (https://datacatalog.regione.emilia-romagna.it/catalogCTA/dataset/elenco-dei-siti-contaminati-della-regione-emilia-romagna-1523632340215-121). Questionnaires were distributed to these 212 municipalities, and 18 responses were collected, representing 8.5% of contacted municipalities, 4.7% of the regional surface area, and 4.6% of the regional population (Table 1). Despite the relatively low response rate, the data provide meaningful insights into the main soil degradation processes in the region.

Table 1. Surface area and number of municipalities involved in the PoLaRecCE questionnaire on Emilia Romagna region soil degradation processes

Province	total surface area (km²)	Number of municipalities	Number of municipalities having at least one site in the regional register of contaminated sites	Number of responses to questionnaire obtained	total surface area of the municipalities that responded to the questionnaire (km²)	total population area of the municipalities that responded to the questionnaire
Bologna	3703	55	45	3	152	
Forlì-Cesena	2378	30	20	3	184,27	
Ferrara	2635	21	17	1	284,13	
Modena	2689	47	29	0	0	
Piacenza	2586	46	22	1	118,23	
Parma	3447	44	25	1	57,65	
Ravenna	1858	18	15	3	60,25	
Reggio Emilia	2293	42	30	3	50,05	
Rimini	864	27	9	3	140,41	

total	**22,453**	**330**	**212**	**18**	**1046,99**	**204,983**
% that responded to the questionnaire				8,5	4,7	4,6 (*)

(*) total population of Emilia Romagna region: 4,467,331 inhabitants

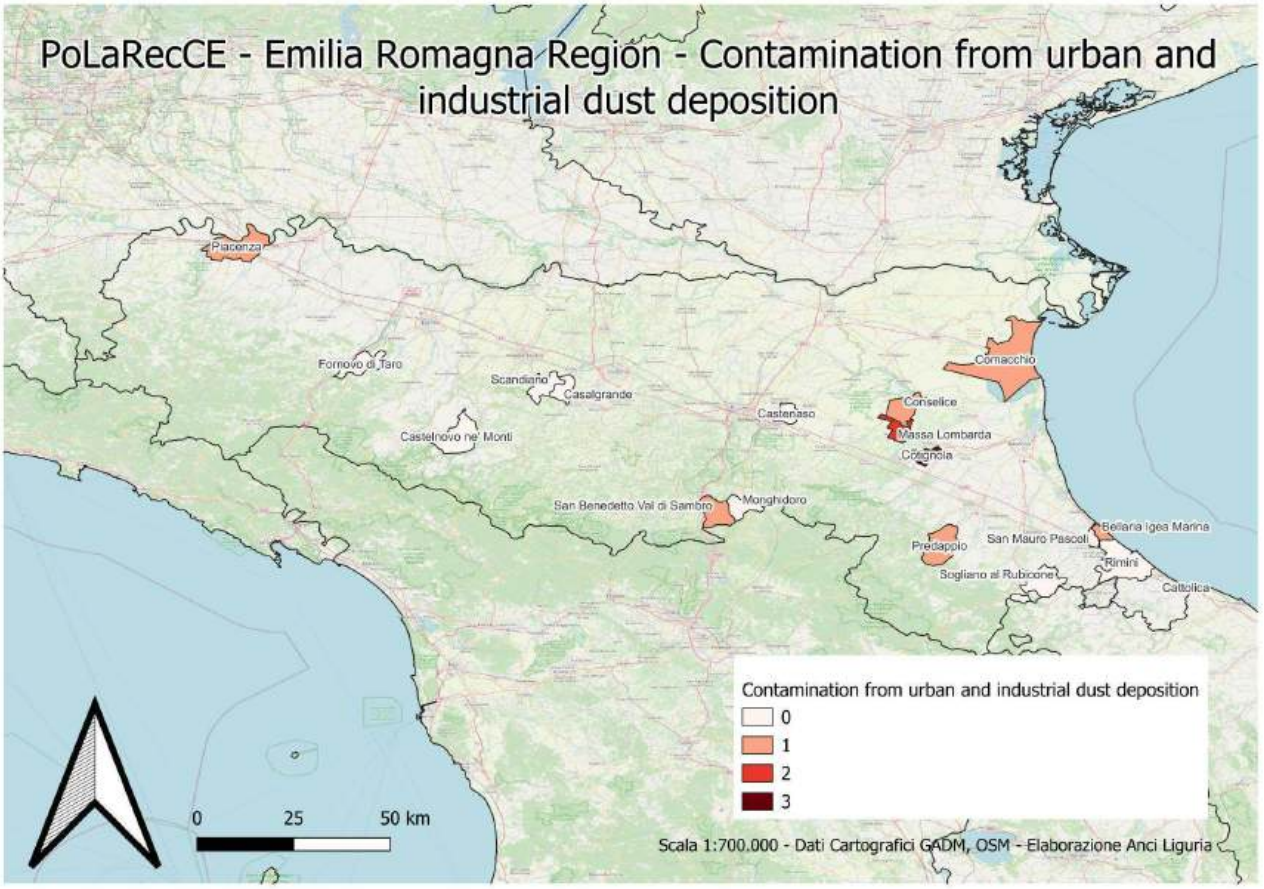

Fig. 19 - Contamination from urban and industrial dust deposition - IT - ER

Urban and Industrial Dust Deposition

Contamination by urban and industrial dust was identified by 44% of municipalities. While often considered of low intensity, in some areas it was highlighted as a problem of higher relevance, reflecting the influence of industrial activities and dense urbanization.

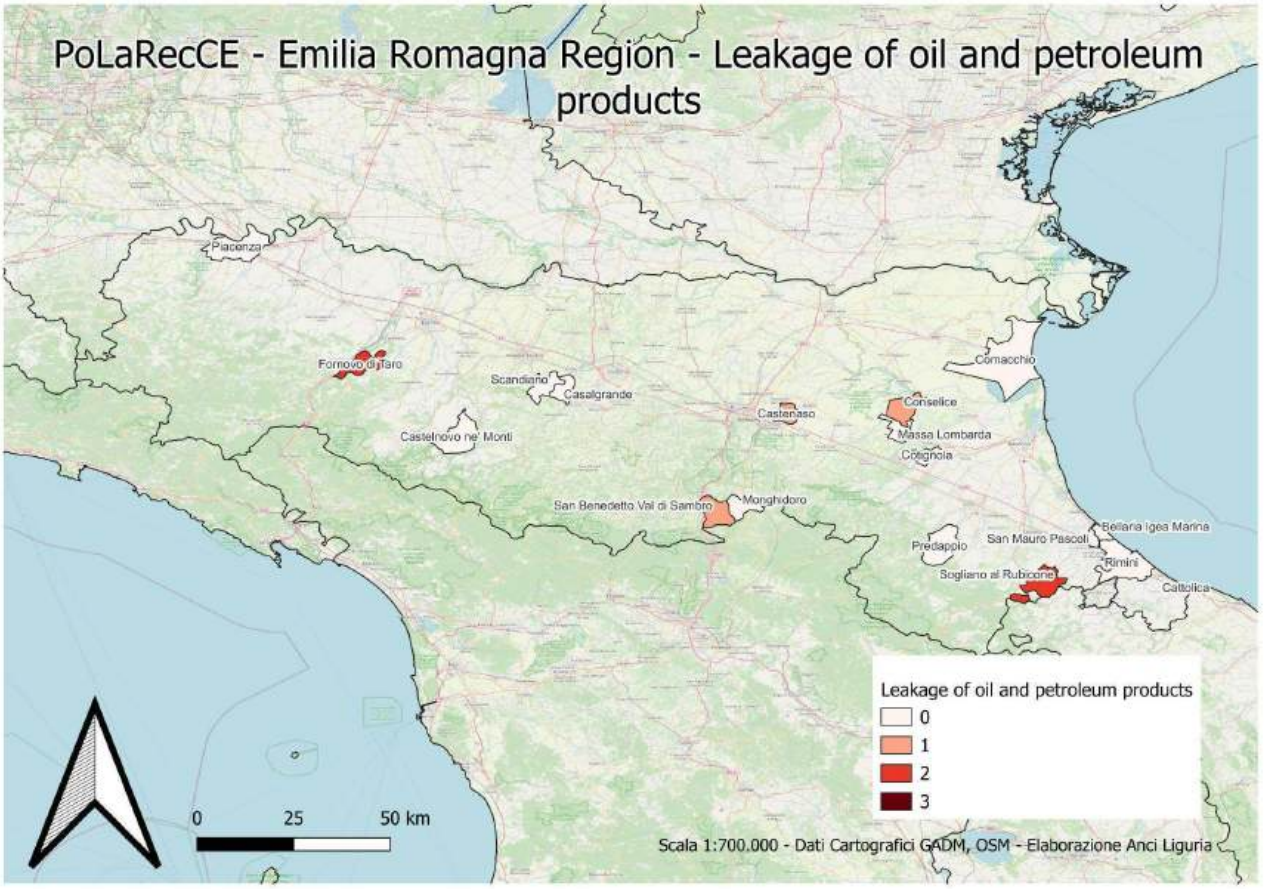

Fig. 20 - Leakage of oil and petroleum products - IT - ER

Leakage of Oil and Petroleum Products

Oil-related degradation was identified in 22% of municipalities. Impacts are usually limited to small areas associated with storage facilities or transport infrastructures, but they demonstrate the persistence of risks tied to industrial and logistic activities.

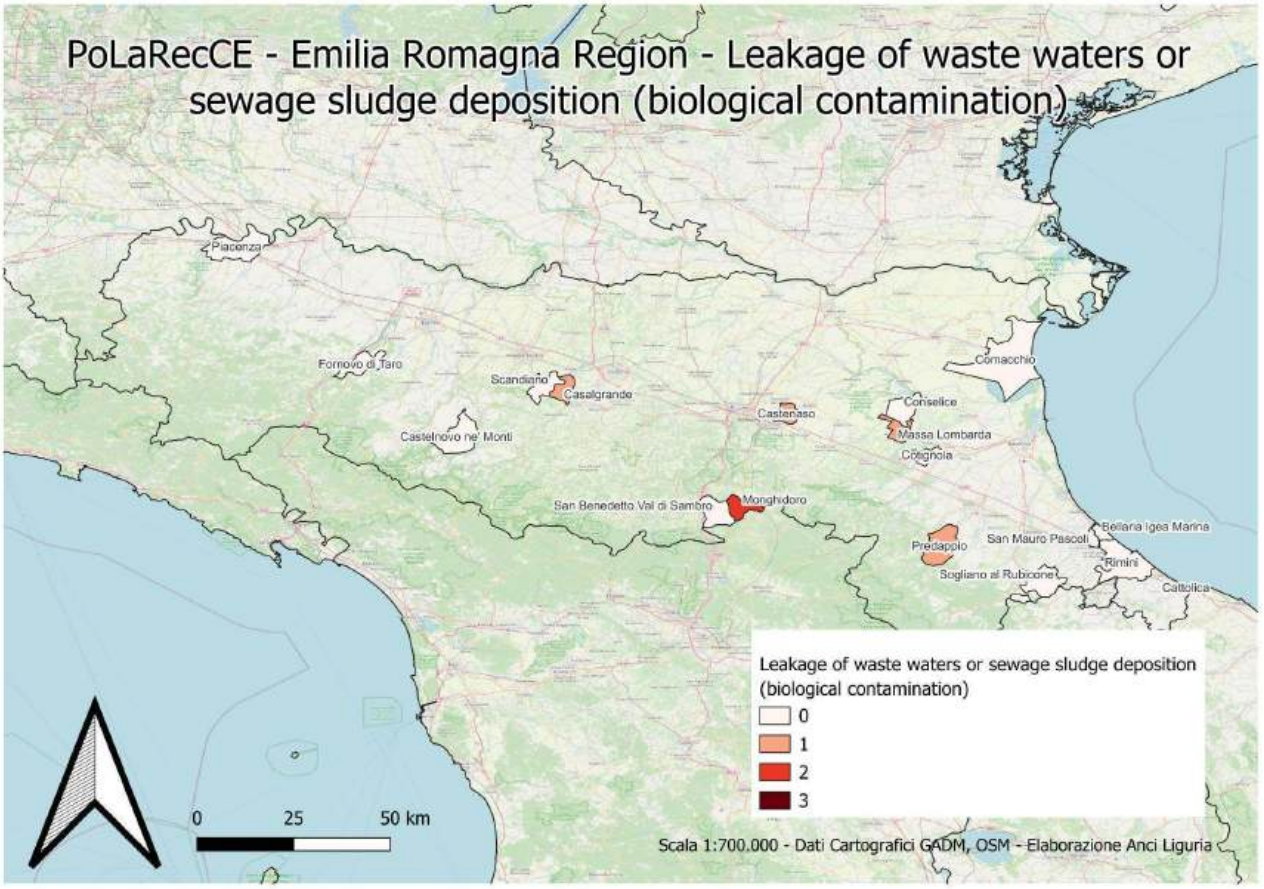

Fig. 21 - Leakage of waste waters or sewage sludge deposition (biological contamination) - IT - ER

Leakage of Wastewater and Sewage Sludge Deposition

Wastewater leakage and sewage sludge deposition were reported by 28% of municipalities. Although generally considered a problem of low to medium intensity, these cases underline the potential for localized biological contamination, particularly in peri-urban and agricultural zones.

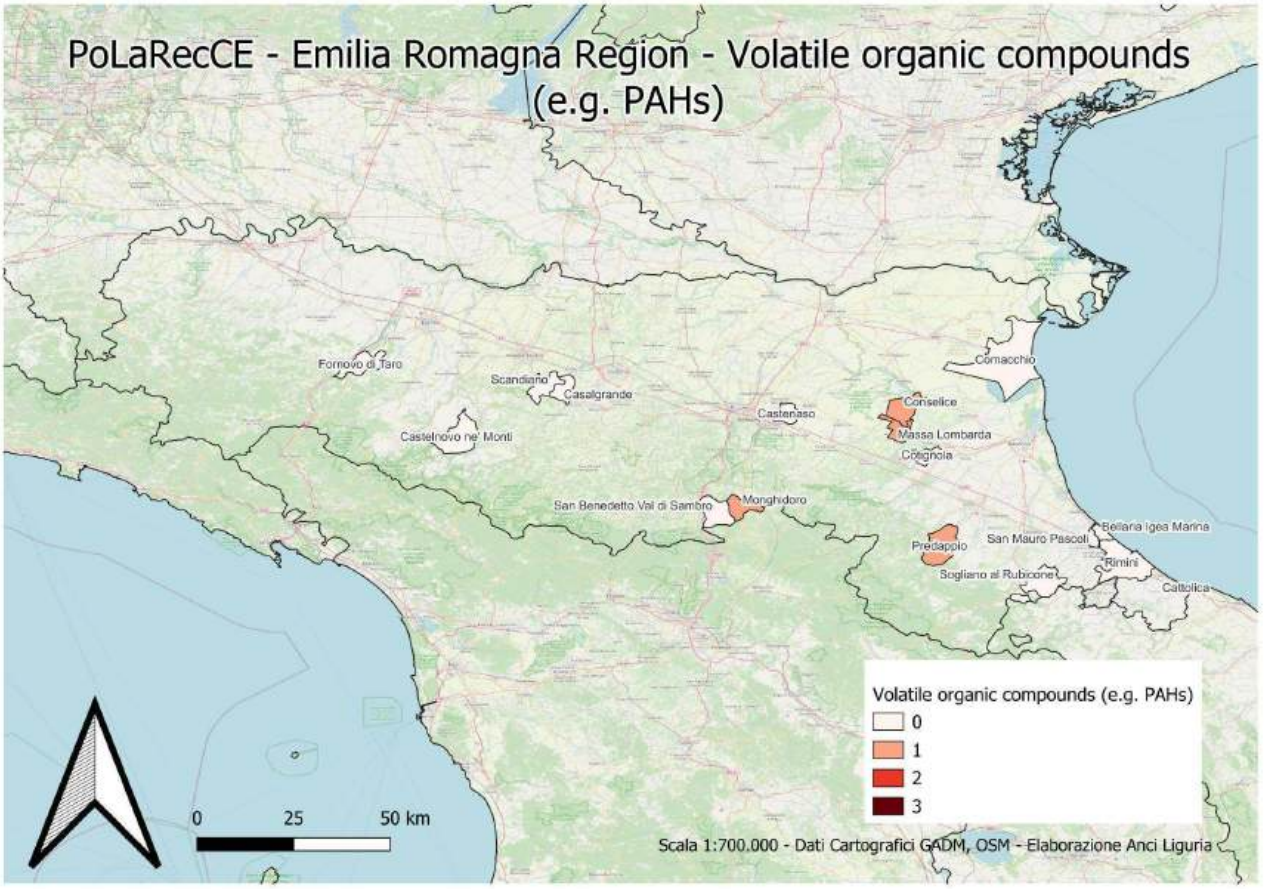

Fig. 22 - Volatile organic compounds (e.g. PAHs) - IT - ER

Volatile Organic Compounds (VOCs, PAHs)

Seventeen percent of municipalities reported soil contamination linked to volatile organic compounds, mainly in areas with a history of industrial activity. Although not a widespread concern, these cases highlight the need for site-specific monitoring.

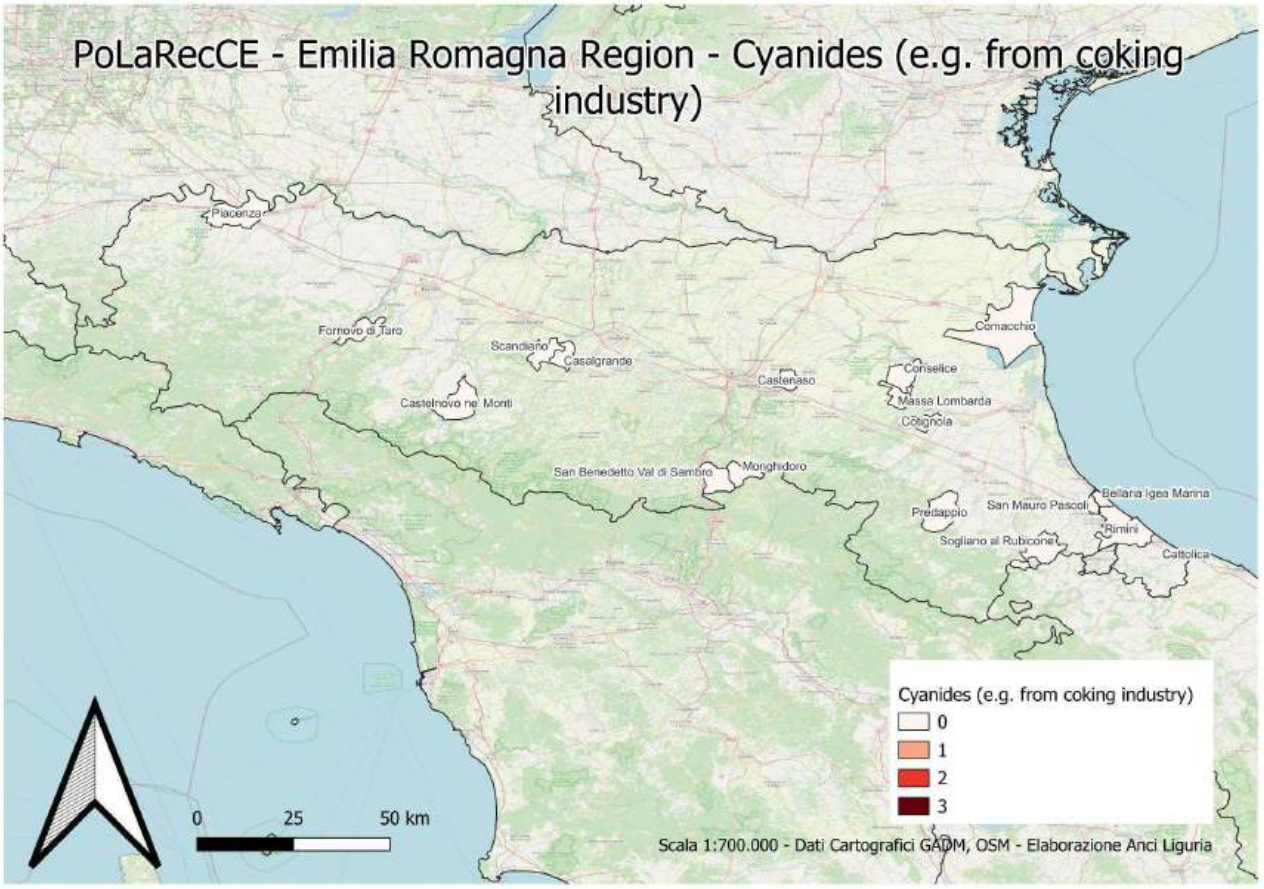

Fig. 23 - Cyanides (e.g. from coking industry) - IT - ER

Fig. 24 - Dumping of wastes materials from coal mining - IT - ER

Fig. 25 - Dumping of wastes materials from ore mining - IT - ER

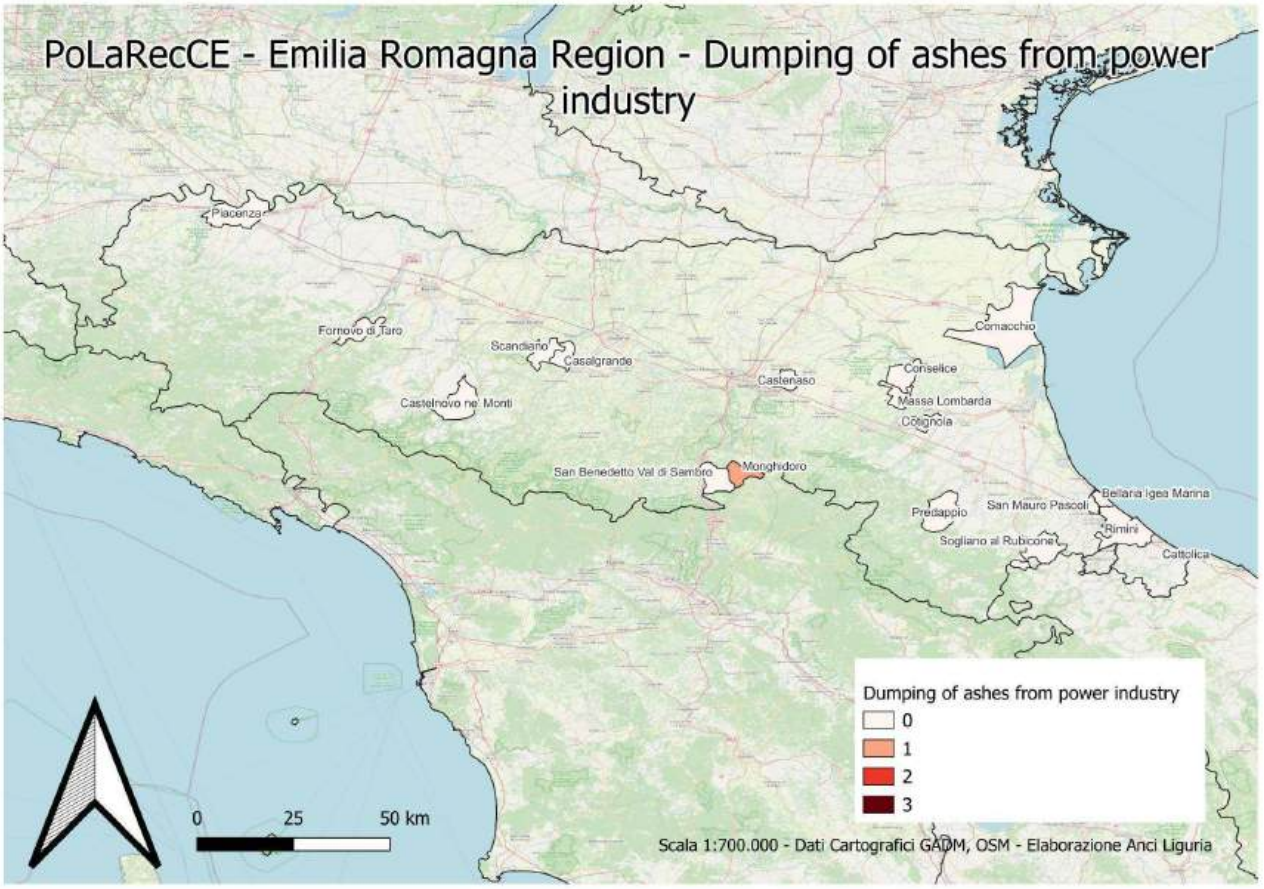

Fig. 26 - Dumping of ashes from power industry - IT - ER

Dumping of Ashes from Power Industry

Ash disposal was reported by only one municipality (6% of the sample), and its overall significance is considered marginal.

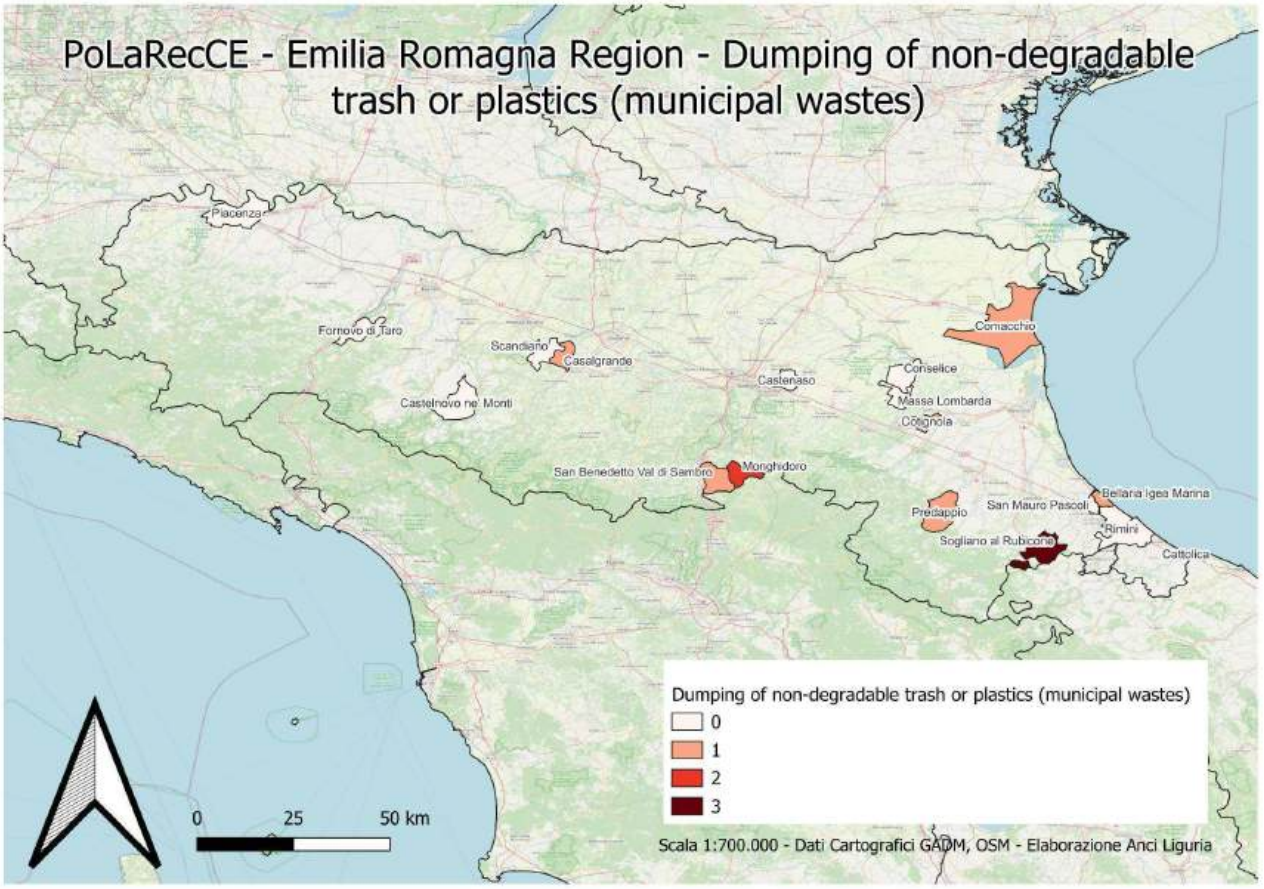

Fig. 27 - Dumping of non-degradable trash or plastics (municipal wastes) - IT - ER

Dumping of Non-Degradable Trash or Plastics

The improper disposal of municipal waste and plastics was reported by 44% of respondents. Most municipalities assessed the problem as low, yet the persistence of illegal landfills and waste mismanagement remains a source of soil degradation in certain localities.

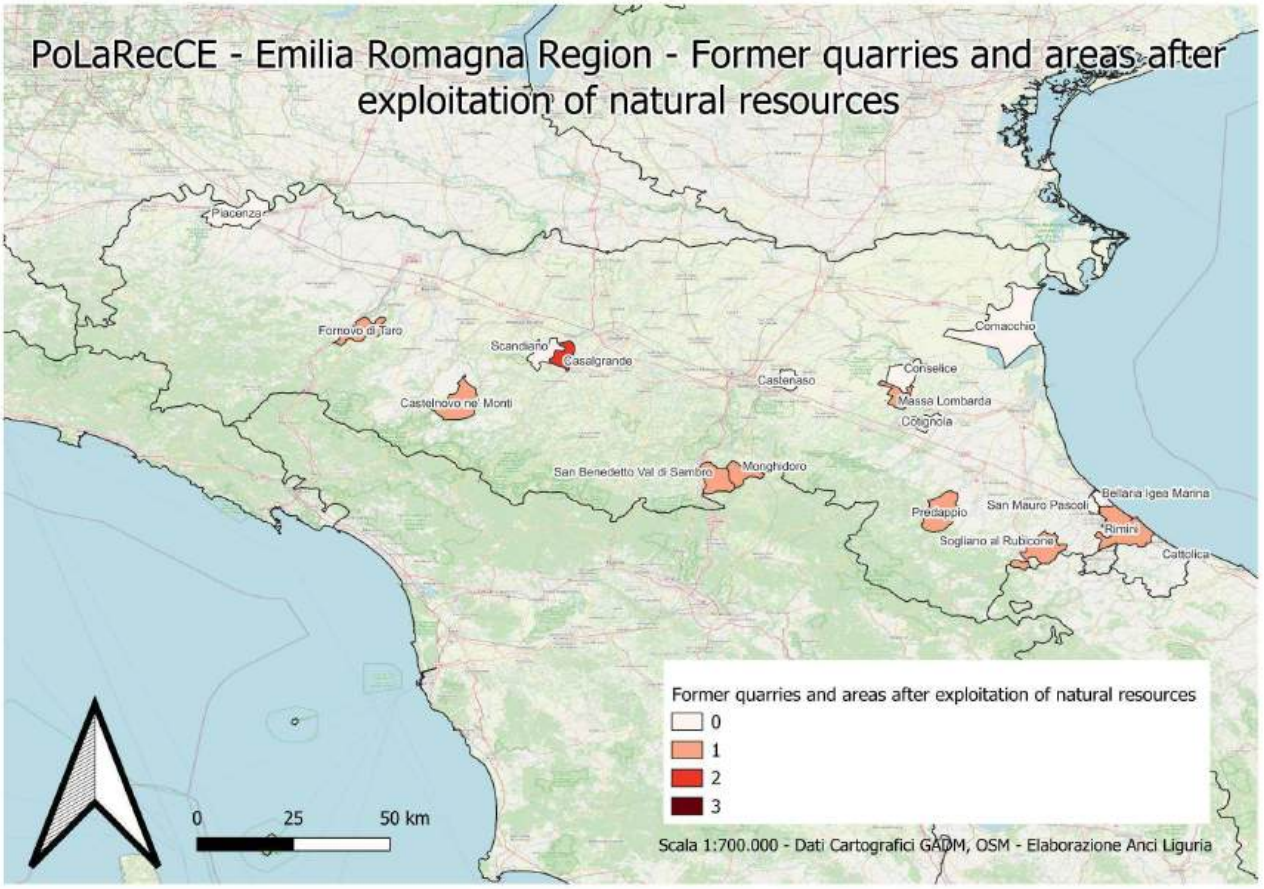

Fig. 28 - Former quarries and areas after exploitation of natural resources - IT - ER

Former Quarries and Resource Exploitation Areas

Half of the respondents indicated some degree of degradation associated with former quarries or areas exploited for natural resources. These sites often represent localized but long-lasting impacts on soil quality, particularly where reclamation has been incomplete or absent.

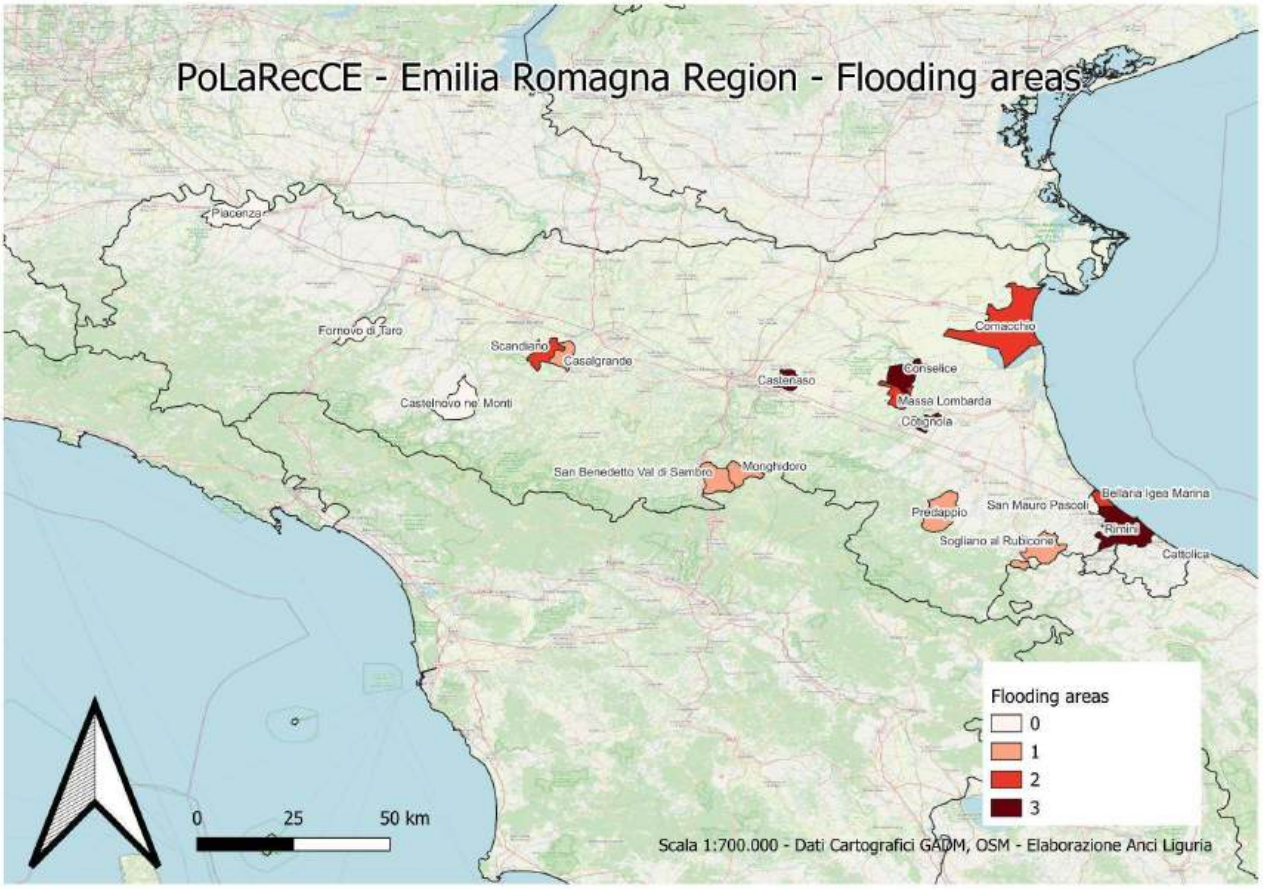

Fig. 29 - Flooding areas- IT - ER

Flooding Areas

Flooding emerged as the most recurrent and widely recognized issue, reported by 72% of respondents. The problem is deeply rooted in the region's geography, as Emilia-Romagna has long been prone to floods, particularly in the plains of Romagna and eastern Emilia. Recent events in 2023 and 2025 dramatically confirmed this vulnerability, with large-scale floods causing extensive damage both in lowland and mountain areas due to hydrogeological instability. This risk is perceived as high and remains one of the most urgent challenges for soil and land management in the region.

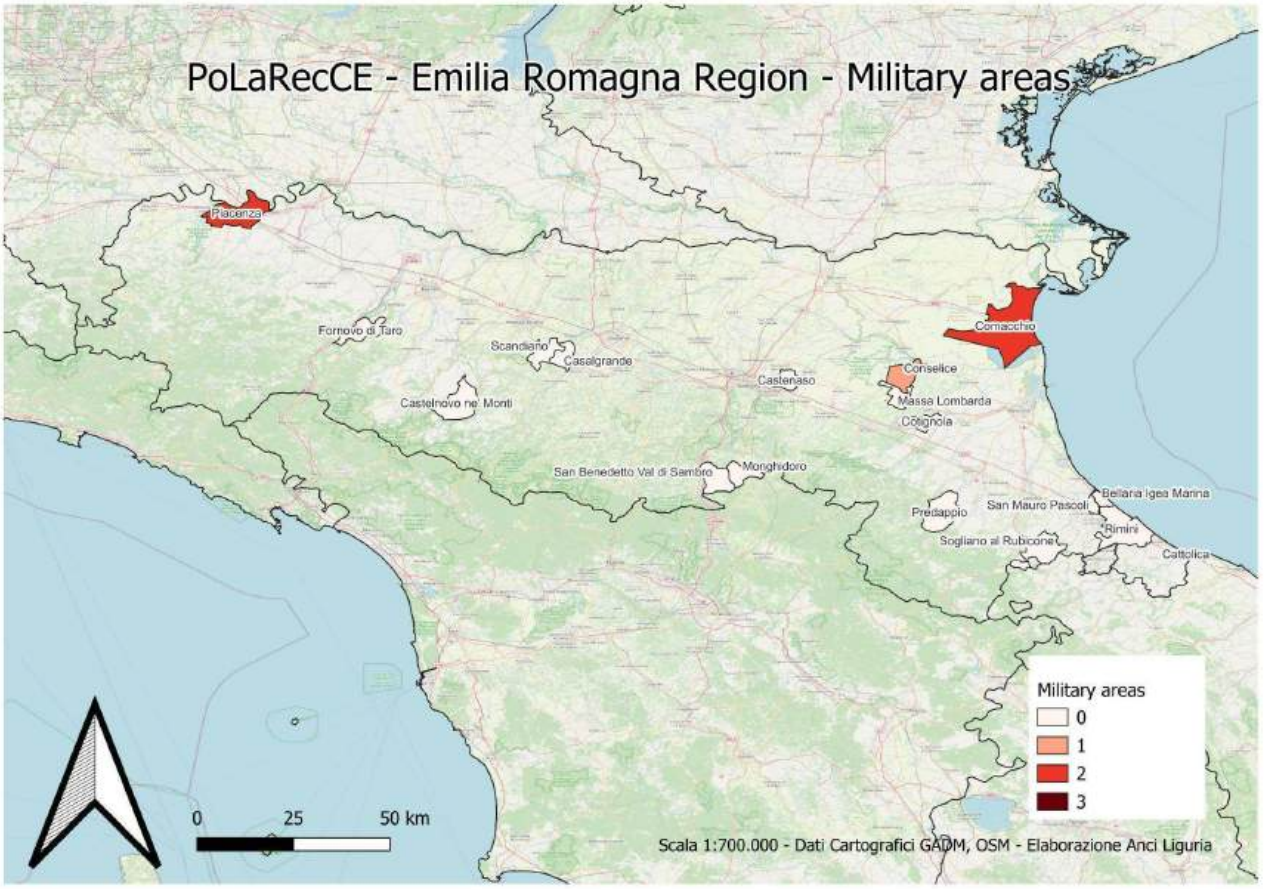

Fig. 30 - Military areas - IT - ER

Military Areas

The presence of degraded soils linked to military activities was mentioned by 17% of respondents, though generally with low relevance.

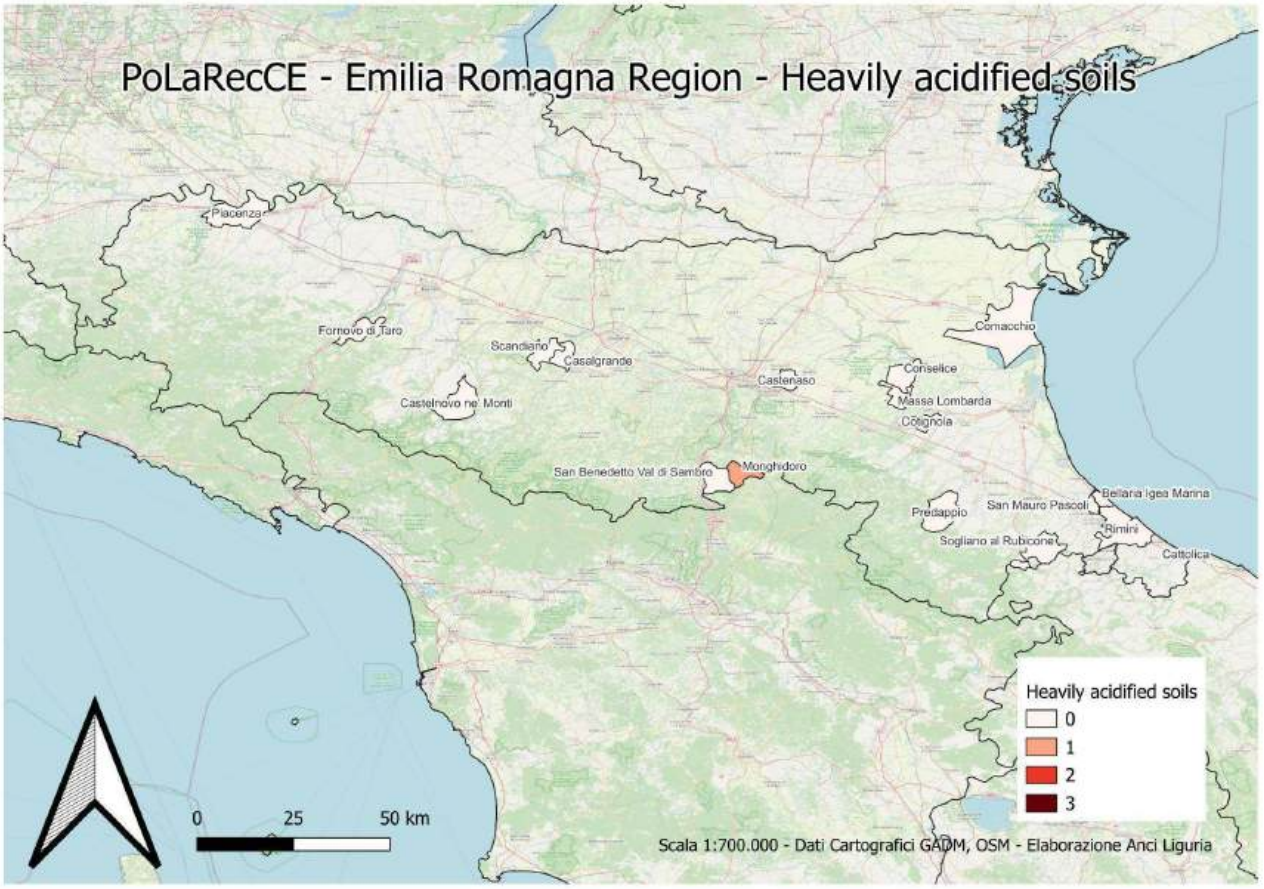

Fig. 31 - Heavily acidified soils - IT - ER

Heavily Acidified Soils

Similarly, heavily acidified soils were identified by a single municipality, corresponding to 6% of the sample, and were not considered a widespread problem.

Other Issues

Some municipalities indicated additional soil degradation processes not explicitly listed in the questionnaire, particularly hydrogeological instability exacerbated by intensive land use and climate variability.

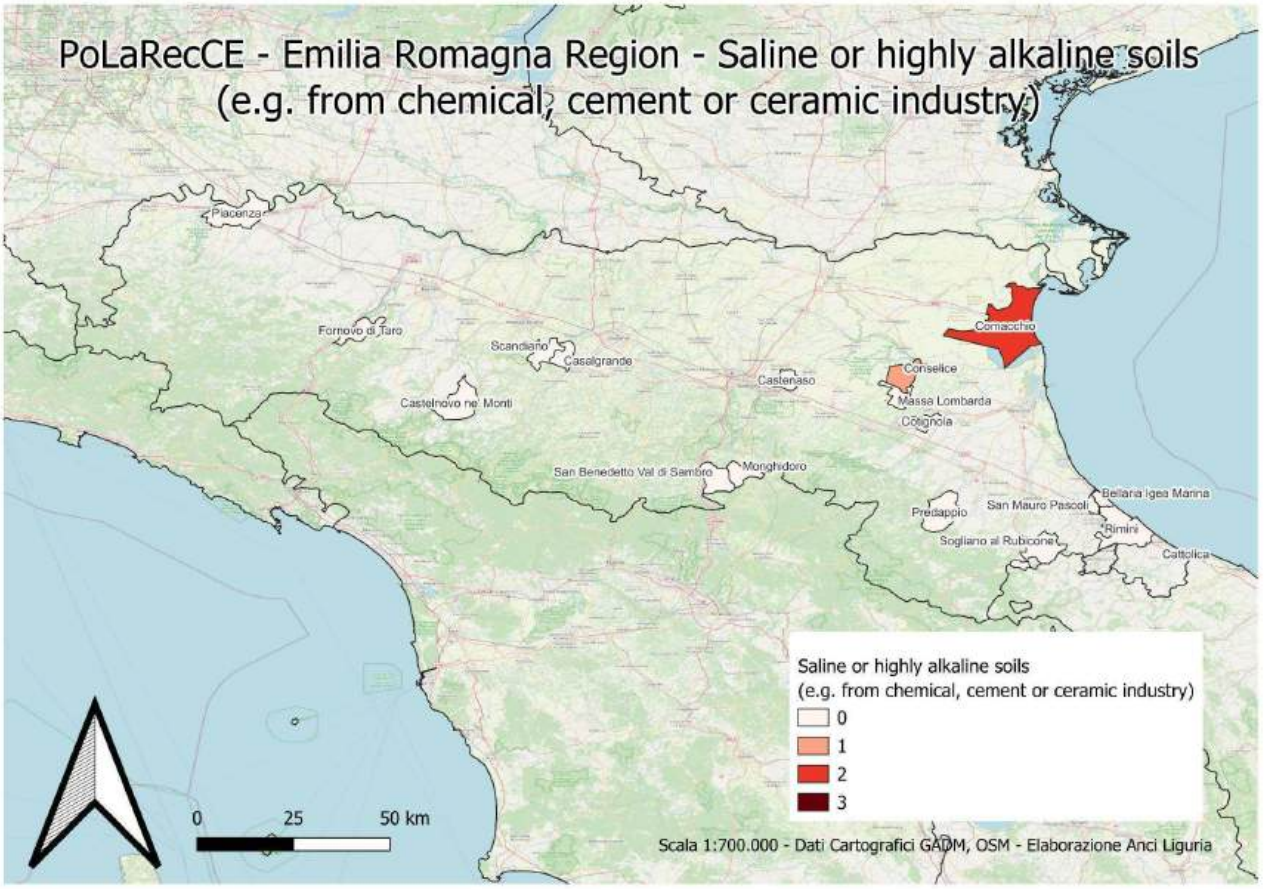

Fig. 32 - Saline or highly alkaline soils (e.g. from chemical, cement or ceramic industry) - IT - ER

Saline or Highly Alkaline Soils

Salinization or alkalinization processes were reported in 11% of municipalities, reflecting localized industrial or agricultural influences.

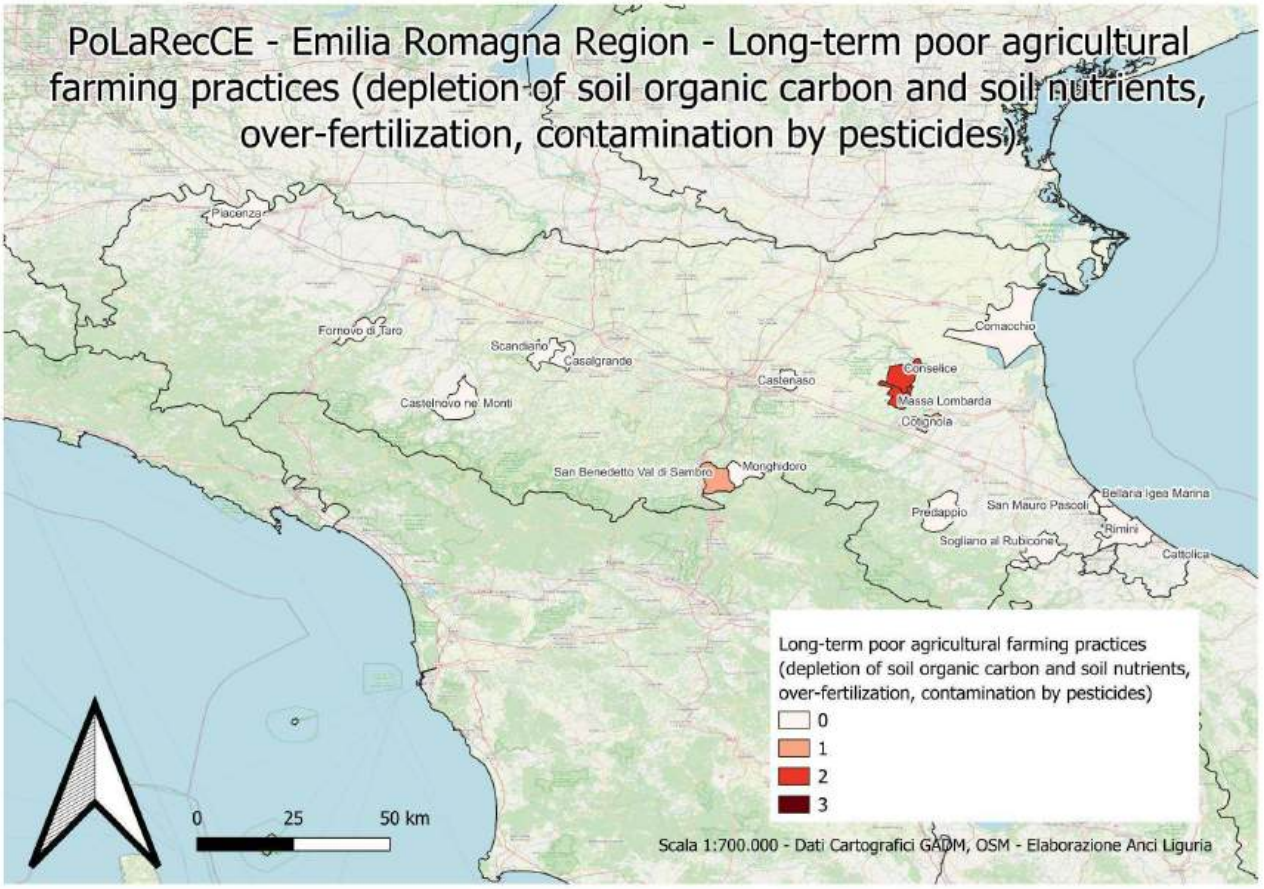

Fig. 33 - Long-term poor agricultural farming practices (depletion of soil organic carbon and soil nutrients, over-fertilization, contamination by pesticides) - IT - ER

Poor Agricultural Practices

Long-term unsustainable farming practices—such as over-fertilization, depletion of organic carbon, or pesticide contamination—were reported by 22% of respondents. These results are consistent with the intensive agricultural profile of the region, though in most municipalities the problem was considered of moderate relevance.

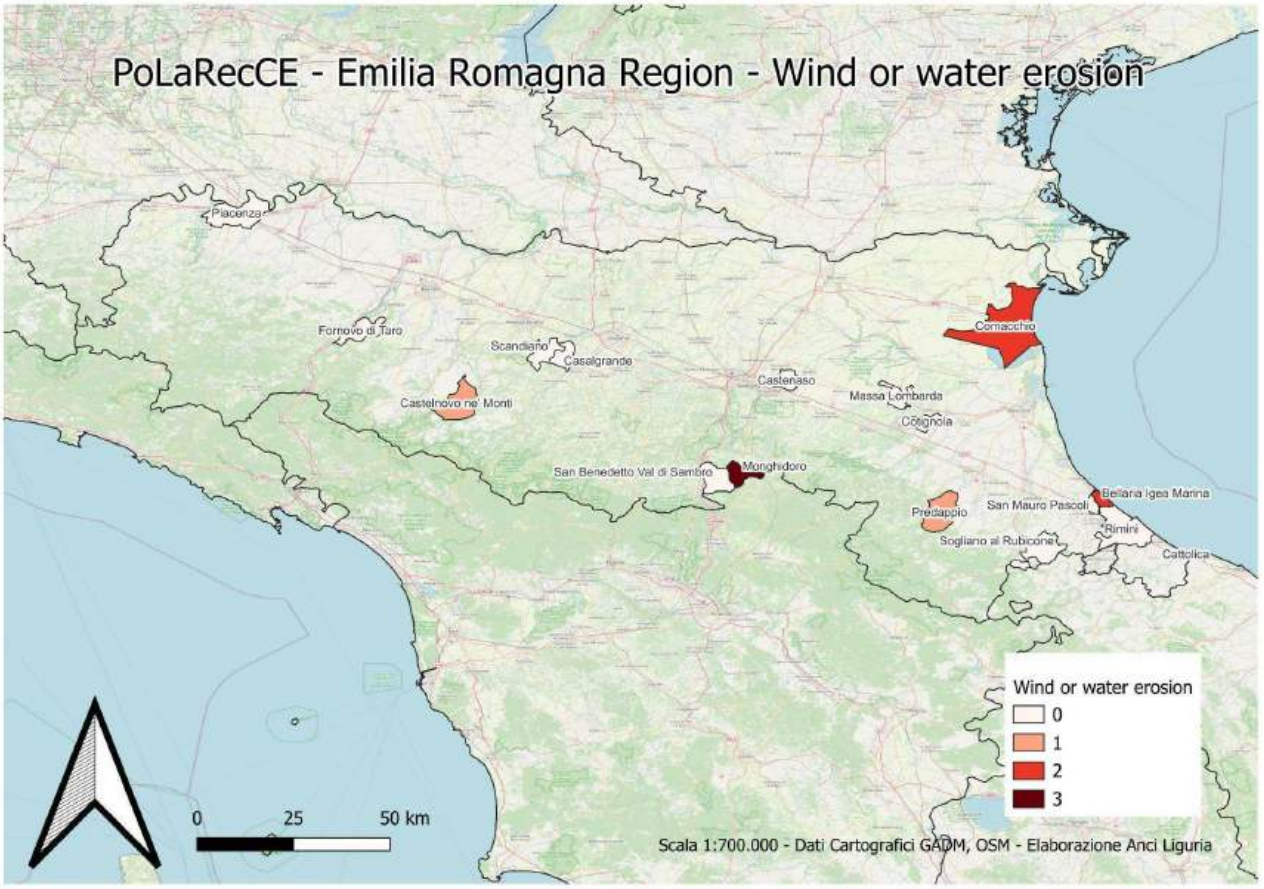

Fig. 34 - Wind or water erosion - IT - ER

Wind and Water Erosion

Erosion processes were also indicated by 28% of respondents, reflecting the combined influence of agricultural practices, climate variability, and soil characteristics. Although not perceived as critical in most cases, erosion nonetheless contributes to the gradual degradation of soil quality.

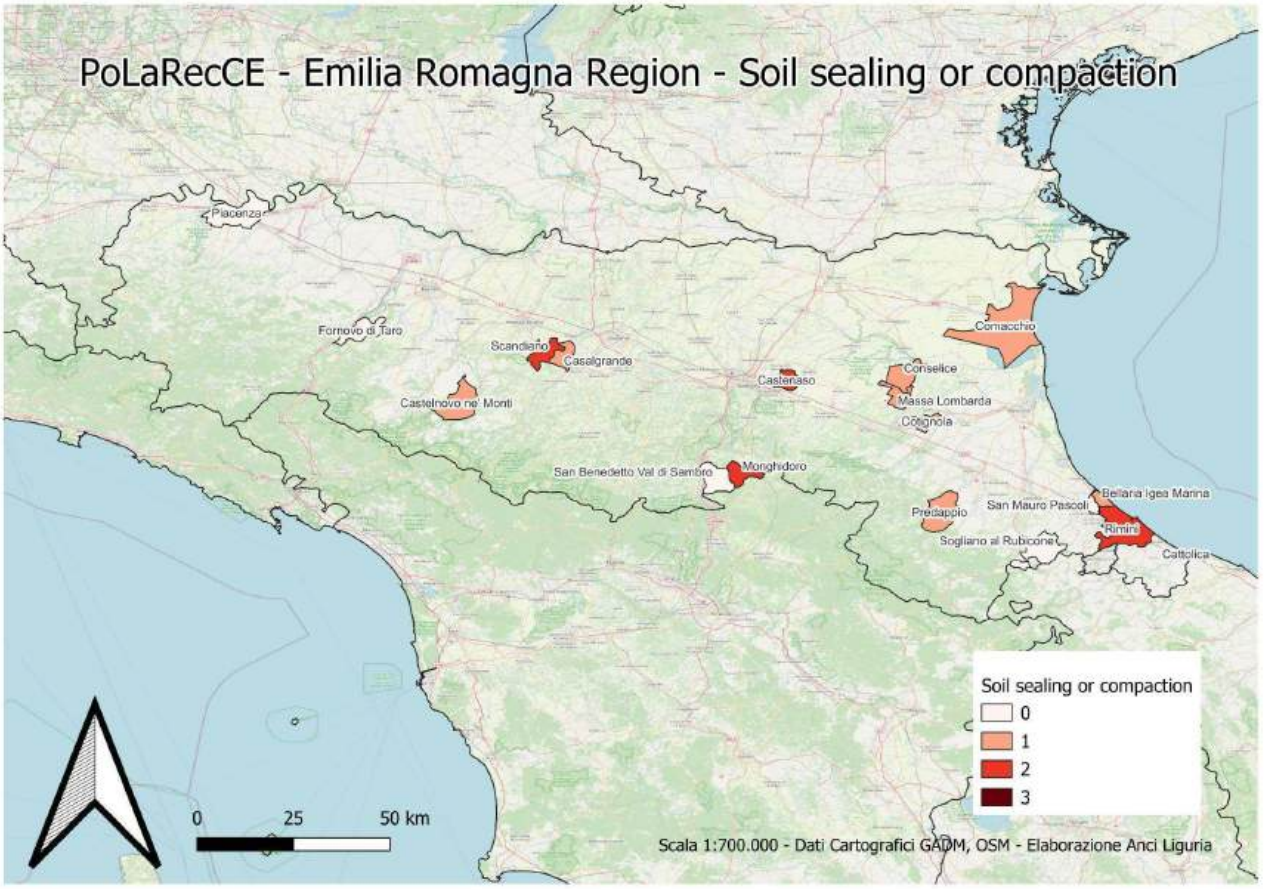

Fig. 35 - Soil sealing or compaction - IT - ER

Soil Sealing and Compaction

The second most relevant issue, indicated by 67% of respondents, concerns soil sealing and compaction. The expansion of urbanization and infrastructure development has led to significant soil consumption. According to ISPRA (2024), Emilia-Romagna had a soil consumption rate of 8.91% of its total area in 2023, well above the national average of 7.16%. This process is increasingly recognized as a critical threat to agricultural productivity and ecosystem services.

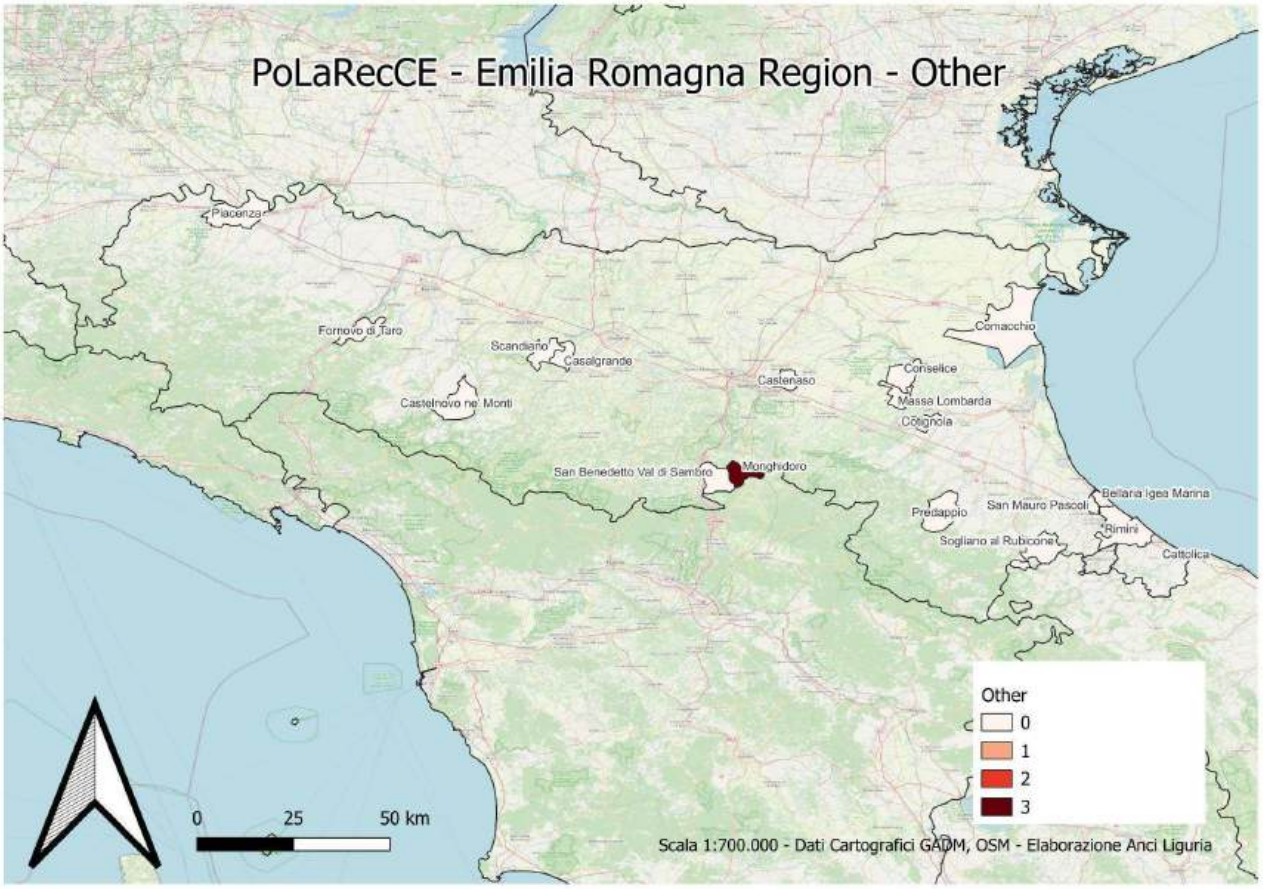

Fig. 36 - Others - IT - ER

Other Issues

Some municipalities indicated additional soil degradation processes not explicitly listed in the questionnaire, particularly hydrogeological instability exacerbated by intensive land use and climate variability.

Synthesis

The results from Emilia-Romagna (Table 2) clearly emphasize two major threats: flooding and soil sealing. These are well recognized by local administrations and supported by both recent events and official monitoring data. Other forms of soil degradation—such as dust deposition, improper waste disposal, and degradation from former quarries—are present but generally considered of lower intensity. The findings underline the dual pressure of natural risks and human-induced soil consumption, making Emilia-Romagna a critical context for the development of sustainable land management practices.

Table 2. Summary of the municipalities' answers to the PoLaRecCE questionnaire on Emilia Romagna region soil degradation processes

#	question	% of municipalities affected	% low impact (level 1)	% medium impact (level 2)	% high impact (level 3)
1	contamination from urban and industrial dust deposition	44,4	75,0	12,5	12,5
2	leakage of oil and petroleum products	22,2	50,0	50,0	0,0
3	leakage of waste waters or sewage sludge deposition (biological contamination)	27,8	80,0	20,0	0,0
4	volatile organic compounds (e.g. PAHs)	16,7	100,0	0,0	0,0
5	cyanides (e.g. from coking industry)	0	-	-	-
6	dumping of wastes materials from coal mining	0	-	-	-
7	dumping of wastes materials from ore mining	0	-	-	-
8	dumping of ashes from power industry	5,6	100,0	0,0	0,0
9	dumping of non-degradable trash or plastics (municipal wastes)	44,4	75,0	12,5	12,5
10	former quarries and areas after exploitation of natural resources	50,0	88,9	11,1	0,0
11	flooding areas	72,2	38,5	30,8	30,8
12	military areas	16,7	33,3	66,7	0,0
13	heavily acidified soils	5,6	100,0	0,0	0,0
14	saline or highly alkaline soils (e.g. from chemical, cement or ceramic industry)	11,1	50,0	50,0	0,0
15	long-term poor agricultural farming practices (depletion of soil organic carbon and soil nutrients, over-fertilization, contamination by pesticides)	22,2	50,0	50,0	0,0
16	wind or water erosion	27,8	40,0	40,0	20,0
17	soil sealing or compaction	66,7	66,7	33,3	0,0
18	others (*)	5,6	0,0	0,0	100,0

(*) given information: Hydrogeological instability issues

3.2. Results in Poland

The Silesian Voivodeship (European region PL22) includes 167 municipalities, to which the PoLaRecCE questionnaire was distributed. Eighty responses were received, although some were incomplete and several municipalities claimed not to have the necessary data. This reluctance may reflect both limited awareness and institutional fragmentation, since municipal administrations are legally responsible for maintaining environmental records. While some questionnaires reported no problems at all, the overall dataset nonetheless provides valuable insights into soil degradation in one of Central Europe's most industrialized regions.

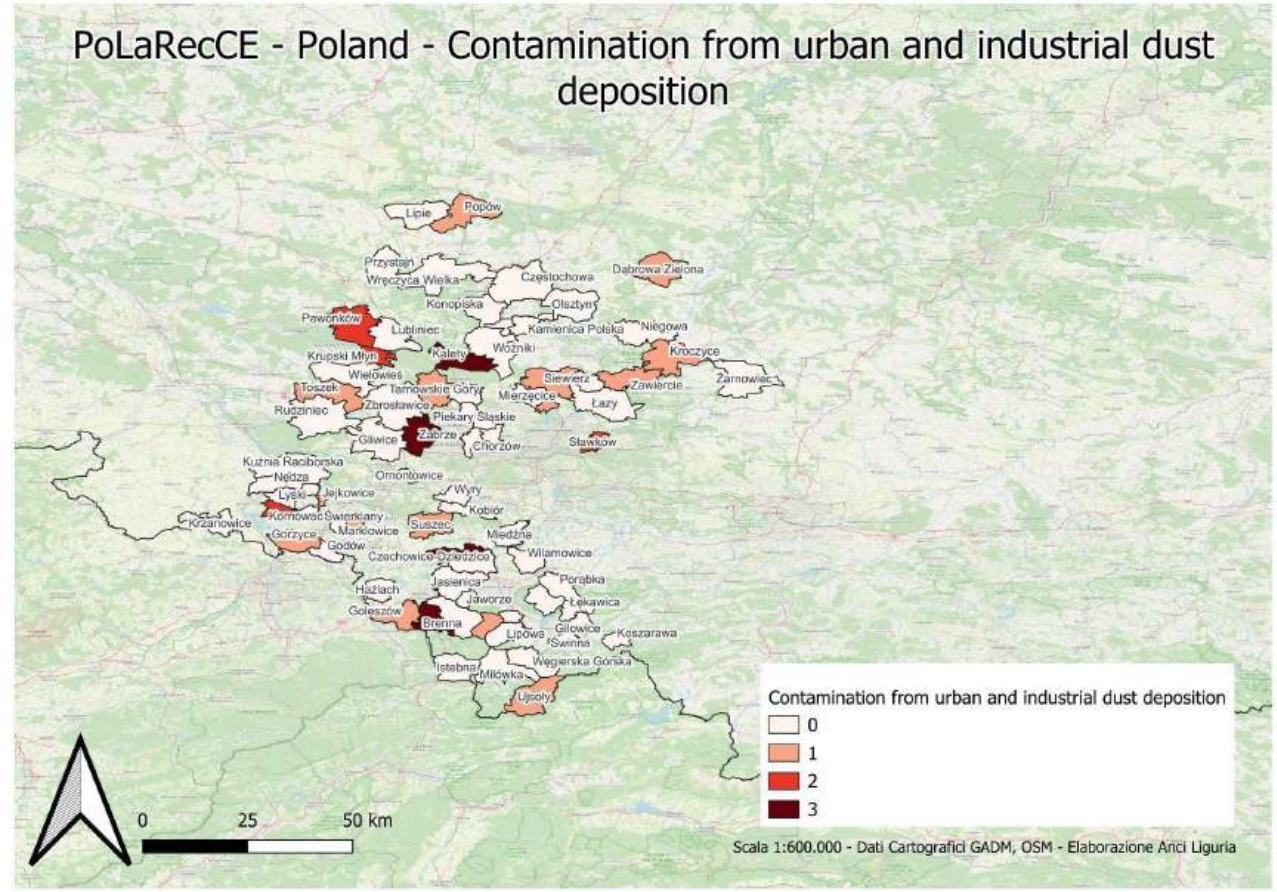

Fig. 37 - Chemical contamination related to urban and industrial dust deposition - POL

Urban and Industrial Dust Deposition

Contamination from atmospheric deposition of heavy metals and industrial particulates was reported by 32% of municipalities. The issue was rated as highly significant in Chorzów, Piekary Śląskie, Siemianowice Śląskie, and Rydułtowy, all located in the Upper Silesian Metropolitan Union (GZM). These findings are consistent with the region's long history of coal mining, metallurgy, and power generation, where cadmium, lead, and zinc are the most critical pollutants. In other municipalities, the issue was reported at lower intensity, though it is likely that contamination extends beyond the areas officially recognized.

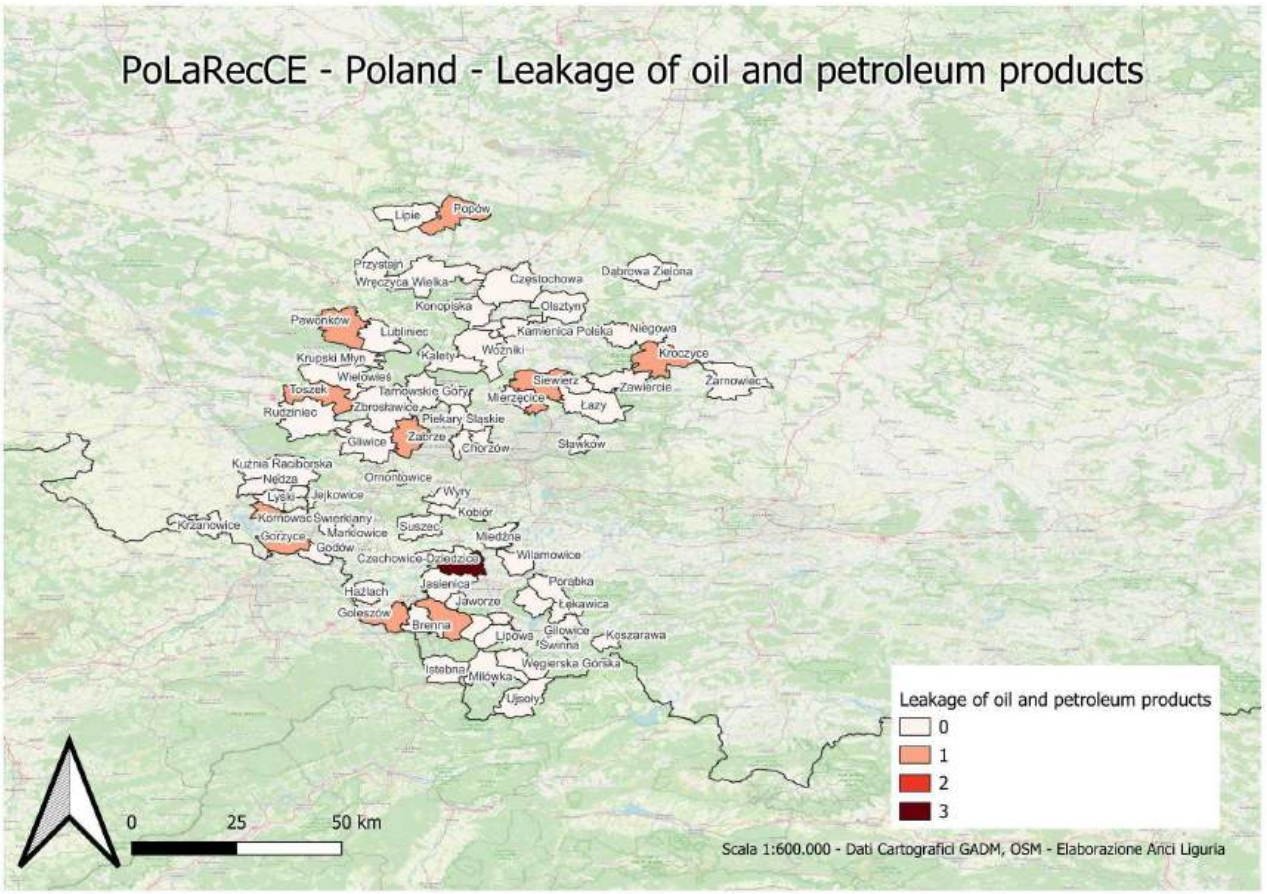

Fig. 38 - Degradation caused by leakage of oil and petroleum products - POL

Leakage of Oil and Petroleum Products

Seventeen percent of municipalities reported soil degradation from oil and petroleum products, with Czechowice-Dziedzice identifying it as highly significant due to the presence of a large refinery that operated for over a century. Other cases were more localized, typically involving pollution around storage tanks or distribution facilities.

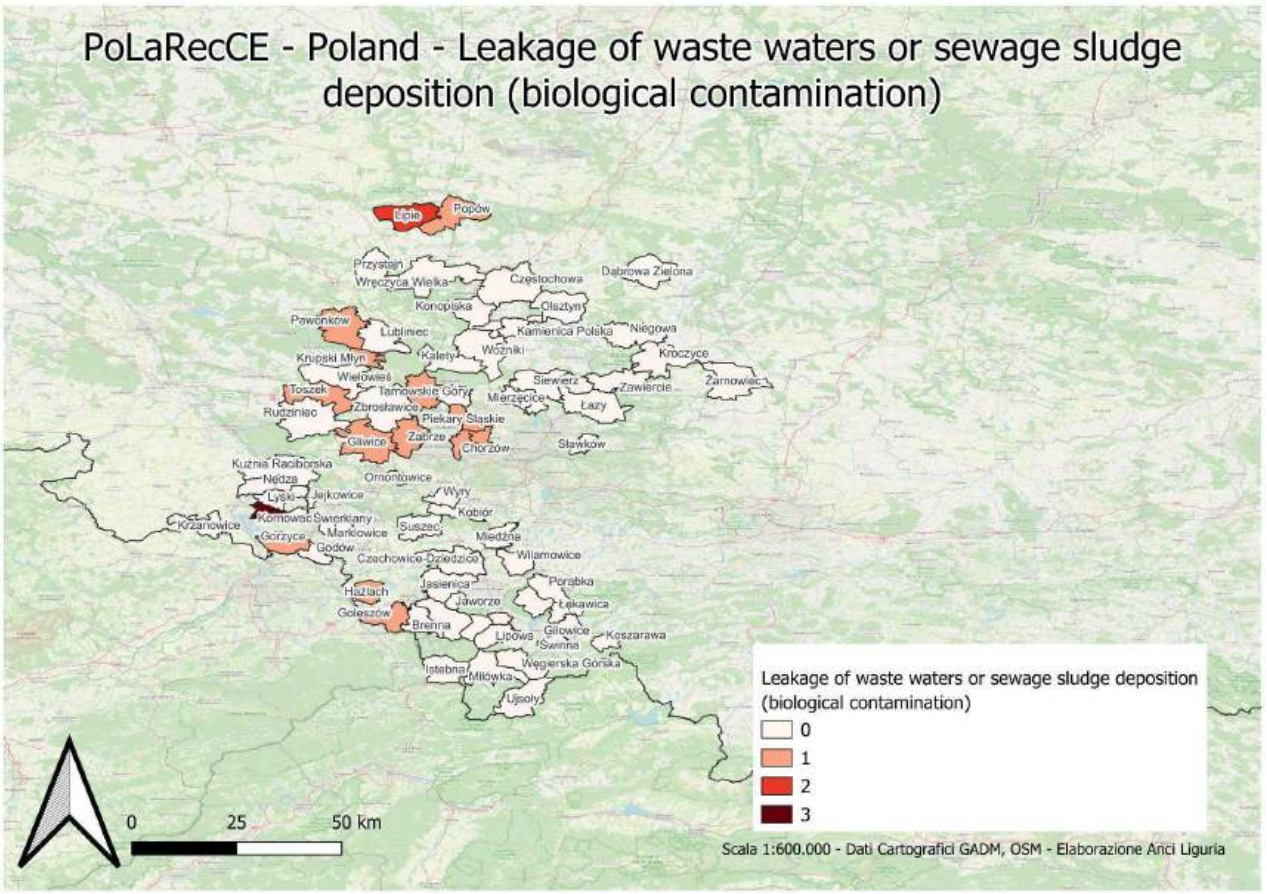

Fig. 39 - Degradation caused by leakage of waste waters or sewage sludge deposition (biological contamination) - POL

Leakage of Wastewater and Sewage Sludge Deposition

Biological contamination was mentioned in 23% of responses. Notably, Suszec reported groundwater and surface water pollution linked to coal mining activities, while in Wielowieś the problem stemmed from uncontrolled use of sewage sludge in agriculture. In both cases, risks to drinking water quality were emphasized.

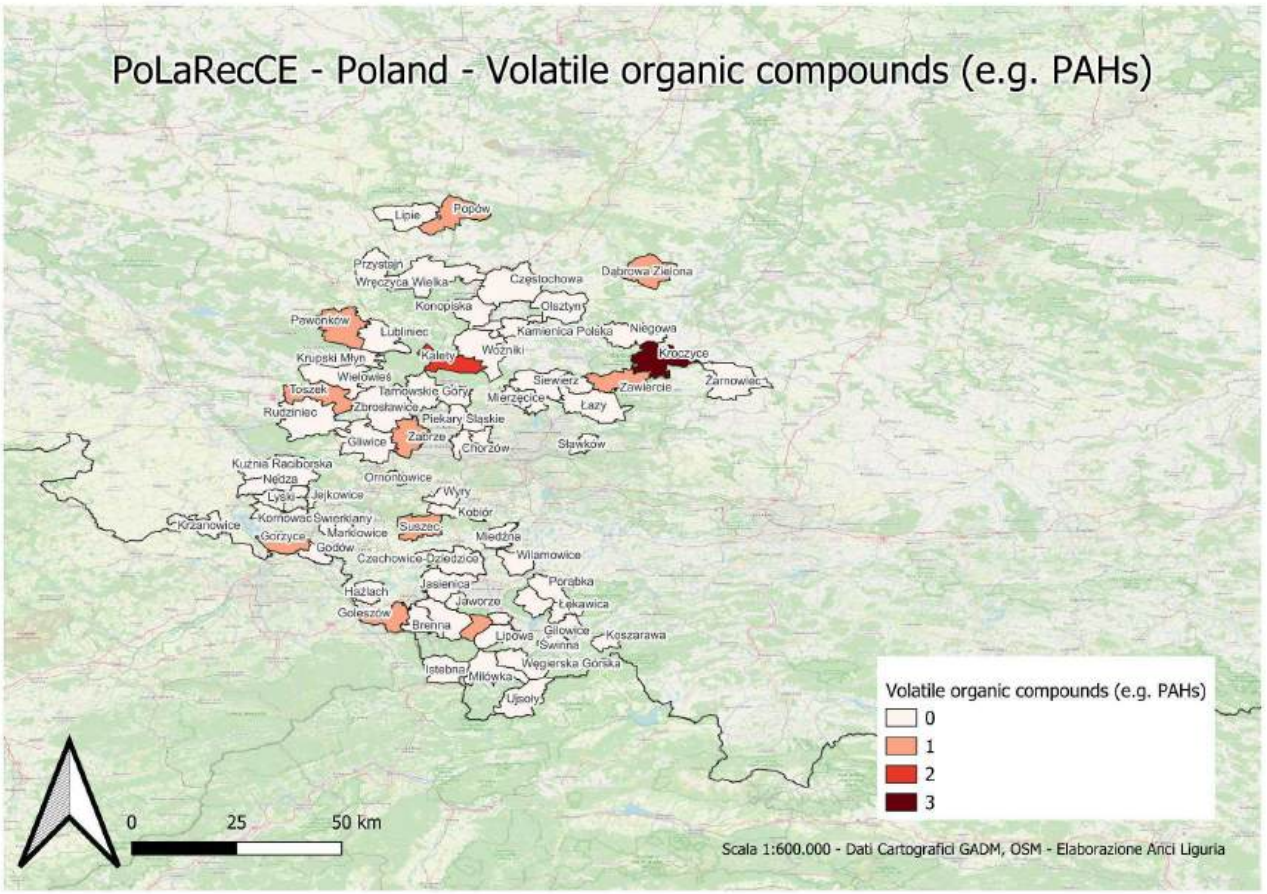

Fig. 40 - Degradation caused by volatile organic compounds (e.g. VOCs, PAHs) - POL

Volatile Organic Compounds (VOCs, PAHs)

Seventeen percent of municipalities reported contamination by VOCs or PAHs, though only Zabrze and Siemianowice Śląskie considered it a medium-to-high concern. Given the region's industrial profile, these findings are probably underestimated, as studies have largely focused only on known hotspots near former coking plants.

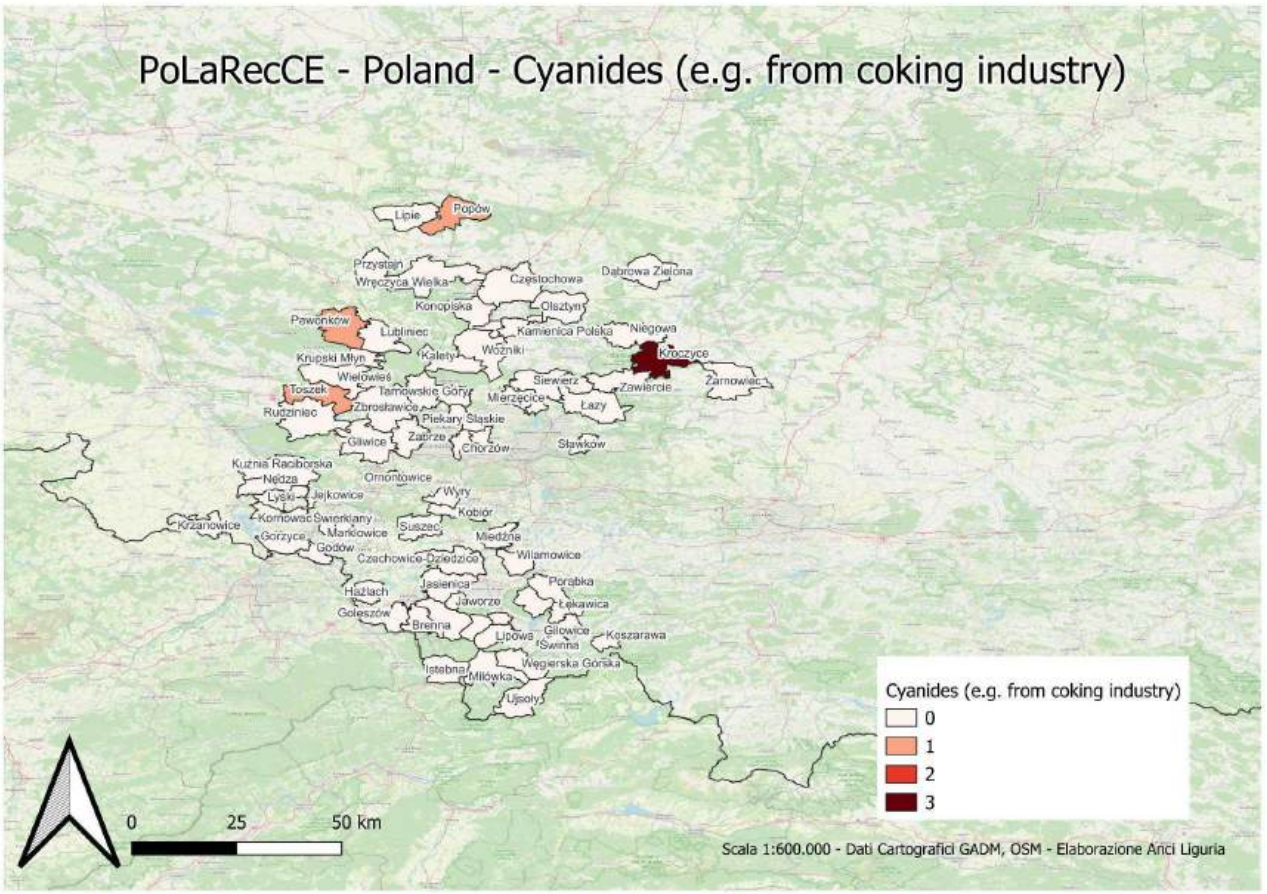

Fig. 41 - Degradation caused by cyanides (e.g. from coking industry) - POL

Cyanides

Cyanide contamination was acknowledged in four municipalities, with Zabrze identifying it as a high-level problem. This reflects the legacy of multiple coking plants that historically operated in the area.

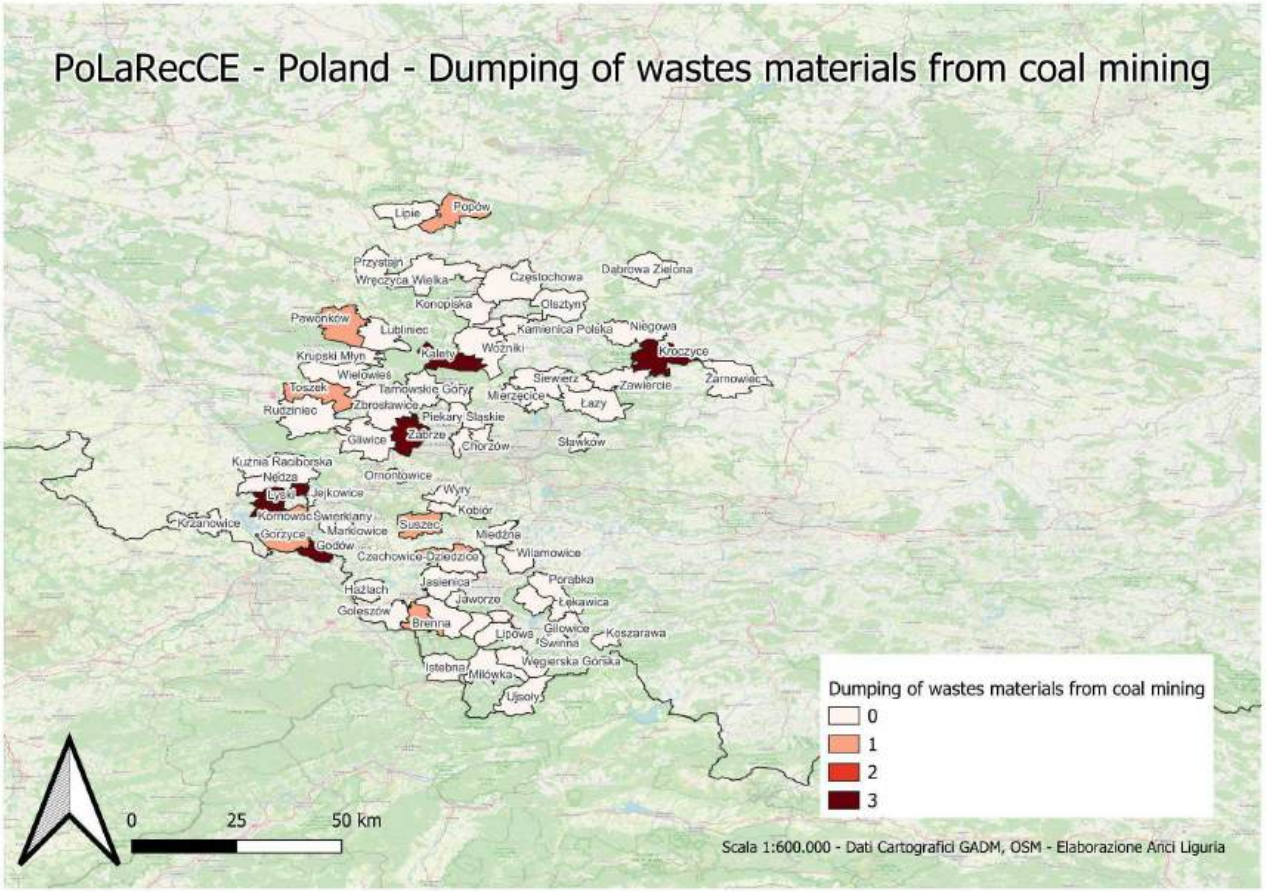

Fig. 42 – Dumping of wastes materials from coal mining - POL

Dumping of Waste Materials from Coal Mining

Waste from coal mining was reported in 20% of municipalities, six of which considered it highly significant. Typical forms include spoil heaps, flotation sludge, and waste rock dumps, all of which contribute to acid drainage, dust emissions, and even spontaneous combustion. These processes not only degrade soil but also alter the local landscape, making them among the most emblematic issues in the region.

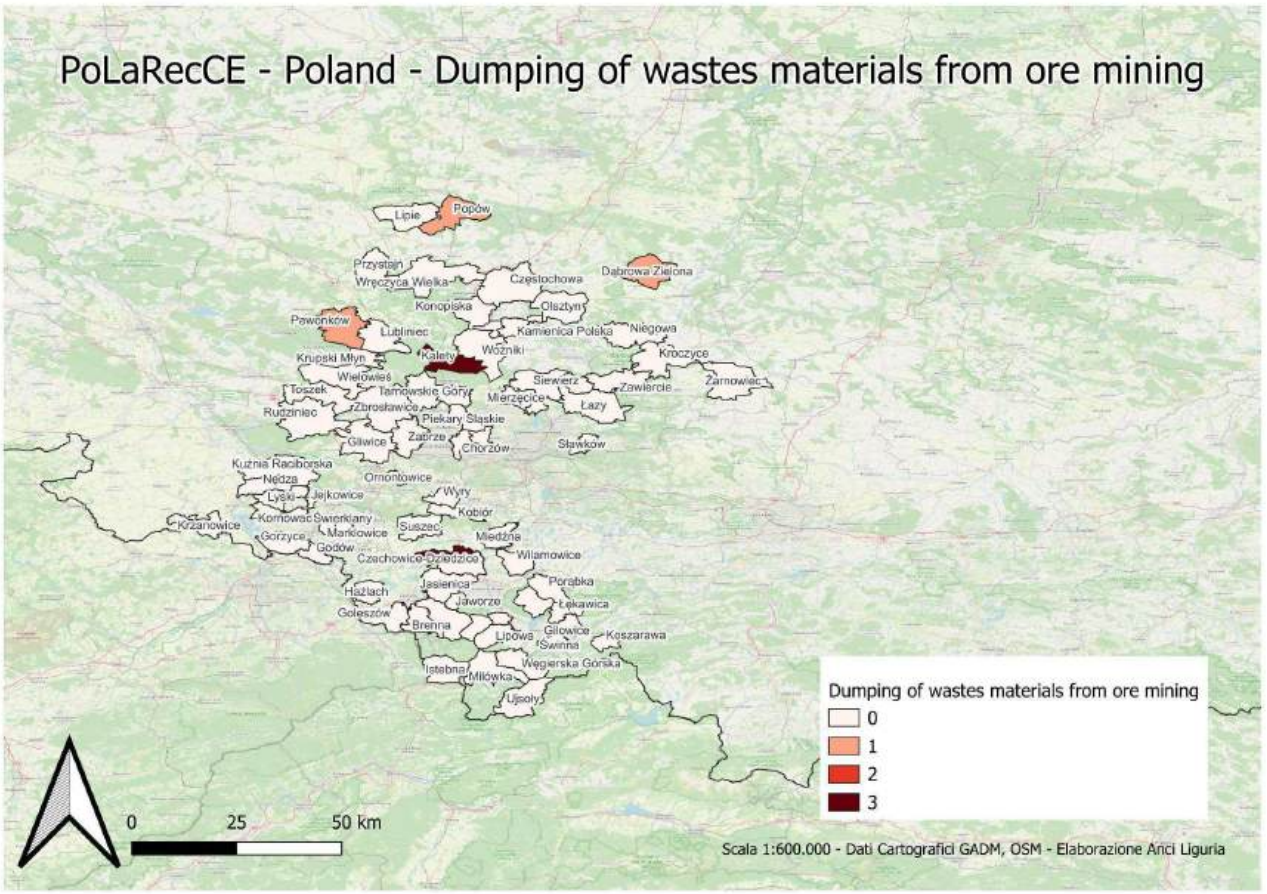

Fig. 43 - Degradation caused by dumping of wastes materials from ore mining - POL

Dumping of Waste Materials from Ore Mining

Ore mining residues were reported in five municipalities, with Siemianowice Śląskie and Piekary Śląskie highlighting them as particularly severe. These cases are linked to the region's long-standing tradition of zinc and lead extraction and processing, with impacts likely extending to neighboring municipalities that did not respond to the survey.

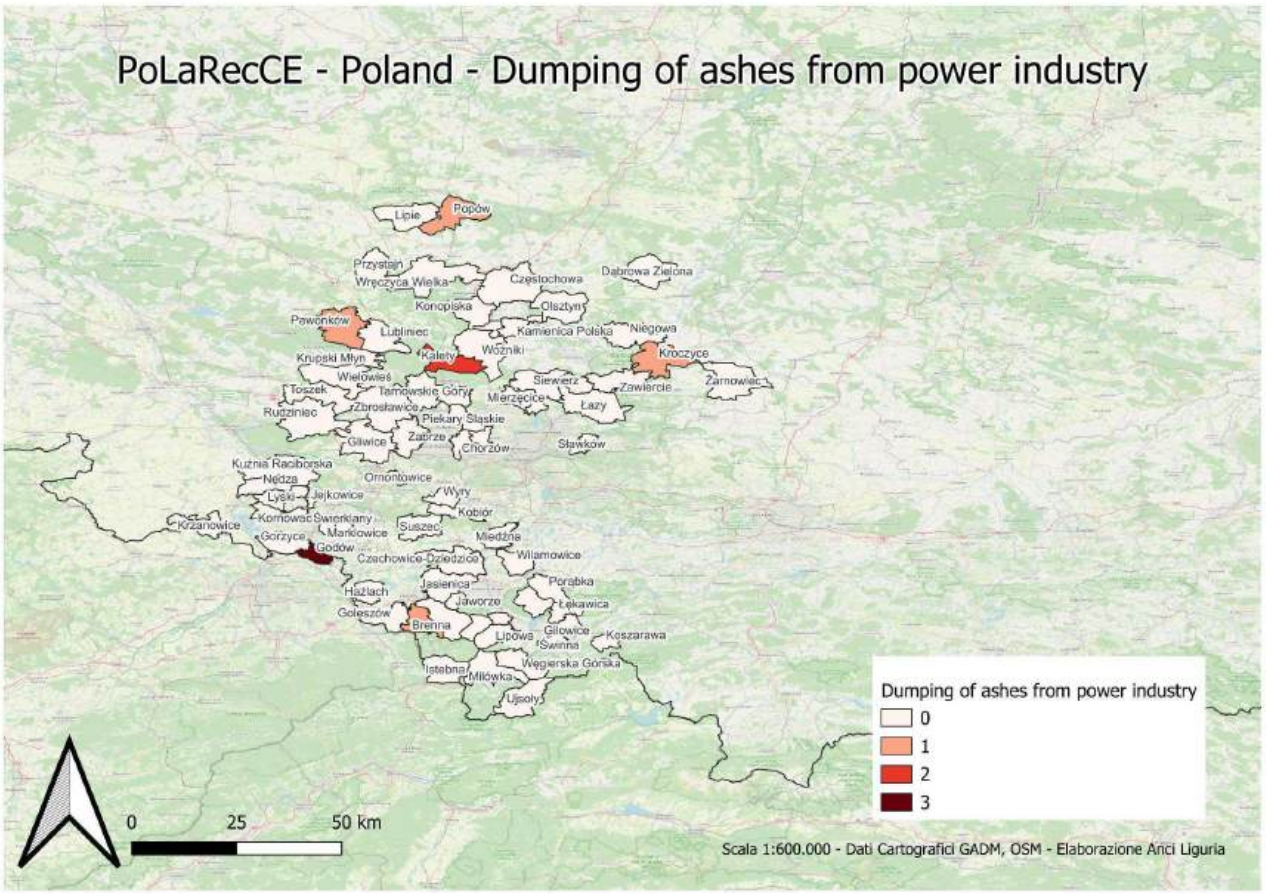

Fig. 44 - Degradation caused by dumping of ashes from power industry - POL

Dumping of Ashes from the Power Industry

Six municipalities identified ash disposal as a source of soil degradation, with Siemianowice Śląskie and Zbrosławice considering it a medium-to-high problem. The latter hosts one of the largest waste storage sites in the region, containing a mixture of coal mining waste and power plant ash, amounting to an estimated 25 million m^3.

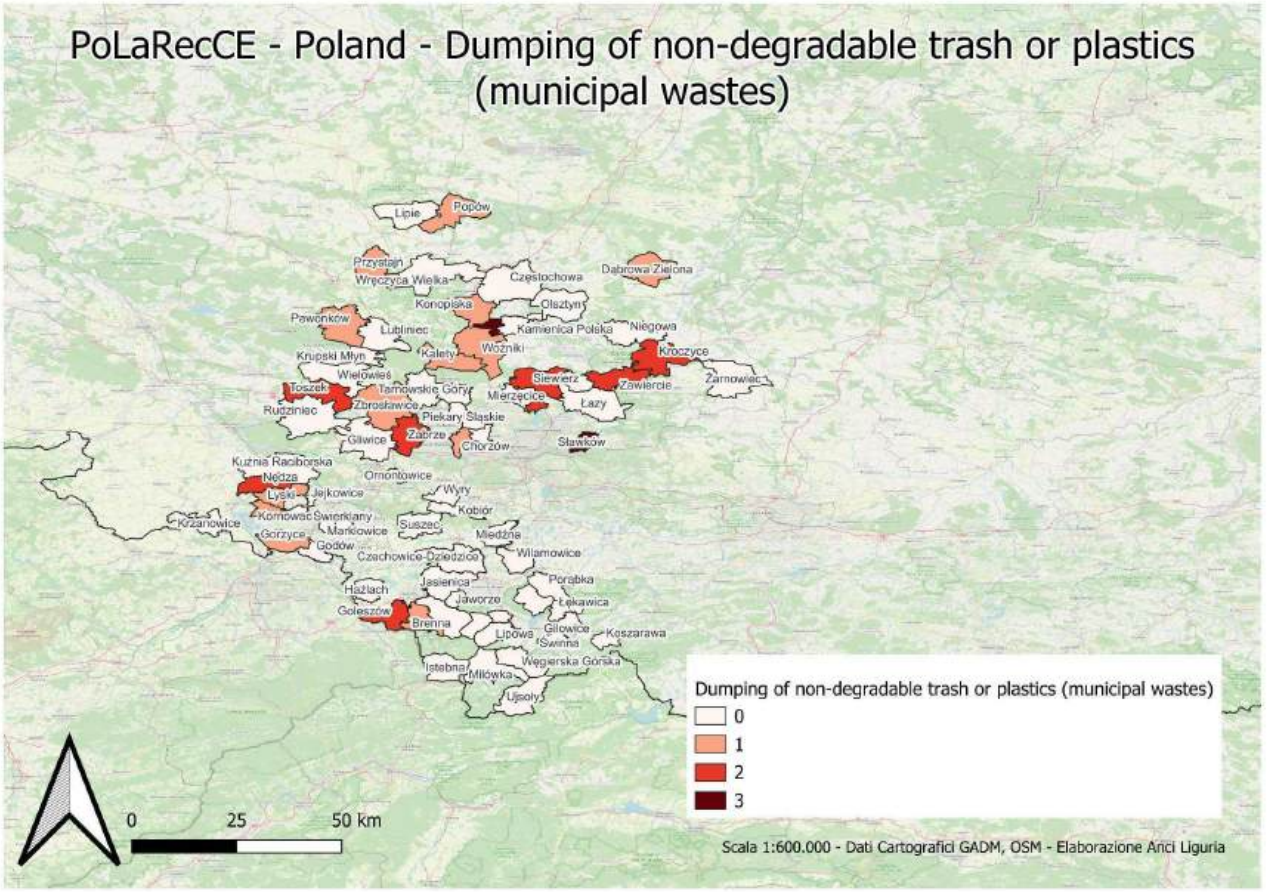

Fig. 45 - Degradation caused by dumping of non-degradable trash or plastics (municipal wastes) - POL

Dumping of Non-Degradable Trash or Plastics

Non-biodegradable waste and plastics were reported by 32% of respondents. In some municipalities, such as Kamienica Polska and Sławków, the problem was considered severe, reflecting decades of inadequate waste management and the persistence of illegal landfills. In other cases, the issue was noted but of lower significance.

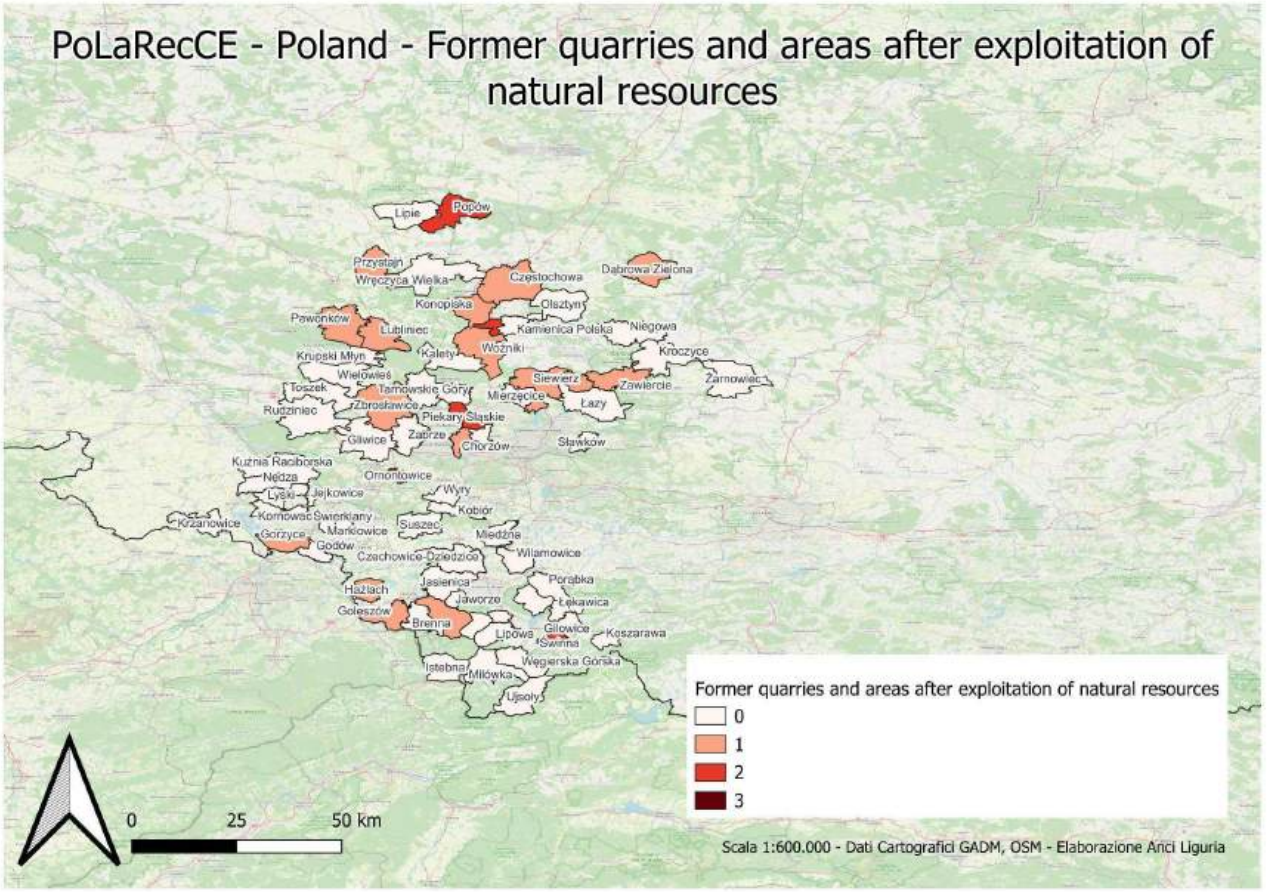

Fig. 46 - Soil degraded in former quarries and areas after exploitation of natural resources - POL

Former Quarries and Resource Exploitation Areas

Thirty-one percent of municipalities indicated problems linked to former quarries and natural resource extraction, though mostly at a moderate level. These included dolomite, limestone, clay, and sand quarries, some of which have been reclaimed for forestry or recreational purposes.

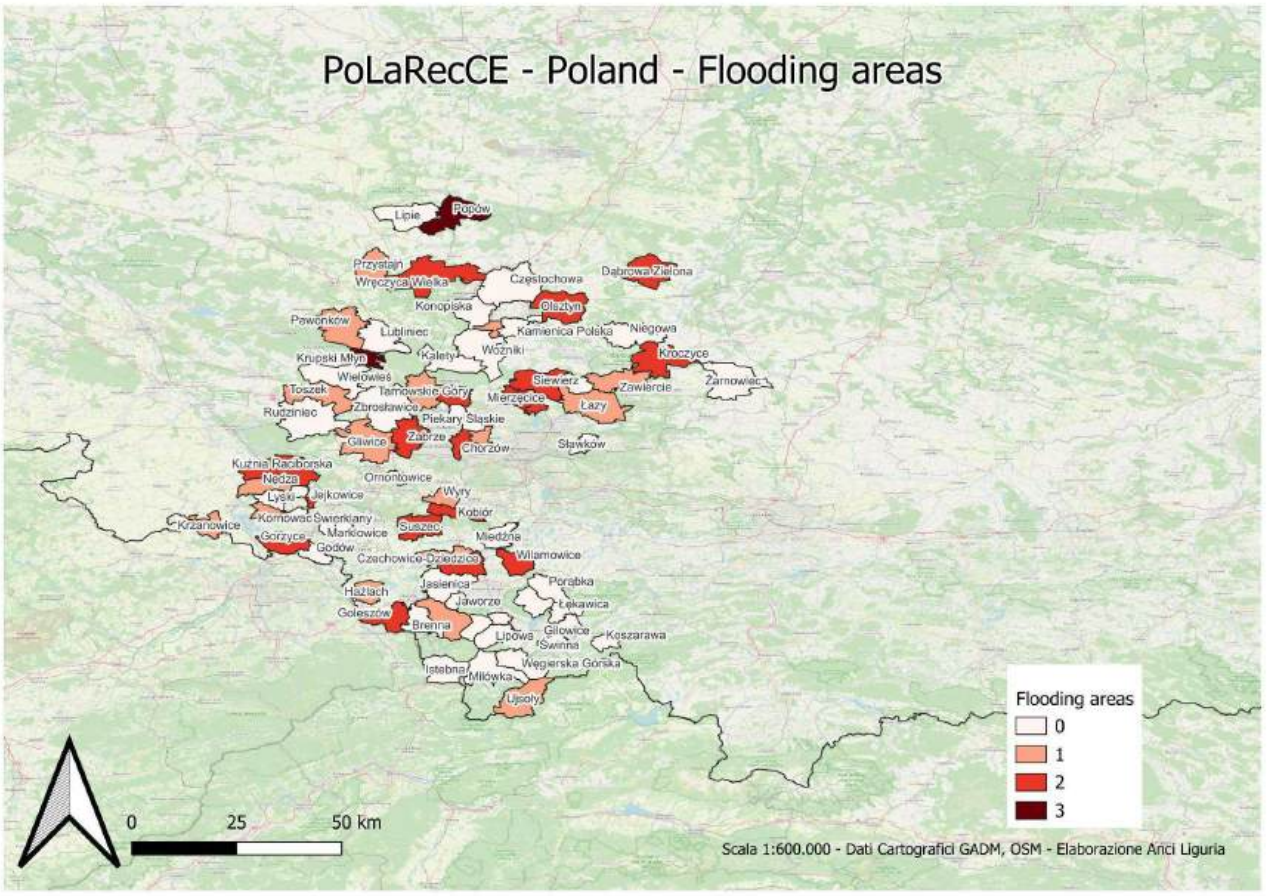

Fig. 47 - Degradation caused by floods - POL

Flooding Areas

Flooding was reported by more than half of the municipalities, with the highest concern along the Oder and Vistula rivers as well as in mountain riverbeds. The problem has become more frequent with climate change, as floods occurred in 1980, 1987, 1997, 2010, 2014, and most recently in 2024. In mining areas, local subsidence and artificial reservoirs also contribute to flooding, as noted in Rydułtowy and Zabrze.

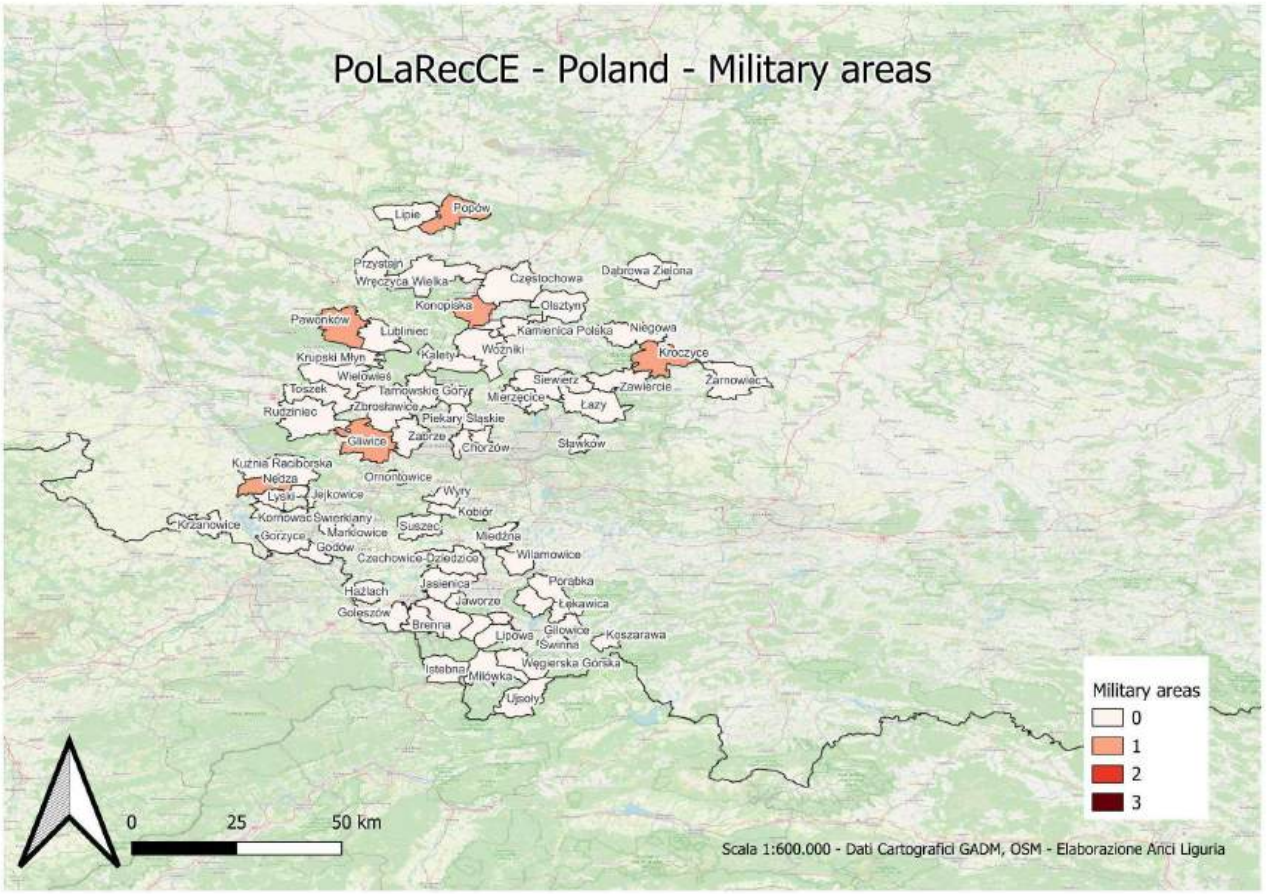

Fig. 48 - Degraded soil in former military areas - POL

Military Areas

Military-related soil degradation was reported by six municipalities, generally at a low level of concern.

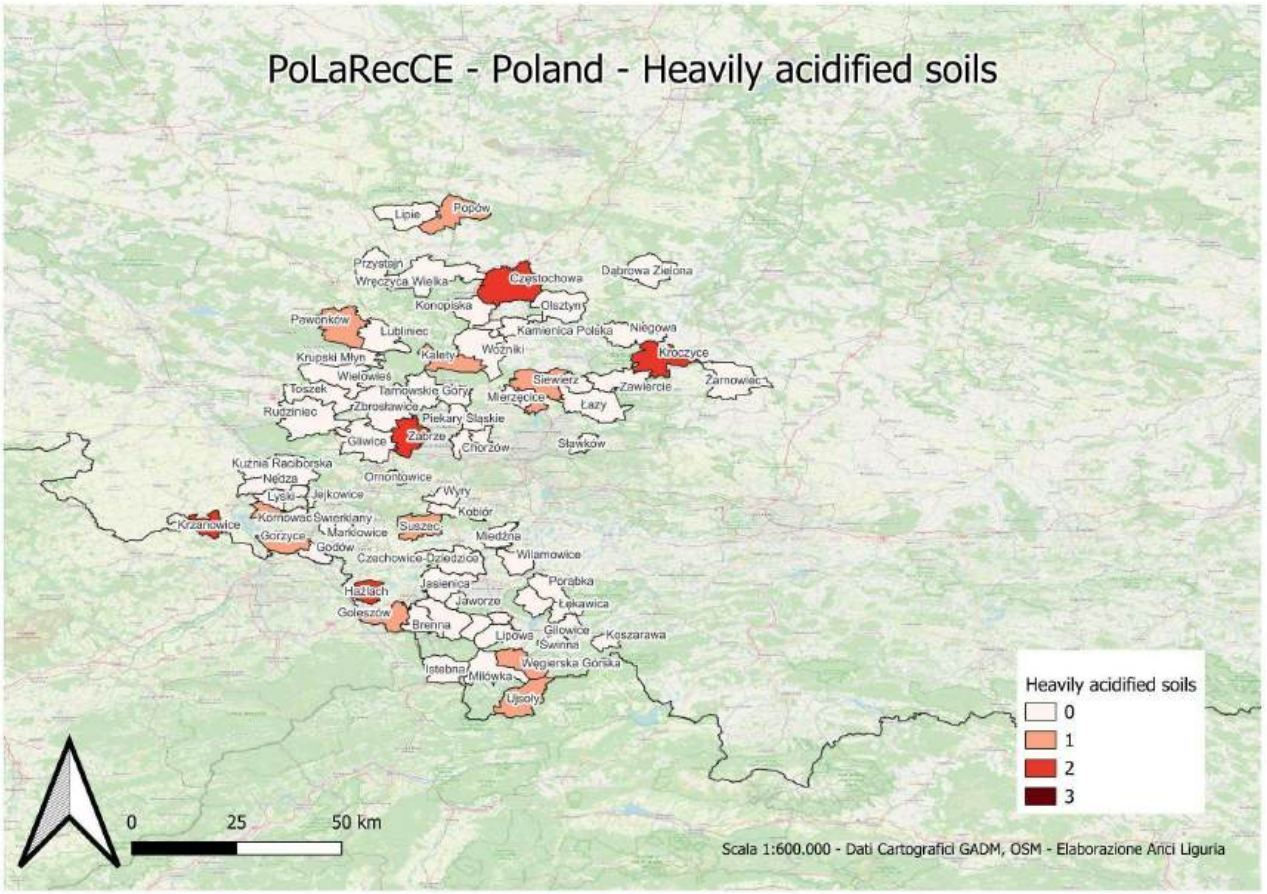

Fig. 49 - Problem with heavily acidified soils - POL

Heavily Acidified Soils

Soil acidification was reported in 22% of responses, with sources including industrial emissions in Zabrze and Rydułtowy and acid rain originating from the Ostrava region in the Czech Republic. In rural areas, excessive fertilizer use was also identified as a driver of acidification.

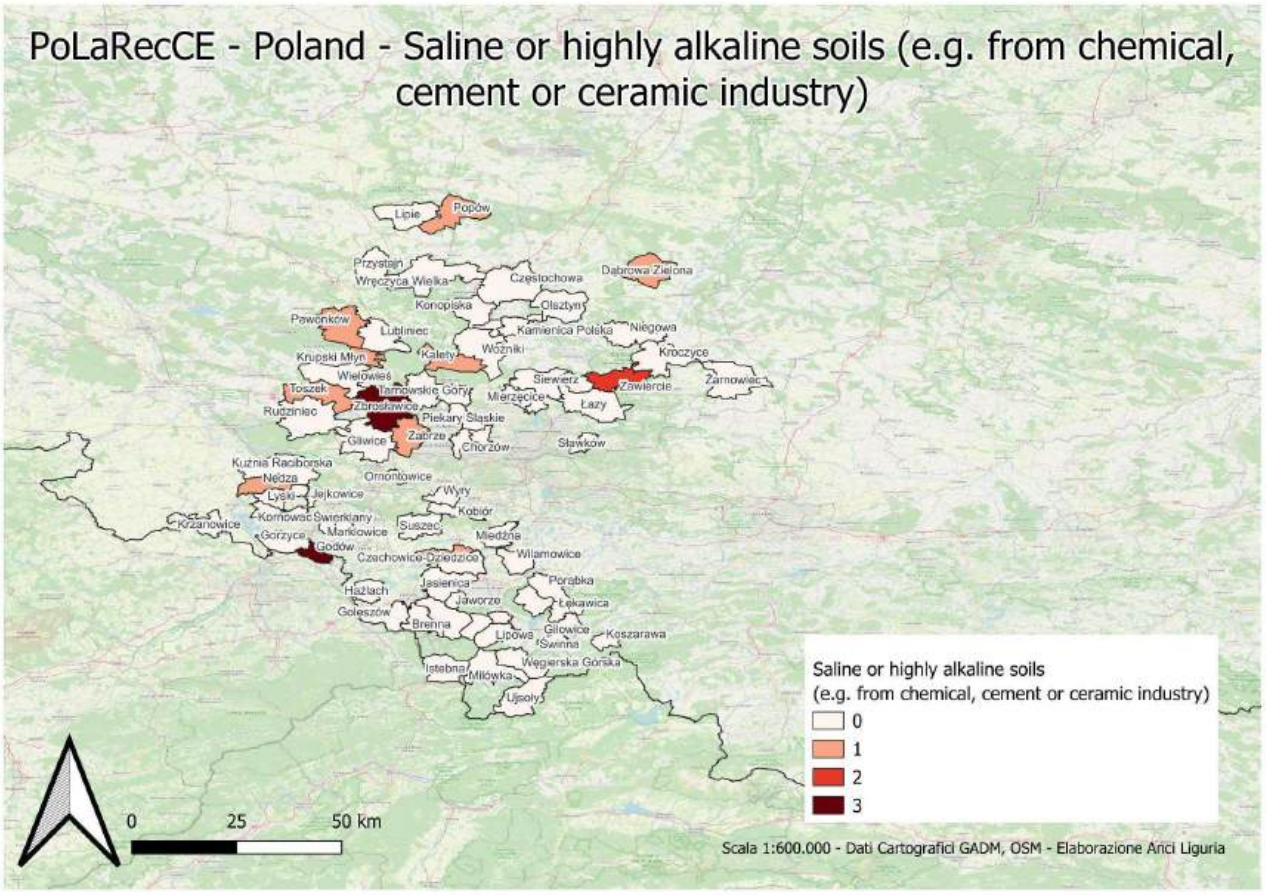

Fig. 50 - Problem with saline or highly alkaline soils (e.g. from chemical, cement or ceramic industry) - POL

Saline or Highly Alkaline Soils

Three municipalities reported significant problems with saline or alkaline soils, each linked to different sources: chemical waste disposal in Tarnowskie Góry, power plant waste in Zbrosławice, and industrial emissions in Zawiercie. Nine additional municipalities mentioned the issue at a lower level.

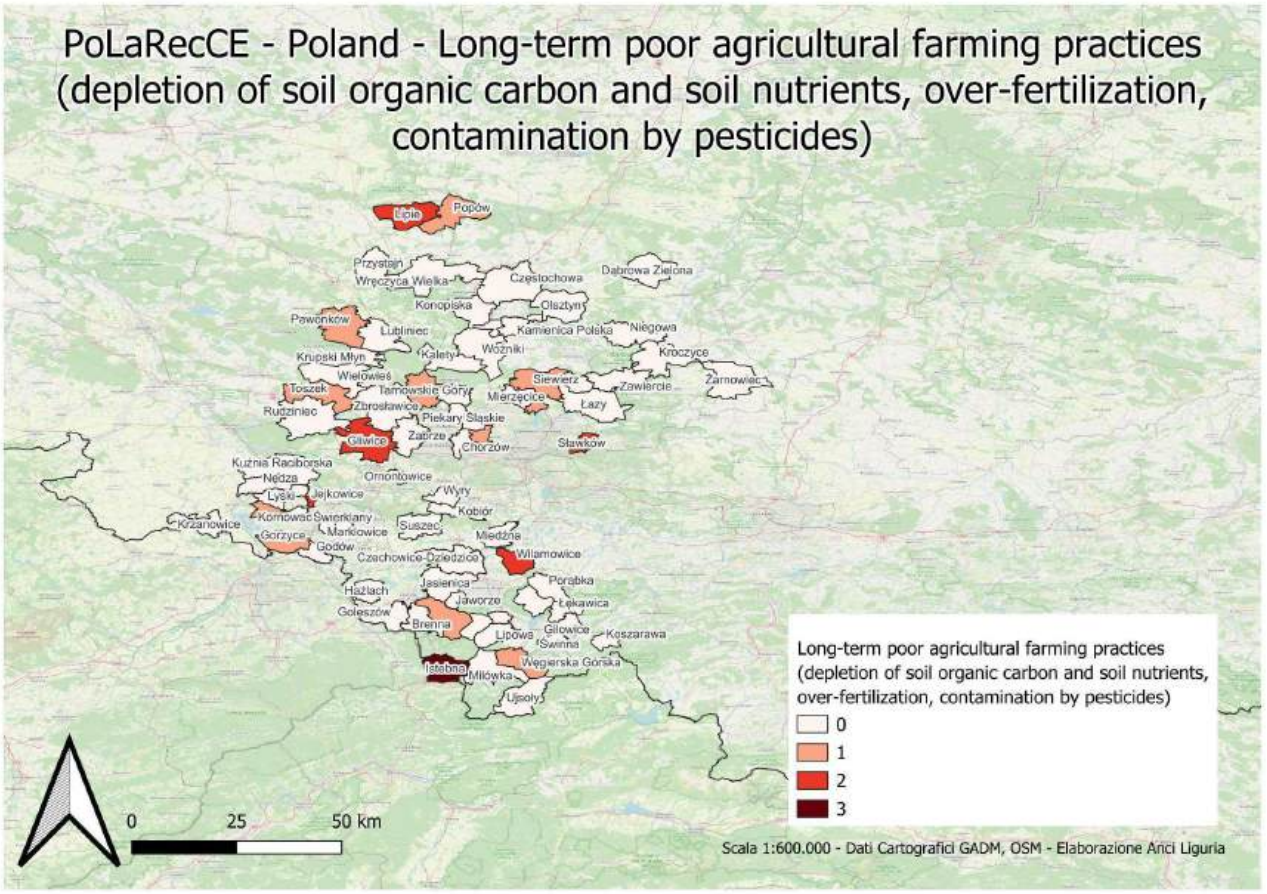

Fig. 51 - Degradation caused by long-term poor agricultural farming practices (depletion of soil organic carbon and soil nutrients, over-fertilization, contamination by pesticides) - POL

Poor Agricultural Practices

Twenty-five percent of respondents indicated degradation caused by intensive or unsustainable farming practices. In Ustroń, this was rated as highly significant, while other rural municipalities (e.g., Nędza, Toszek, Wielowieś, Wilamowice, Sławków) reported moderate impacts, mainly related to nutrient depletion and loss of soil organic matter.

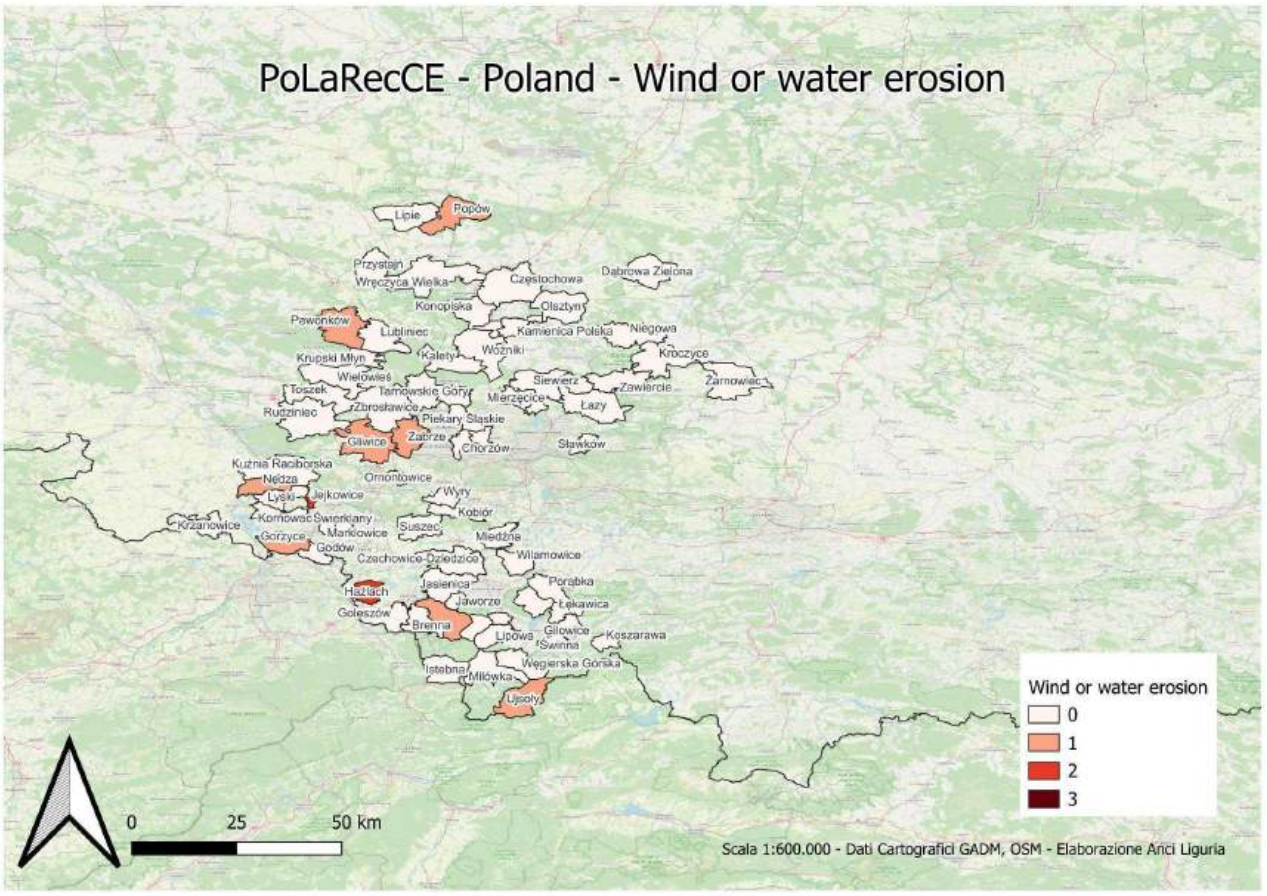

Fig. 52 - Degradation caused by wind or water erosion - POL

Wind and Water Erosion

Erosion was mentioned by 16% of municipalities, typically as a low-level issue. Only Istebna and Nędza reported it as more relevant, in connection with steep slopes and heavy rainfall or surface water runoff.

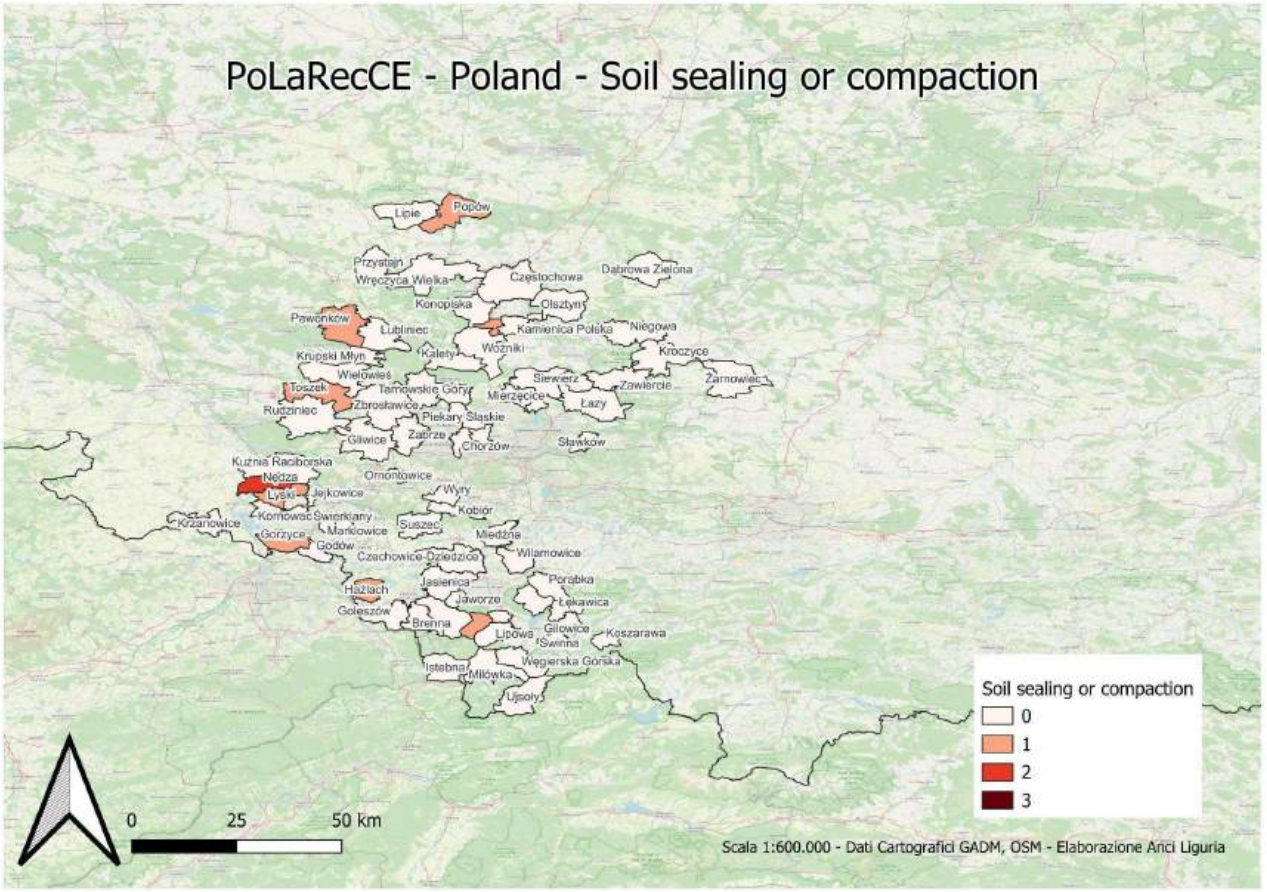

Fig. 53 - Degradation caused by intensive soil sealing or soil compaction - POL

Soil Sealing and Compaction

Sealing and compaction were reported in eight municipalities, usually as minor problems. The exception was Kuźnia Raciborska, which considered it of medium relevance despite being a small rural area. Interestingly, only one large GZM city (Gliwice) acknowledged the issue, and at a low level.

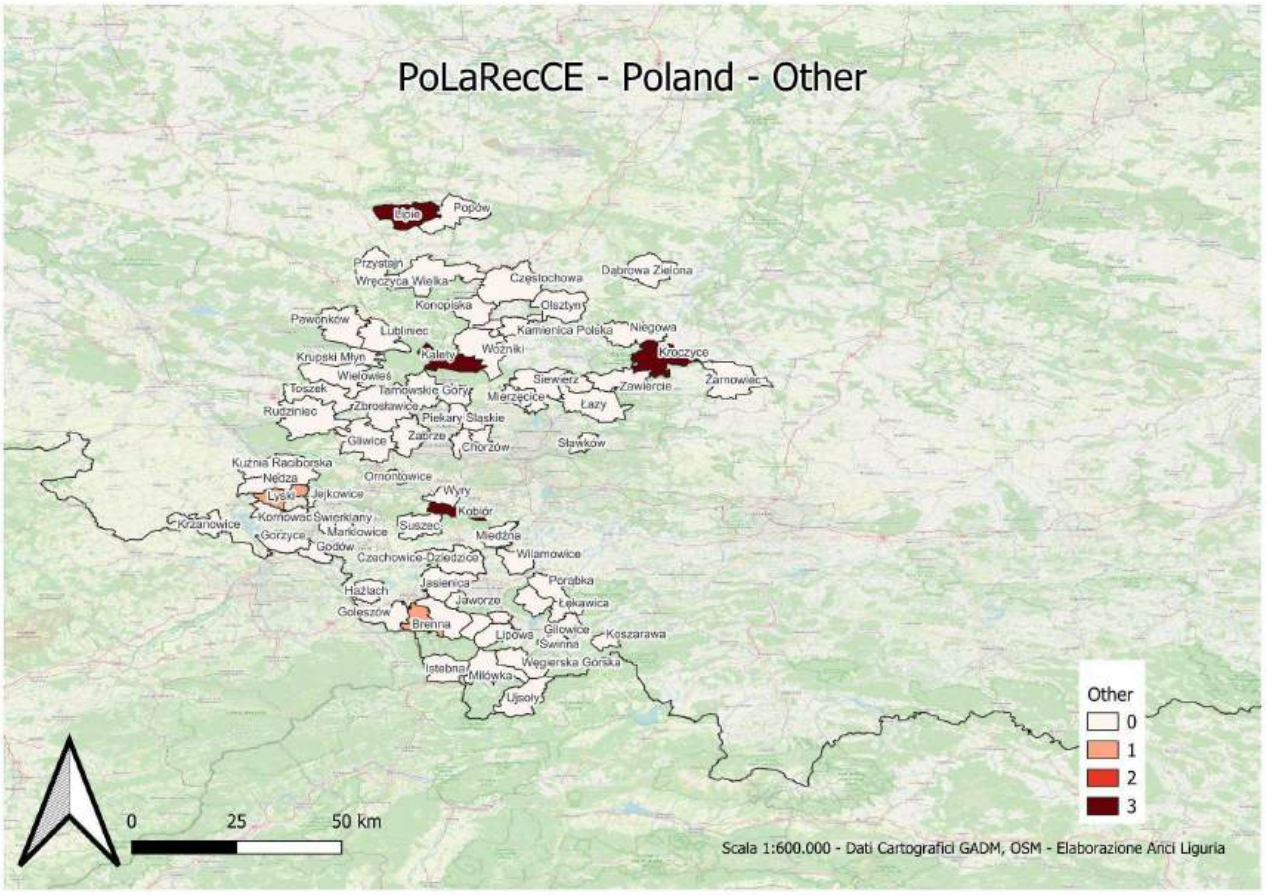

Fig. 54 - Other - POL

Other Issues

Several municipalities, particularly in areas of active or historical coal mining, reported surface deformations such as subsidence basins, depressions, and sinkholes. These are characteristic features of Silesia's geological transformation caused by centuries of underground mining and represent a distinctive type of degradation in the region.

Synthesis

The Silesian Voivodeship survey highlights a complex interplay of industrial legacies, natural processes, and gaps in local awareness. While flooding and mining-related degradation stand out as the most widespread issues, chemical contamination from dust, oil, cyanides, and heavy metals remains a significant concern, particularly in the Upper Silesian Metropolitan Union. The findings also reveal a disconnection between the extent of environmental problems and the level of recognition by local administrations, suggesting that awareness-raising and improved environmental monitoring should be integral components of future interventions.

3.3. Results in Slovenia

In Slovenia, municipalities do not systematically collect detailed data on soil degradation, and much of the information derives from national-level studies. Nonetheless, municipalities are responsible for identifying degraded areas, often in connection with eligibility for European funding. Eighteen questionnaires were collected, offering a partial but informative overview of local soil degradation issues.

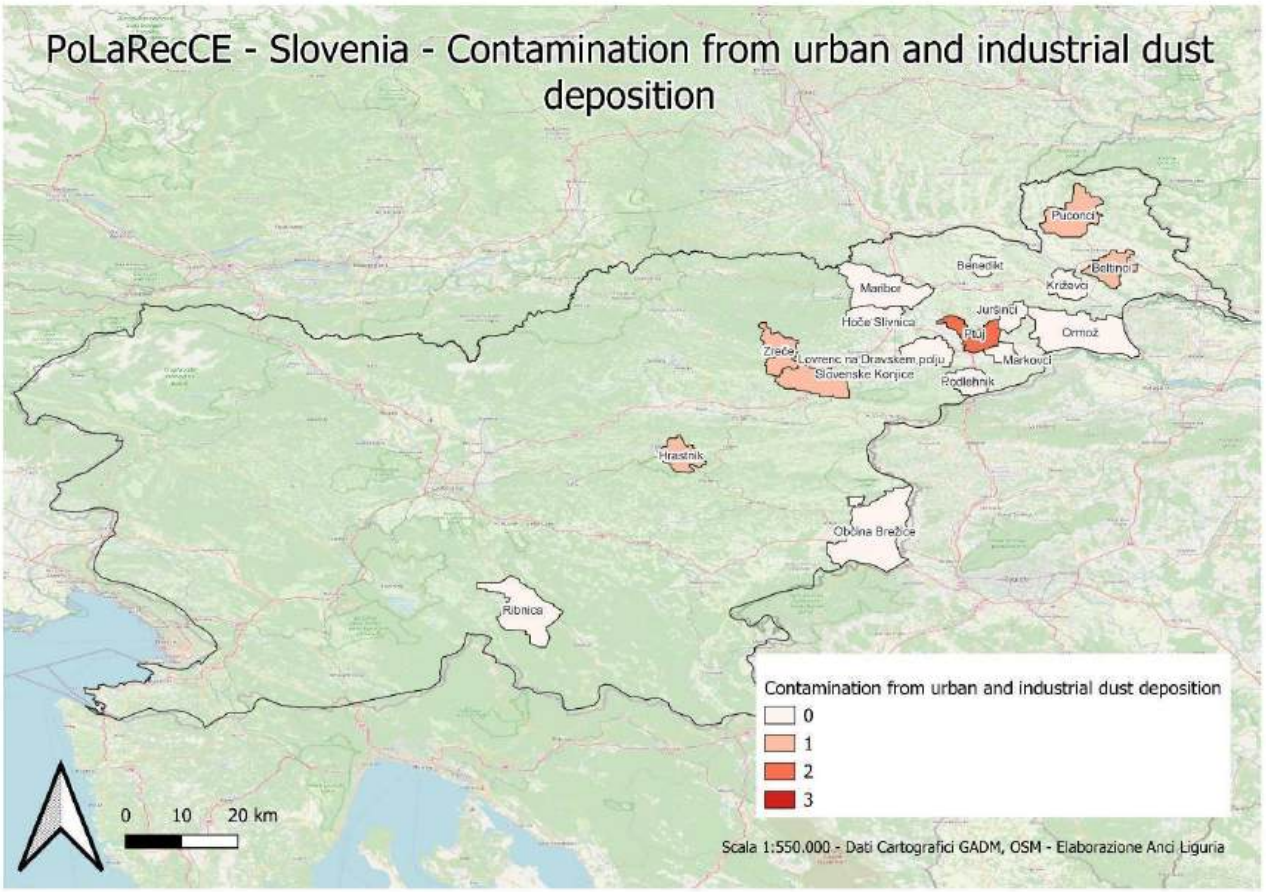

Fig. 55 - Contamination from urban and industrial dust deposition - SLO

Urban and Industrial Dust Deposition

The municipality of Ptuj reported widespread contamination from industrial and urban dust deposition, estimating that around 50% of its territory is affected. This represents one of the most critical findings in the Slovenian sample.

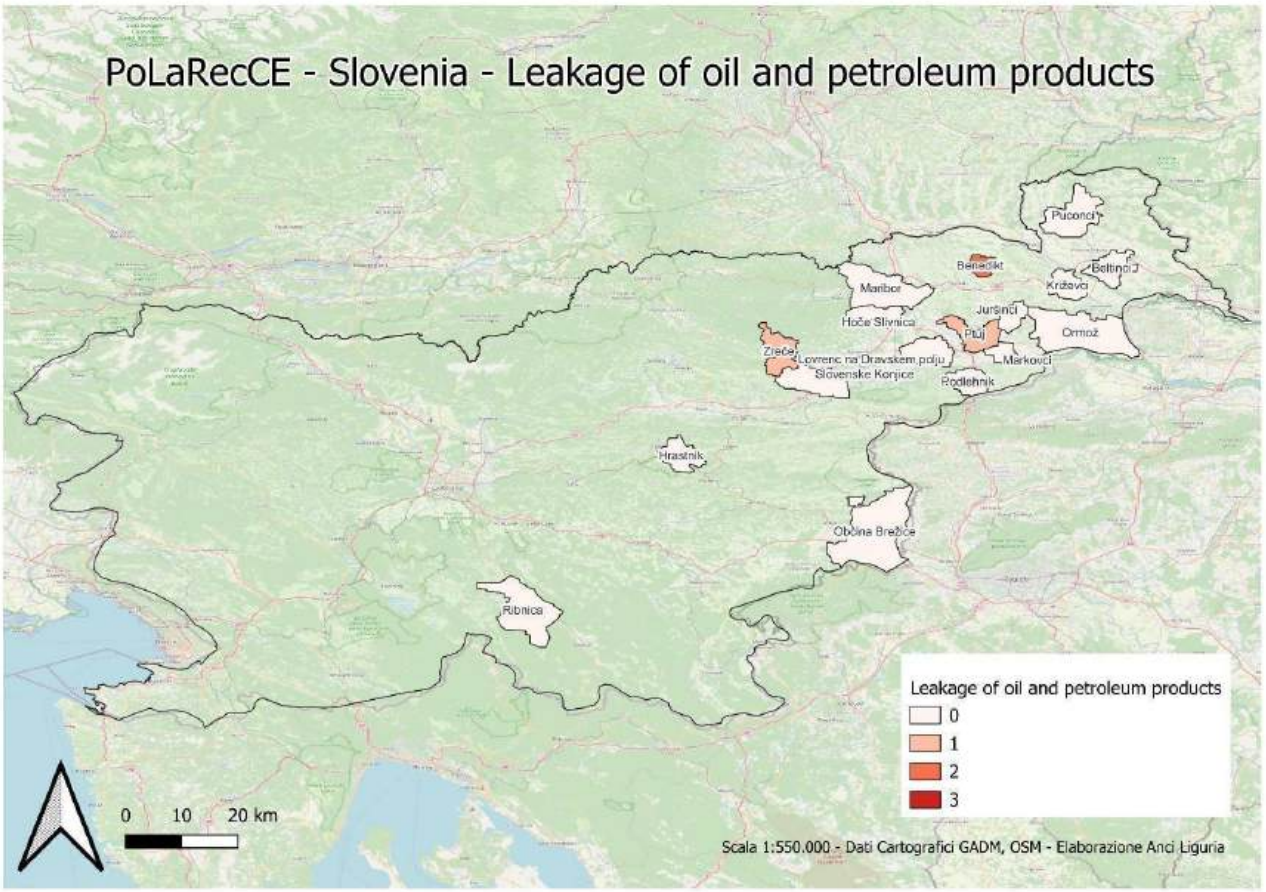

Fig. 56 - Leakage of oil and petroleum products - SLO

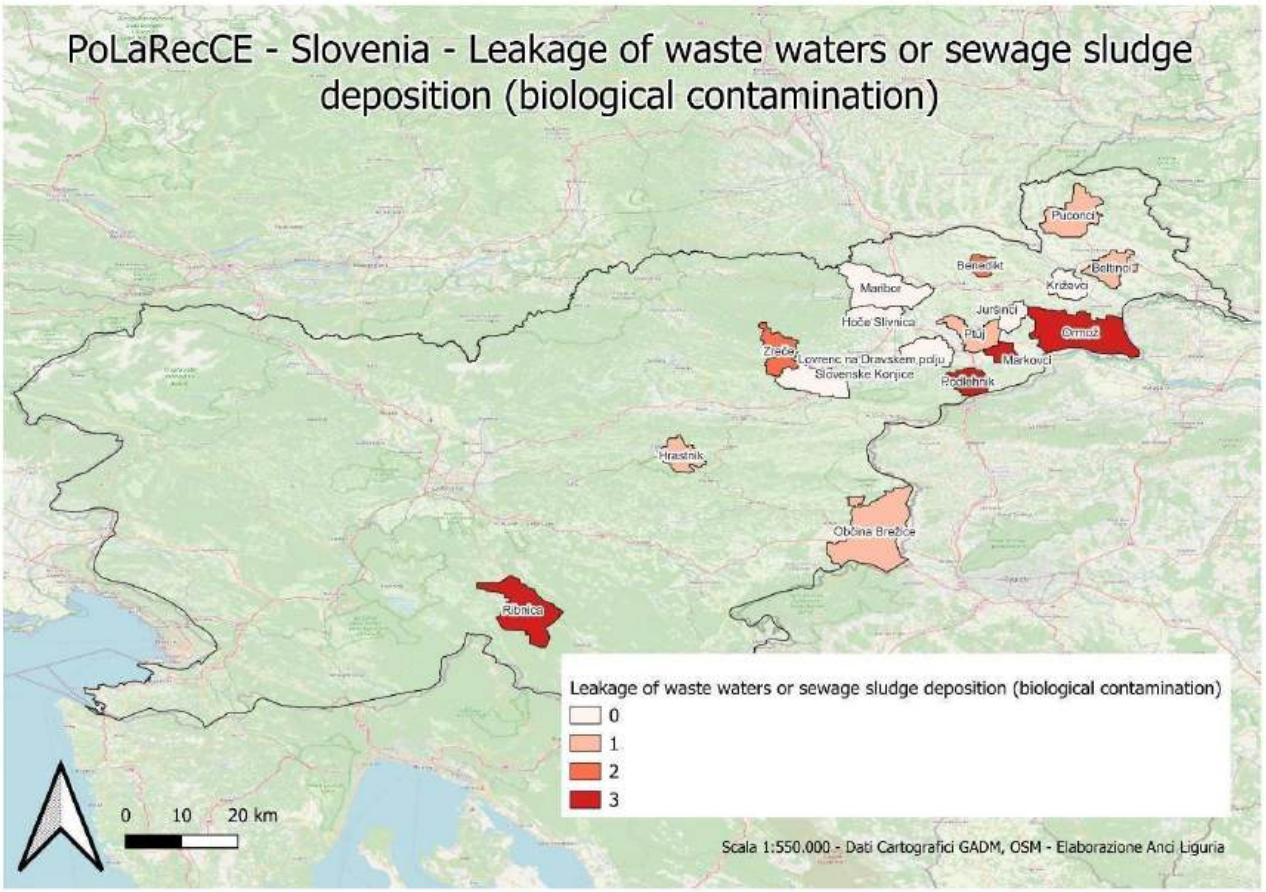

Fig. 57 - Leakage of waste waters or sewage sludge deposition (biological contamination) - SLO

Leakage of Wastewater and Sewage Sludge Deposition

Three municipalities—Markovci, Ormož, and Podlehnik—reported serious degradation (level 3) linked to wastewater leakage or sewage sludge deposition. These findings suggest that biological contamination remains a concern in specific areas, particularly where waste management practices are insufficient.

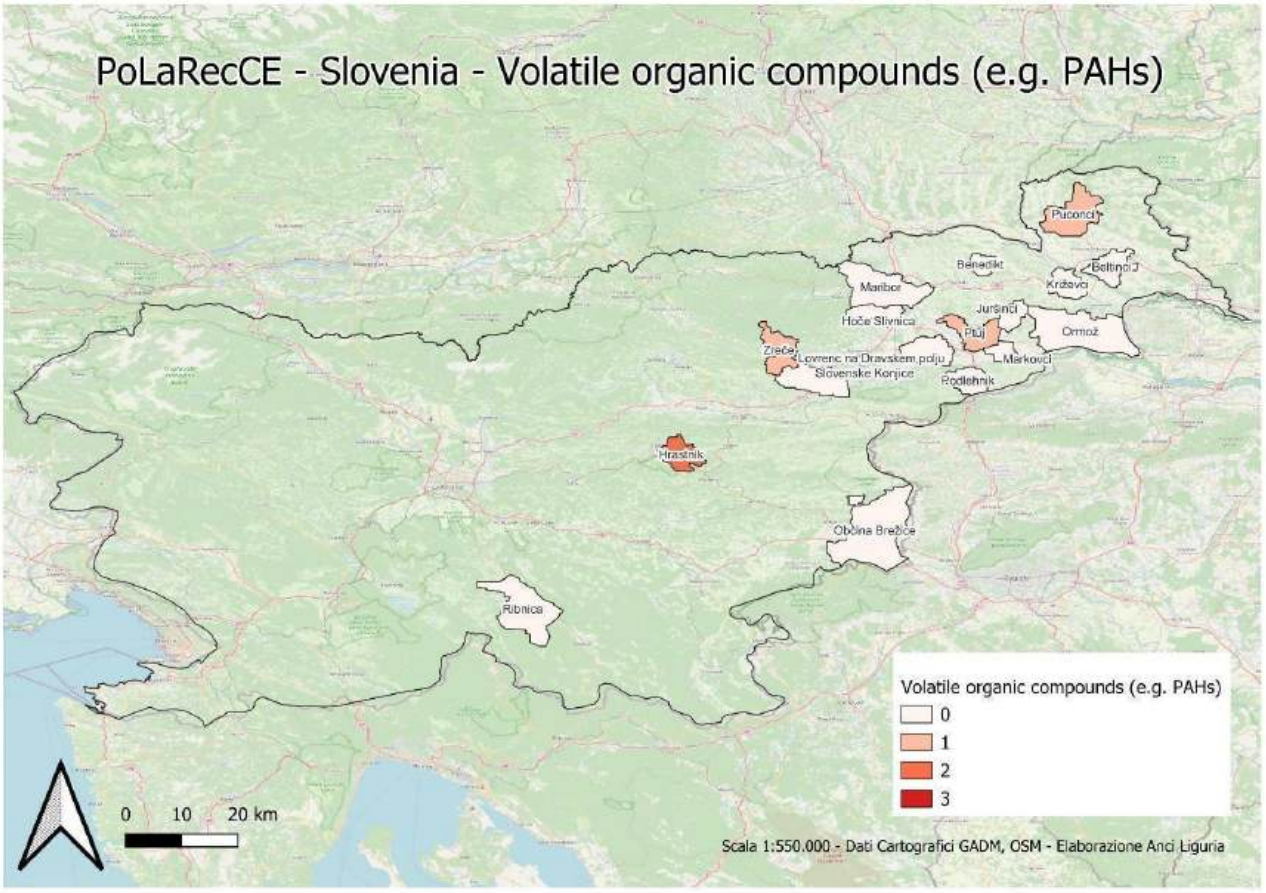

Fig. 58 - Volatile organic compounds (e.g. PAHs) - SLO

Volatile Organic Compounds (VOCs, PAHs)

Ptuj also indicated that approximately 30% of its territory is influenced by volatile organic compounds, pointing to localized but significant industrial impacts.

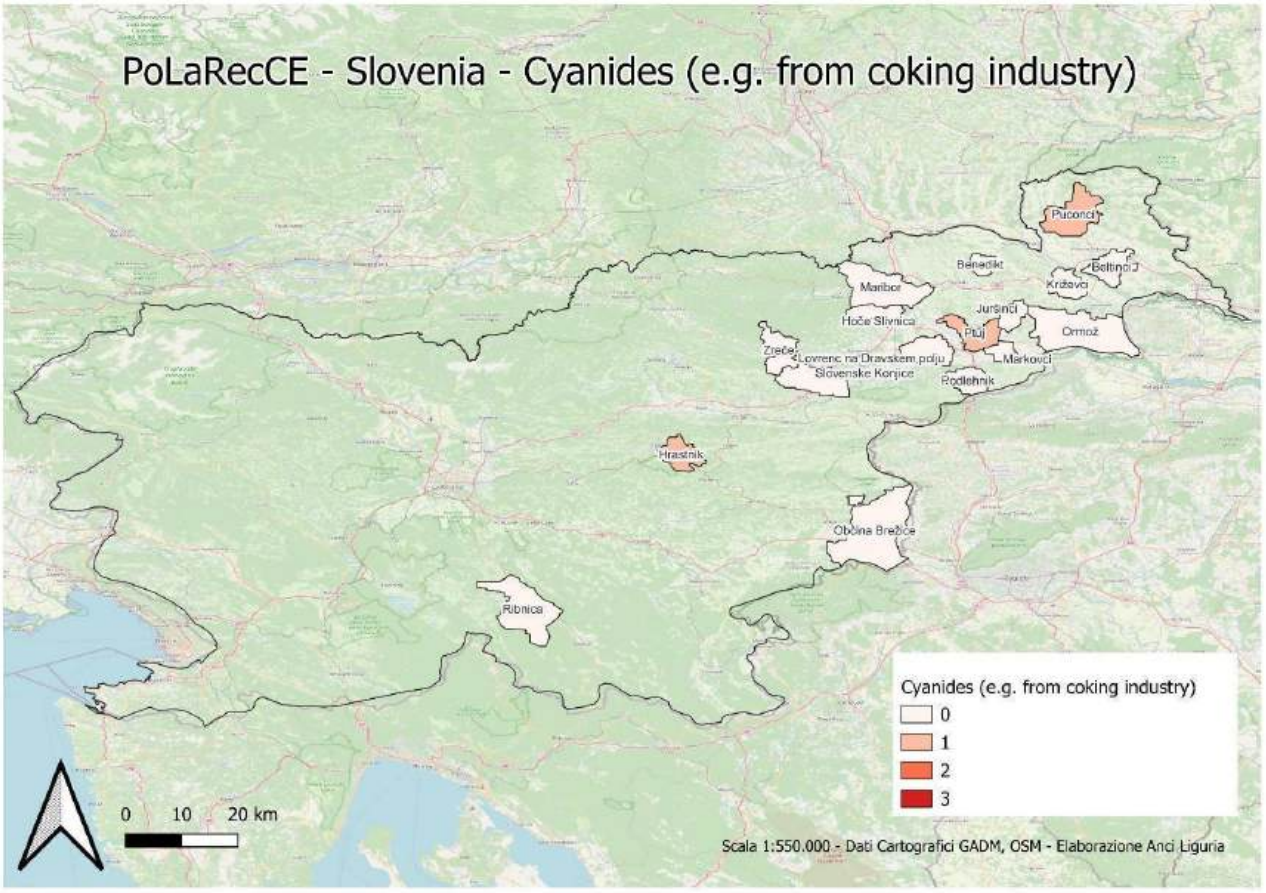

Fig. 59 - Cyanides (e.g. from coking industry) - SLO

Fig. 60 - Dumping of wastes materials from coal mining - SLO

Fig. 61 - Dumping of wastes materials from ore mining - SLO

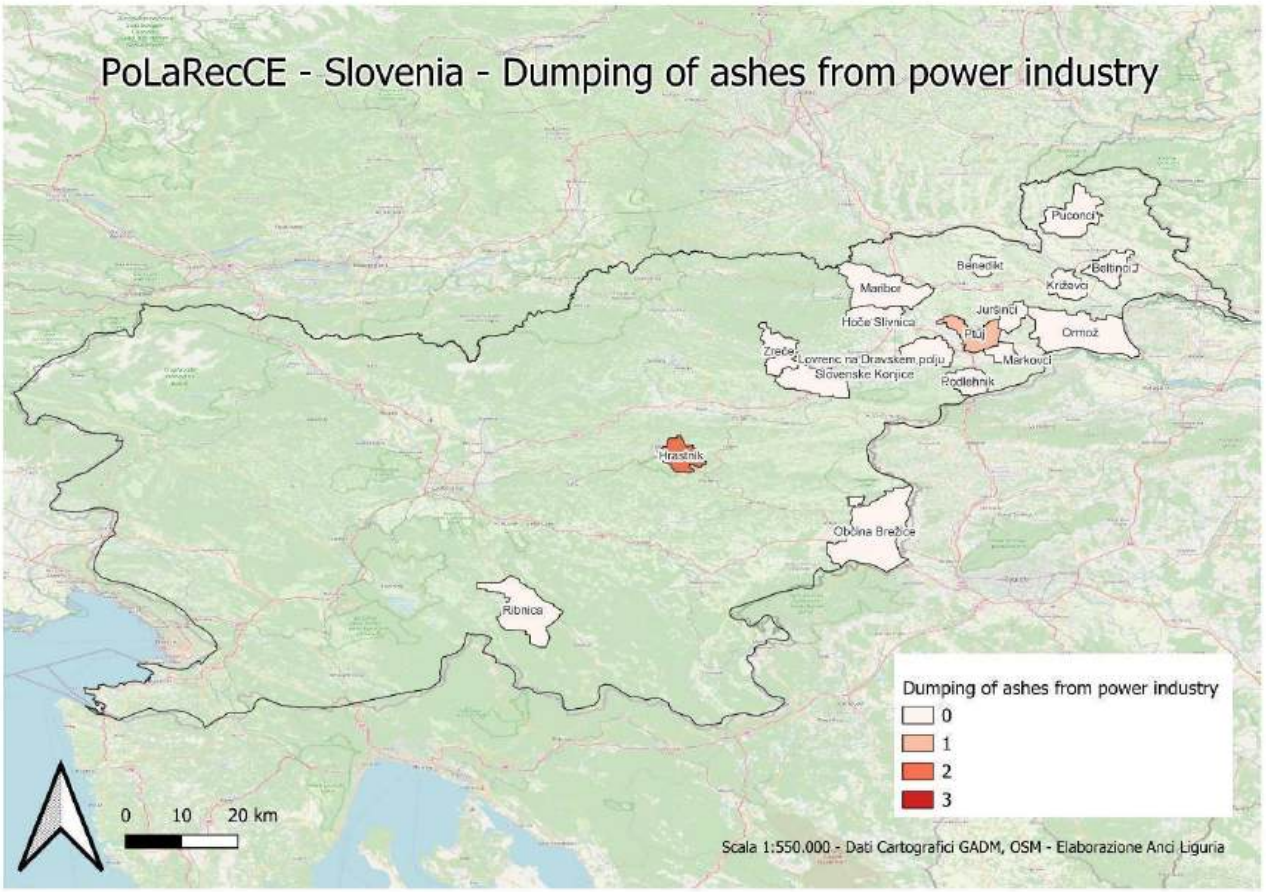

Fig. 62 - Dumping of ashes from power industry - SLO

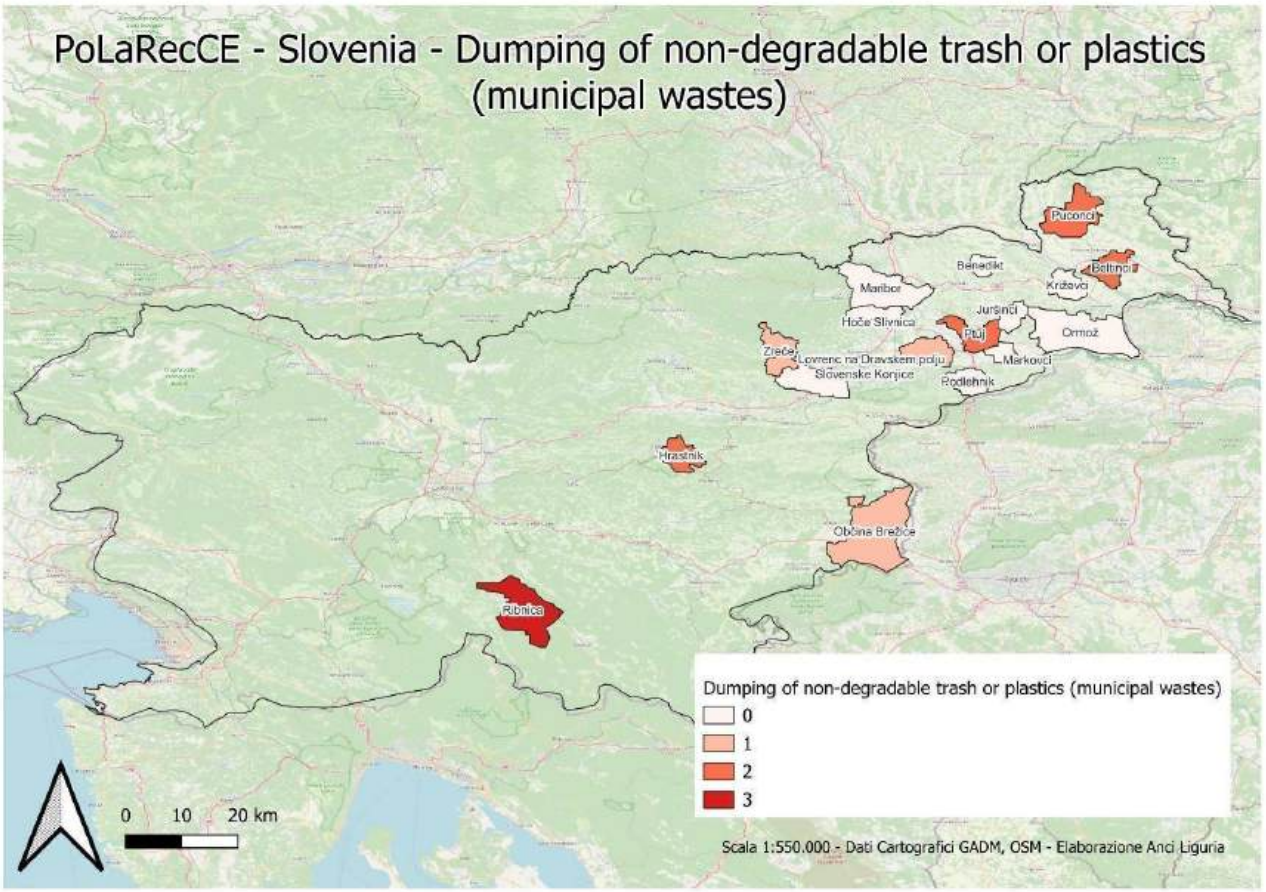

Fig. 63 - Dumping of non-degradeted trash or plastic (municipal wastes) - SLO

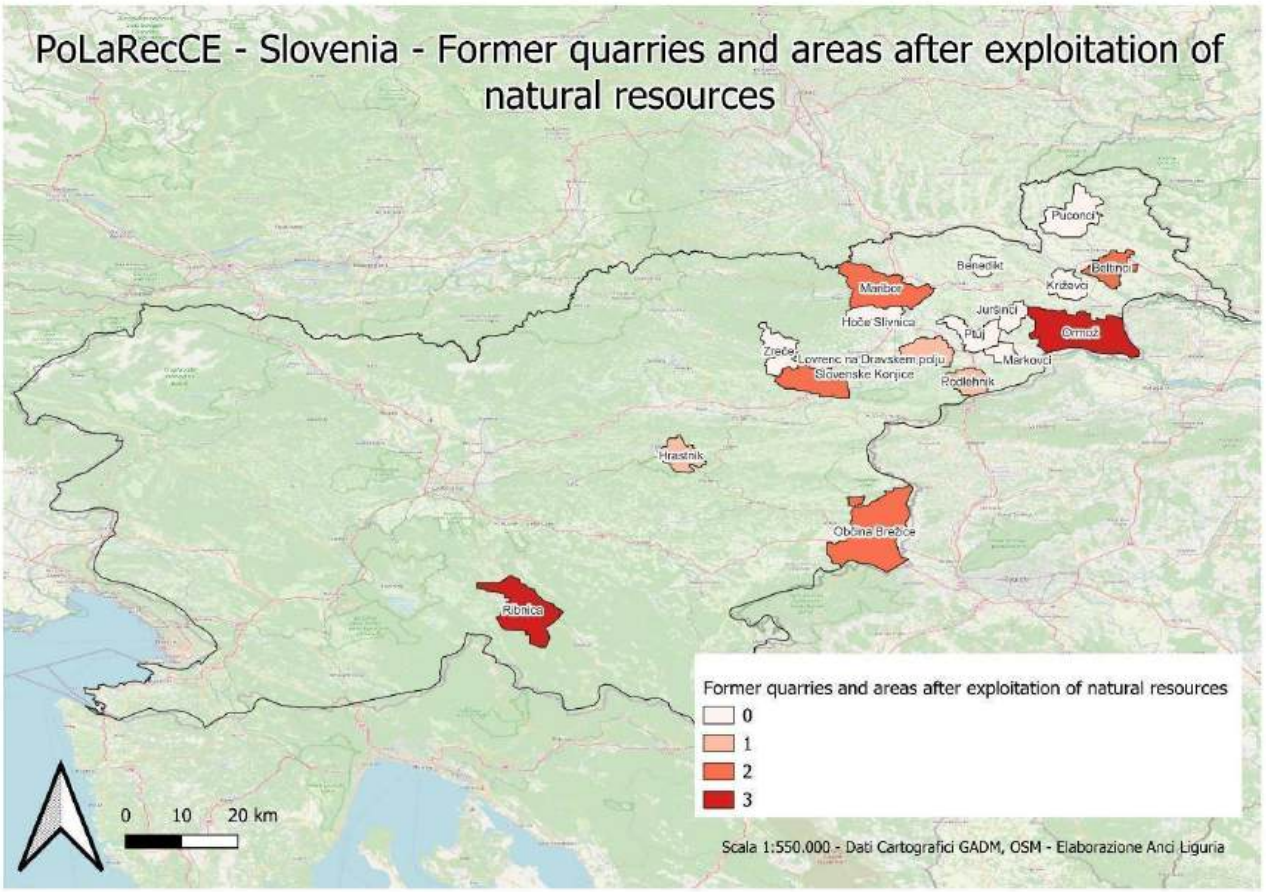

Fig. 64 - Former quarries and areas after exploitation of natural resources - SLO

Former Quarries and Resource Exploitation Areas

In Ormož, active gravel and clay extraction sites were reported as contributing to soil degradation. While some exhausted sections of these quarries are already overgrown or repurposed, ongoing activities continue to exert pressure on local soils.

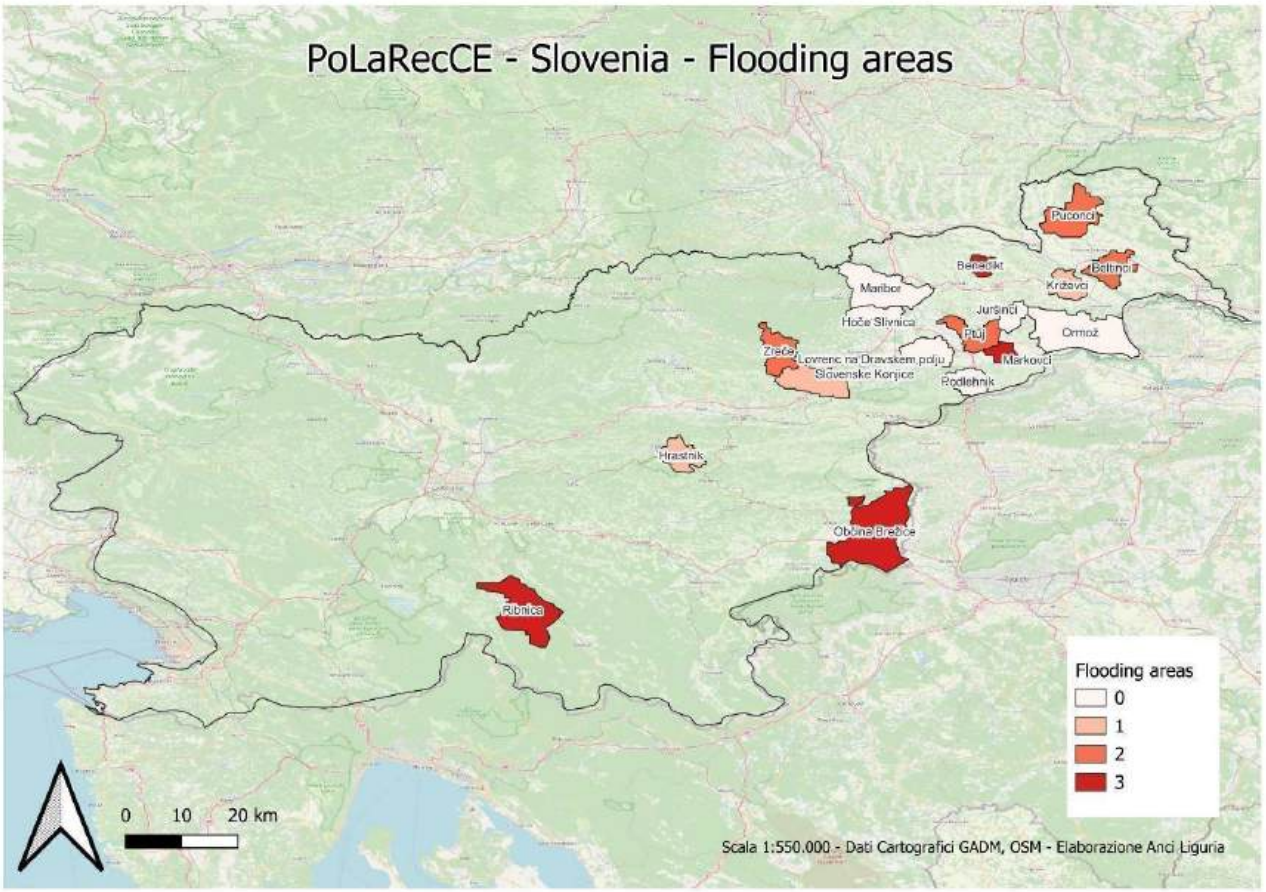

Fig. 65 - Flooding areas - SLO

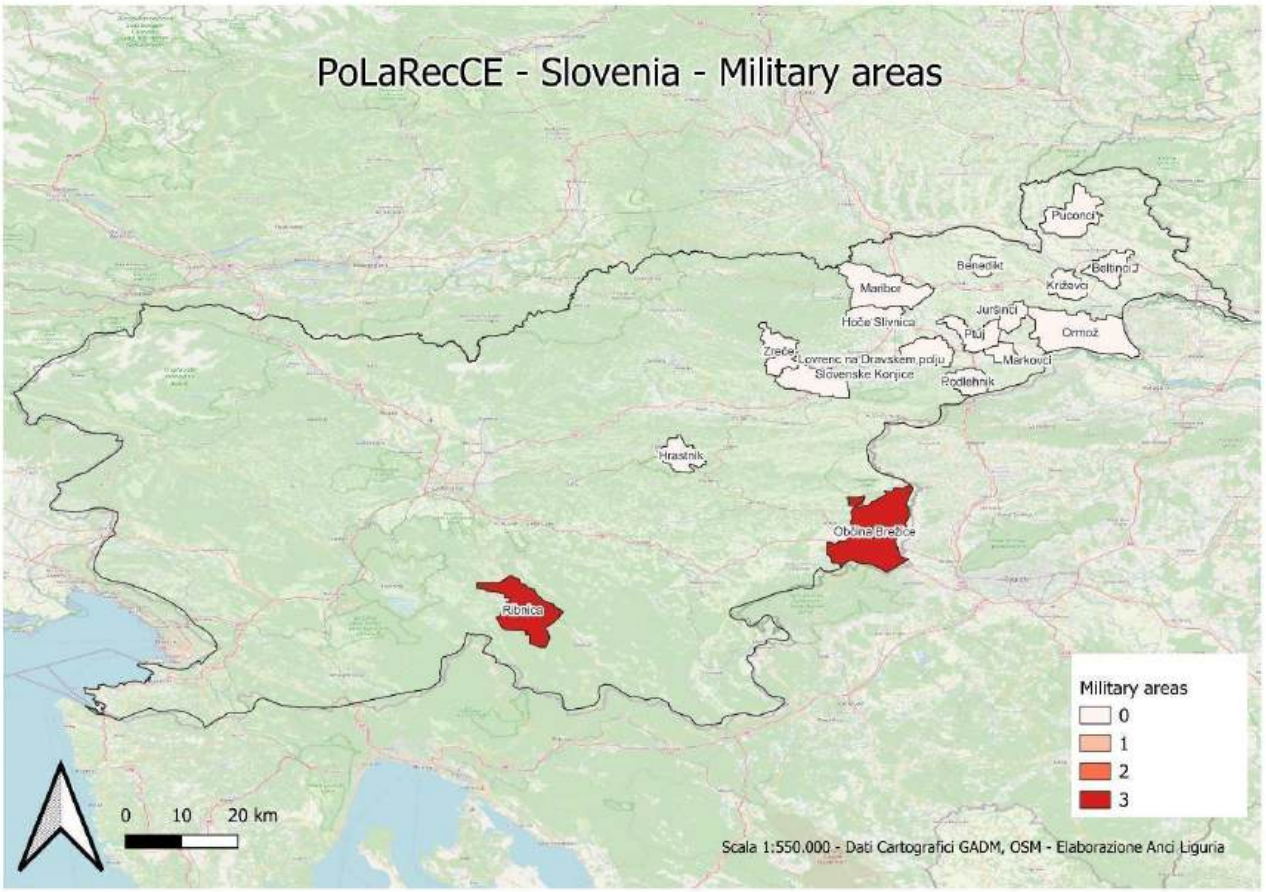

Fig. 66 - Military areas - SLO

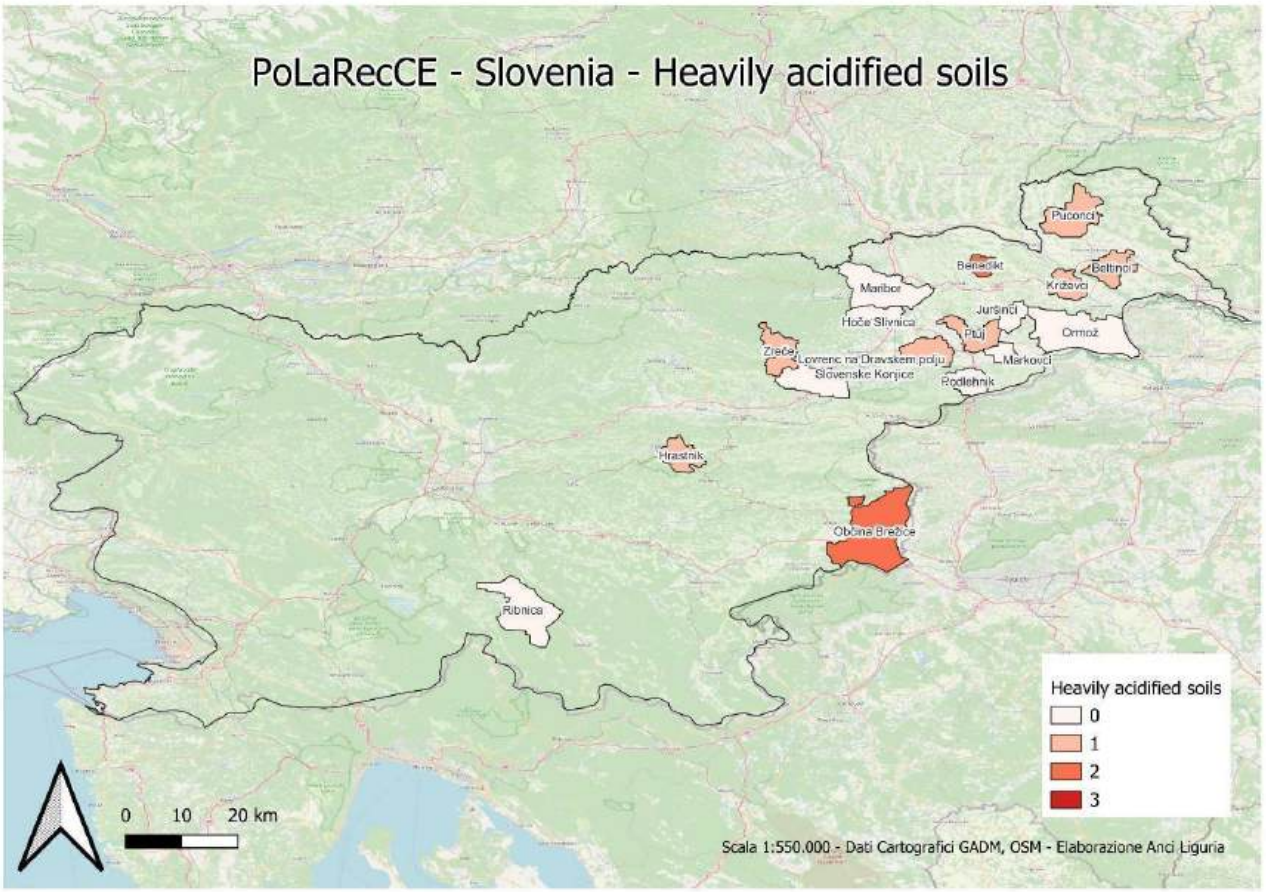

Fig. 67 - Heavily acidified soils - SLO

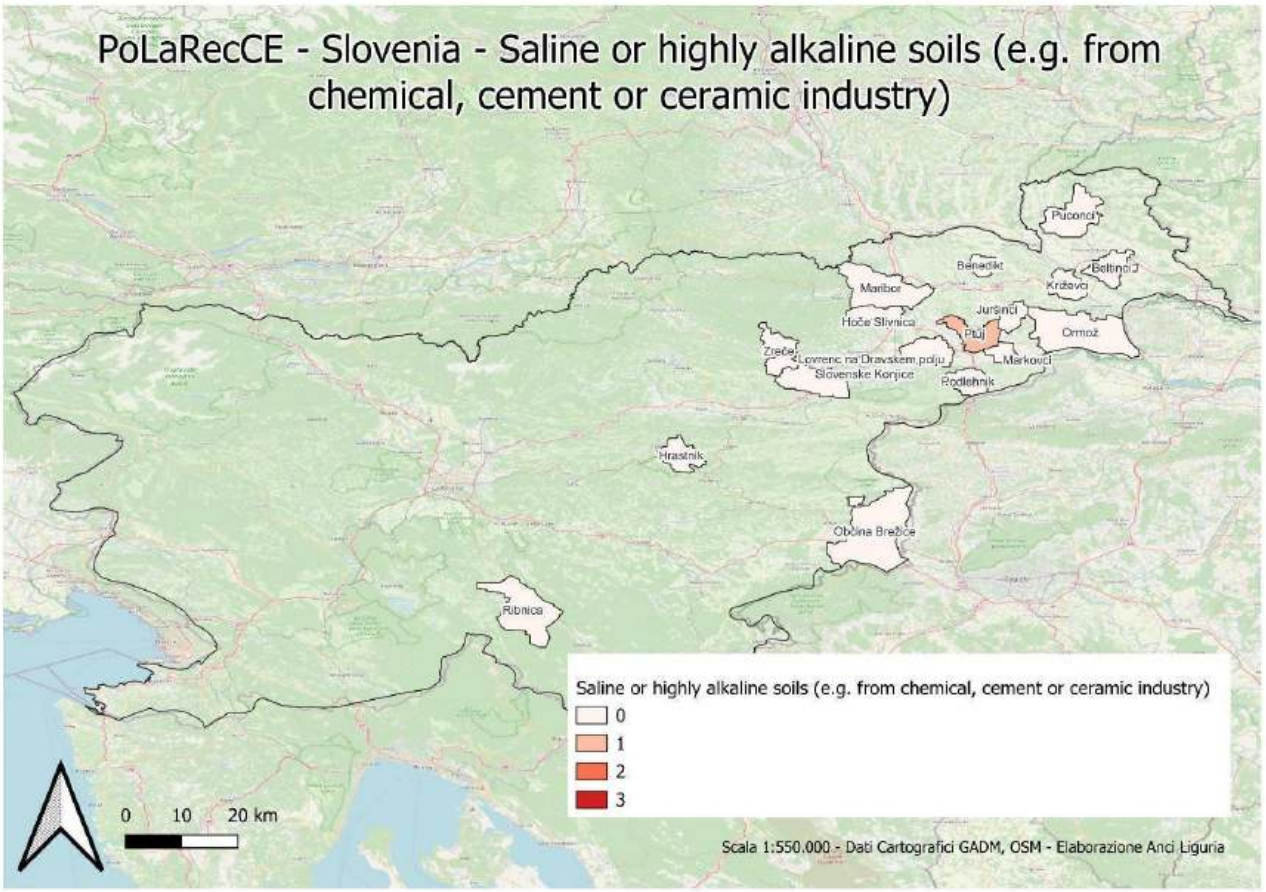

Fig. 68 - Saline or highly alkaline soils (e.g. from chemical, cement or ceramic industry) - SLO

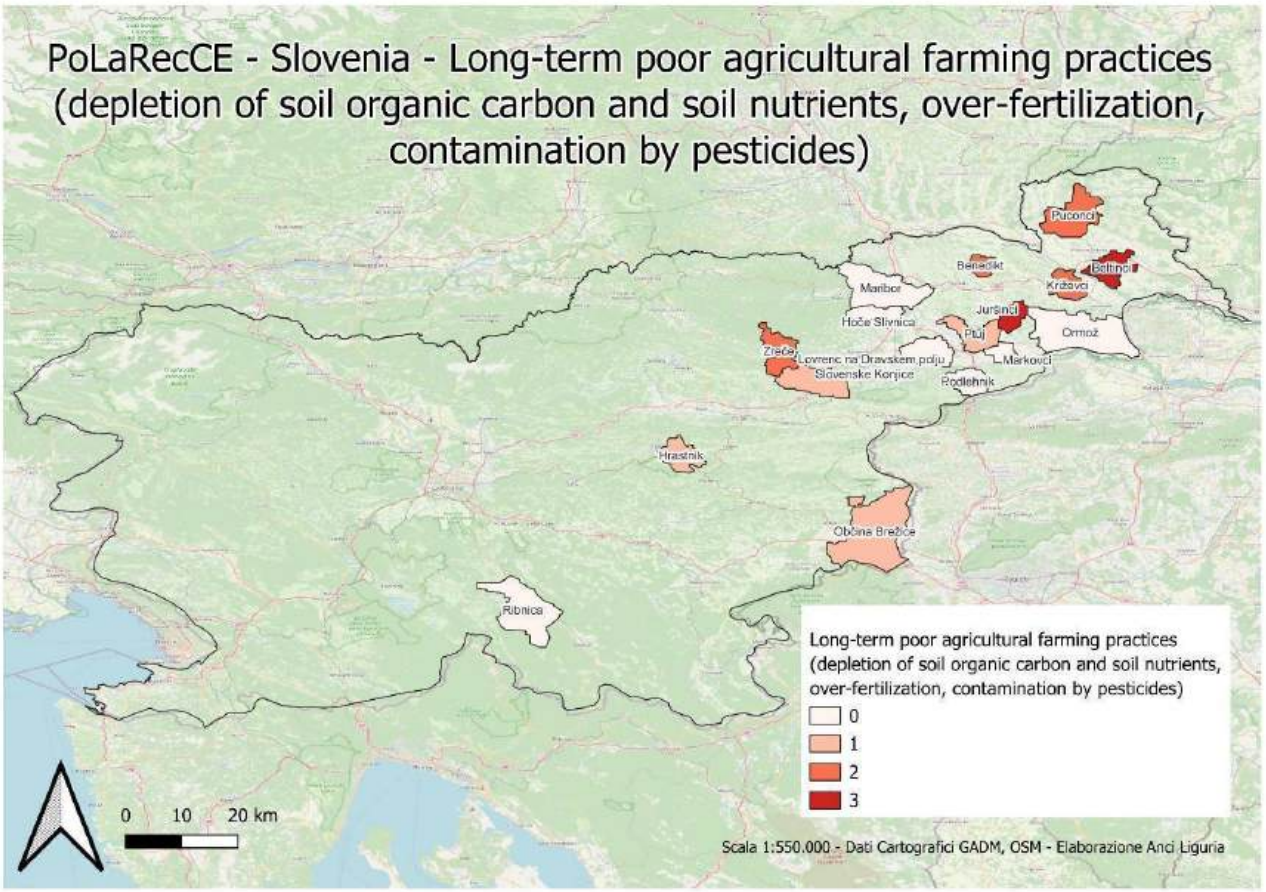

Fig. 69 - Long-term poor agricultural farming practices - SLO

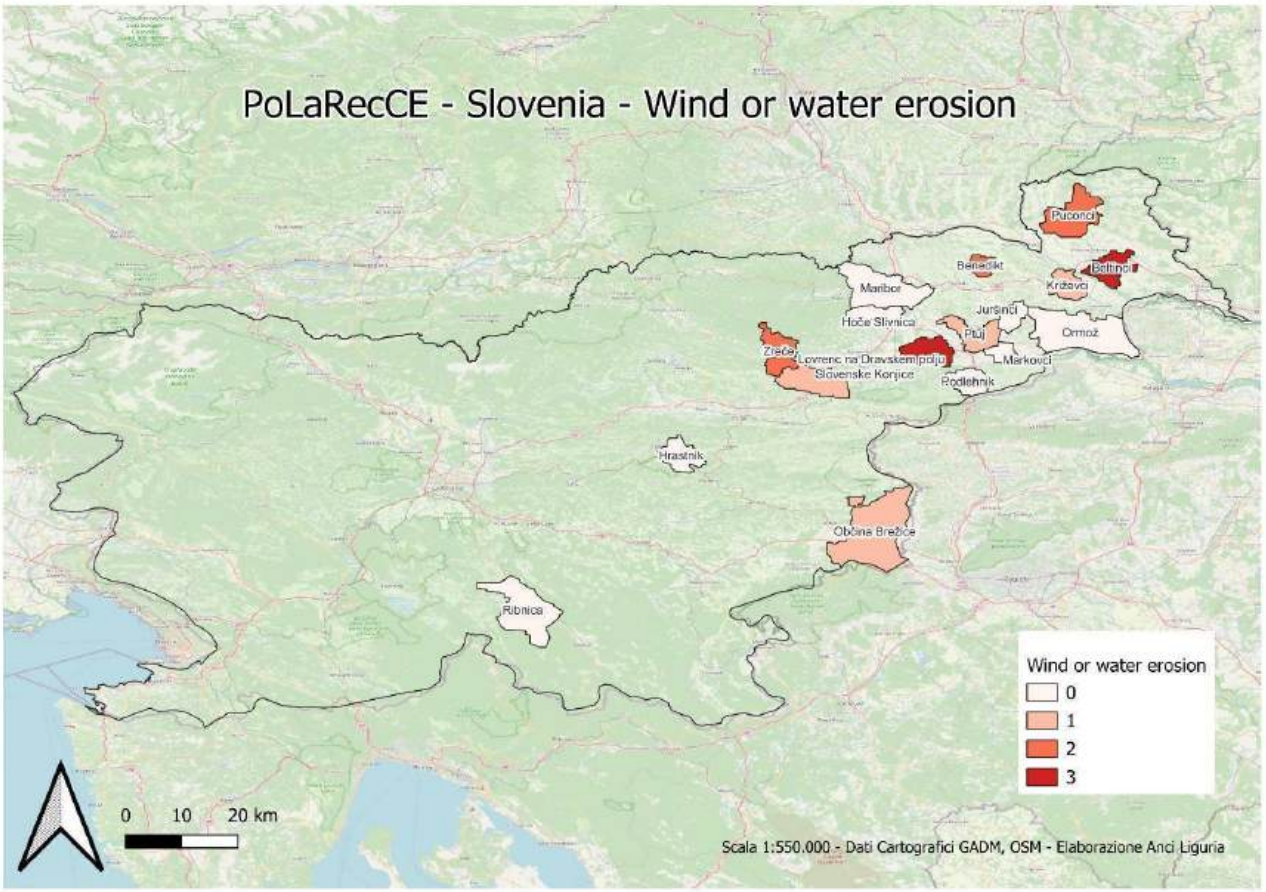

Fig. 70 - Wind or water erosion - SLO

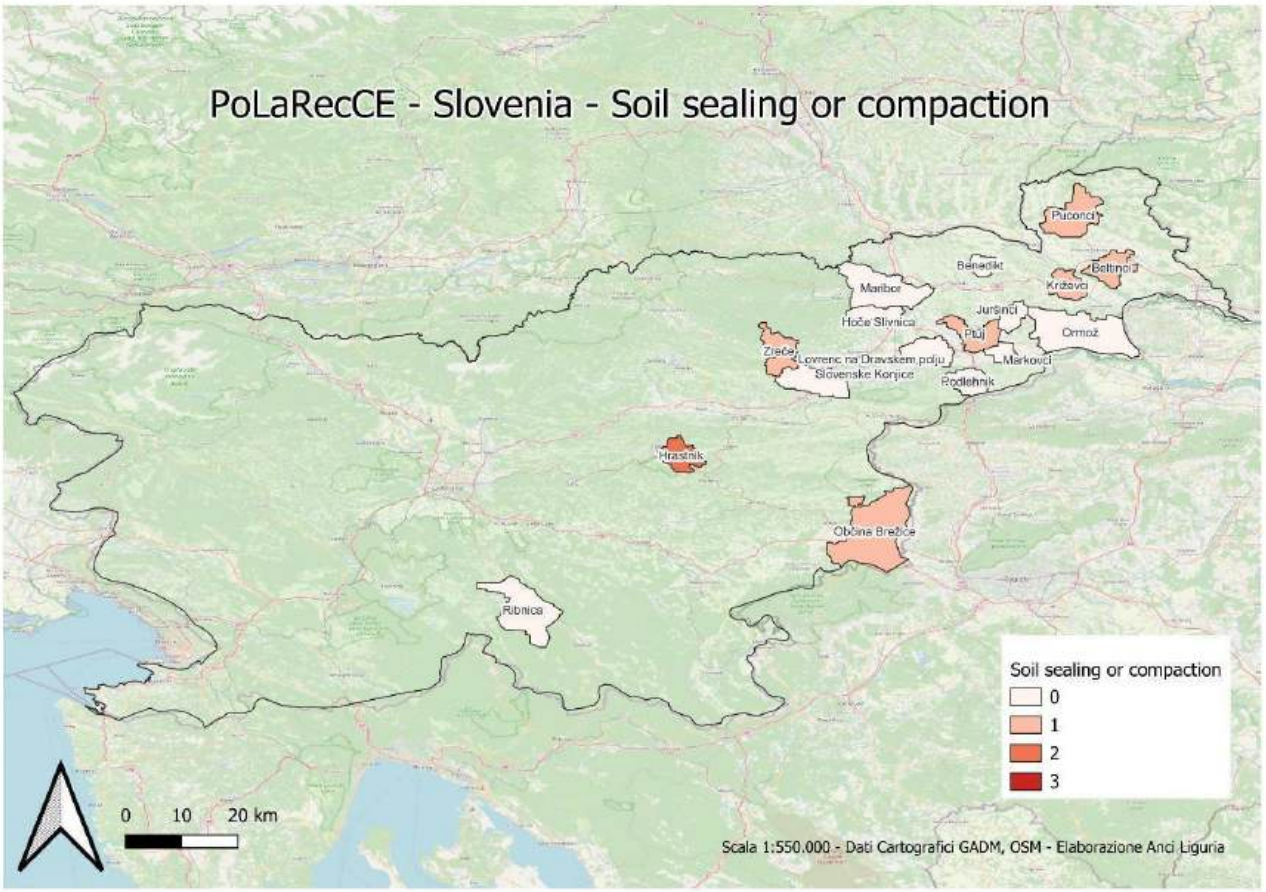

Fig. 71 - Soil sealing or compaction - SLO

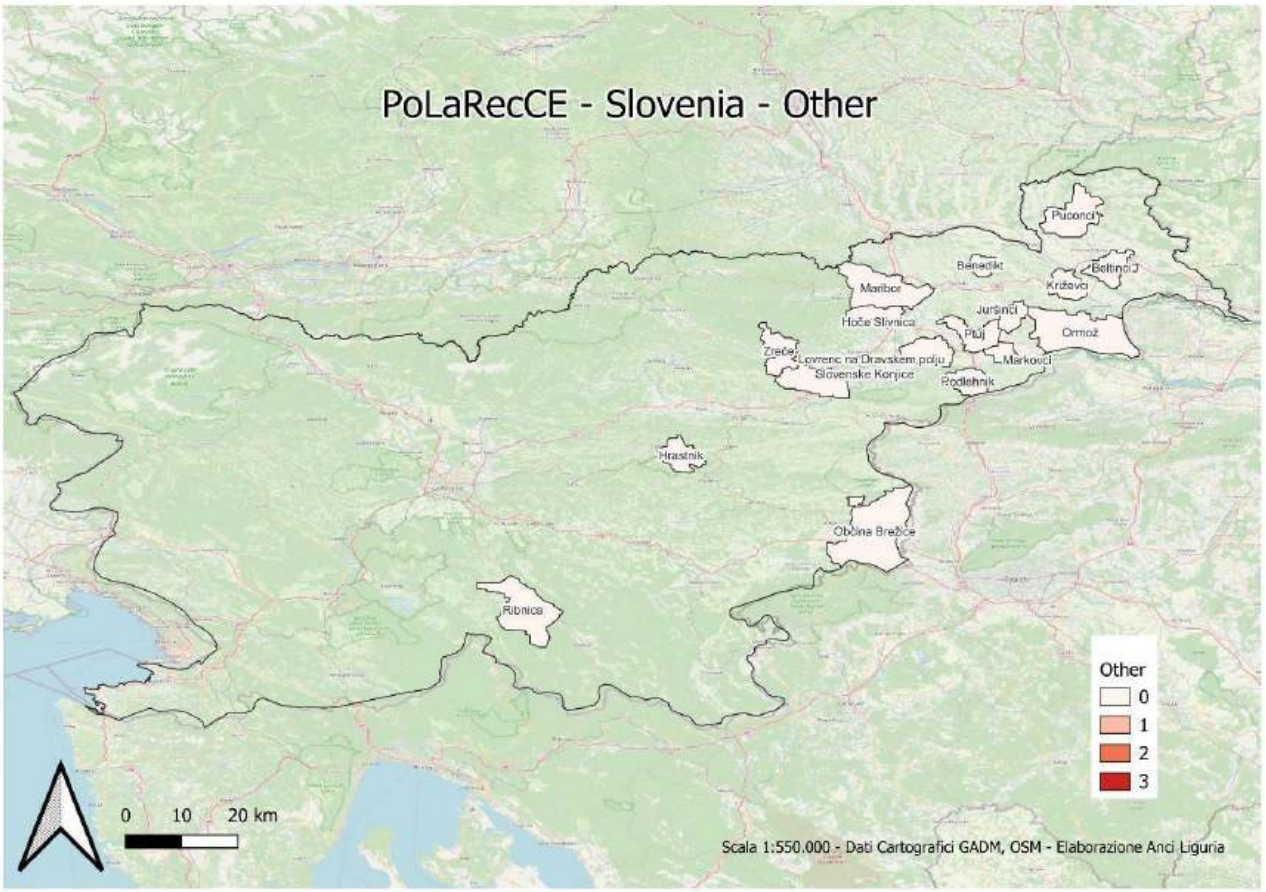

Fig. 72 - Other - SLO

Other Issues

No other major categories of degradation were systematically reported, and in most municipalities the level of concern appeared low. The relatively limited number of issues identified may reflect both the smaller industrial base of Slovenia and the lack of systematic monitoring at the municipal level.

Synthesis

The Slovenian results suggest that widespread soil degradation is not perceived as a pressing issue, with the exception of a few municipalities where industrial or waste-related pressures remain significant. The strong results in Ptuj and the recurrent wastewater-related problems in other municipalities highlight the uneven distribution of risks and the importance of targeted interventions. At the same time, the findings reflect the challenges posed by the absence of consistent municipal-level data collection, which may lead to underestimation of soil degradation processes.

3.4. Results Croatia

In Croatia, the survey yielded very limited participation: only three municipalities provided responses, which considerably restricts the representativeness of the dataset. The low interest expressed by municipalities suggests that soil degradation is not perceived as a priority issue at the local level. Nevertheless, the few collected questionnaires reveal some critical aspects.

Flooding Areas

In the municipality of Gradina, flooding was reported as a problem affecting approximately 30% of the territory, though at a low level of intensity (level 1). This reflects the exposure of certain localities to hydrological risks, even if not considered highly severe.

Soil Sealing and Compaction

Gradina also highlighted soil sealing and compaction as an issue for about 40% of its territory, again at a relatively low level of intensity (level 1). The problem is linked to land conversion and infrastructure pressures, although not perceived as critical.

Heavily Acidified Soils

The same municipality reported acidification problems affecting 70% of its territory, this time with greater severity (level 2). Such a high proportion indicates that soil chemical degradation is a serious concern locally, even if not widely recognized at the national scale.

Poor Agricultural Practices

The most significant problem reported was soil degradation due to unsustainable agricultural practices, including nutrient depletion, over-fertilization, and pesticide contamination. This form of degradation was assessed as level 3, affecting up to 80% of Gradina's surface area. These findings point to long-term pressures from farming methods that undermine soil fertility and resilience.

Other Issues

No additional categories of degradation were systematically reported by the small sample of municipalities that responded.

Synthesis

Although the Croatian dataset is too limited to draw regional conclusions, the results from Gradina highlight how localized problems can be highly significant. Acidification and poor agricultural practices emerge as particularly severe threats, suggesting that where data are available, soil degradation can represent a major challenge. The lack of wider municipal engagement, however, remains a critical limitation, underscoring the need for greater awareness-raising and capacity building at the local level.

3.5. Results in Hungary

Békés County, located in the Great Hungarian Plain, covers 5,631 km², includes 75 municipalities, and had a population of about 315,000 in 2022. The PoLaRecCE questionnaire was distributed to all municipalities, but only eight responded, corresponding to a response rate of 10.7%. Although limited, the dataset offers valuable insights into soil degradation in a largely agricultural region strongly influenced by climatic variability and groundwater dynamics (Table 3).

Table 3. Area and number of settlements participating in the PoLaRecCE questionnaire on soil degradation processes in Békés county

Well	municipality / commune	County	area, km2	Population
1	Csorvás	BÉKÉS/HUNGARY	90,18	4 369
	Csabaszabadi			

2		BÉKÉS/HUNGARY	32,71	268
3	Gyomaendrőd	BÉKÉS/HUNGARY	303,93	12 003
4	Szabadkígyós	BÉKÉS/HUNGARY	45,56	2 345
5	Körösladány	BÉKÉS/HUNGARY	123,79	4 066
	Dévaványa			

6		BÉKÉS/HUNGARY	216,55	6 582
7	Kunágota	BÉKÉS/HUNGARY	56,73	2 274
8	Sarkad	BÉKÉS/HUNGARY	125,57	9 093

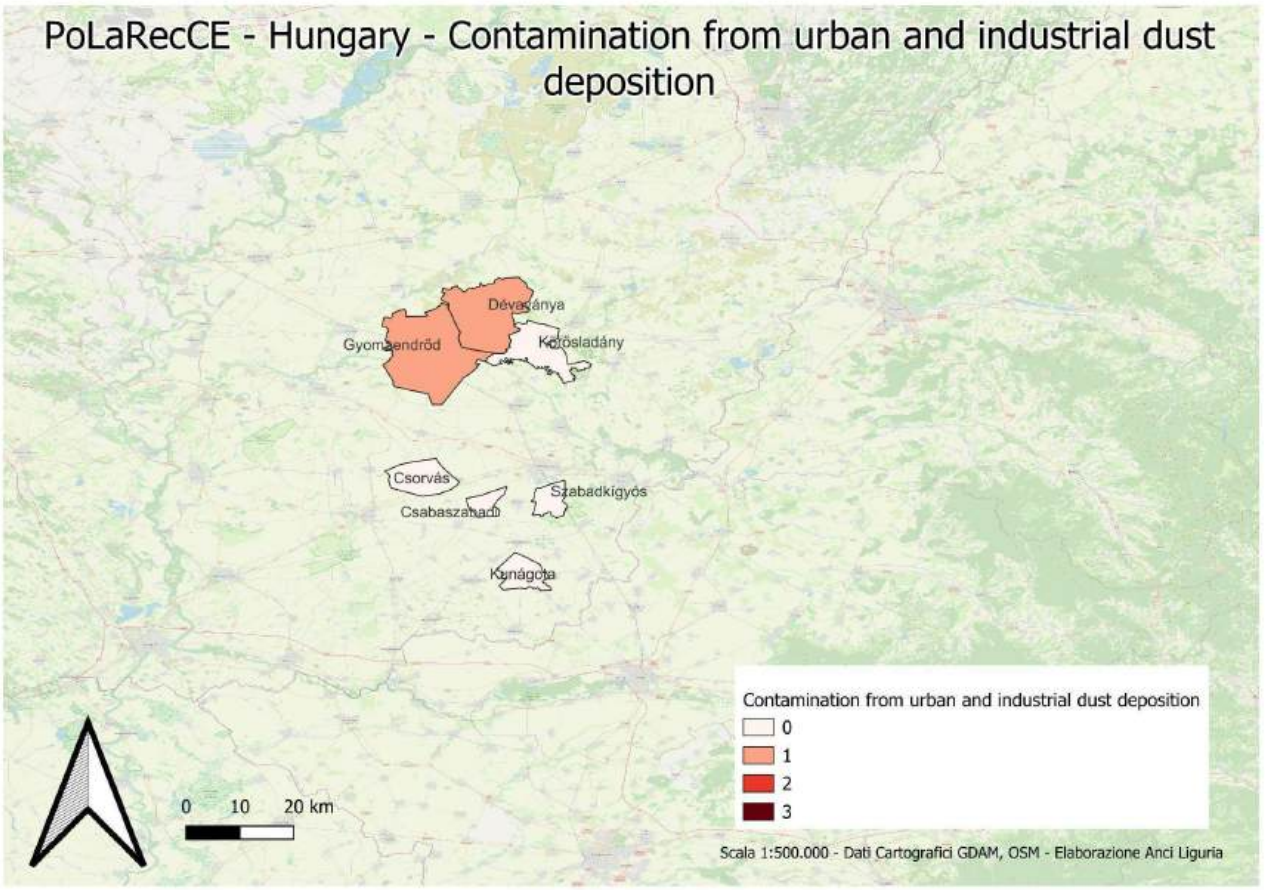

Fig. 73 - Contamination from urban and industrial dust deposition - HUN

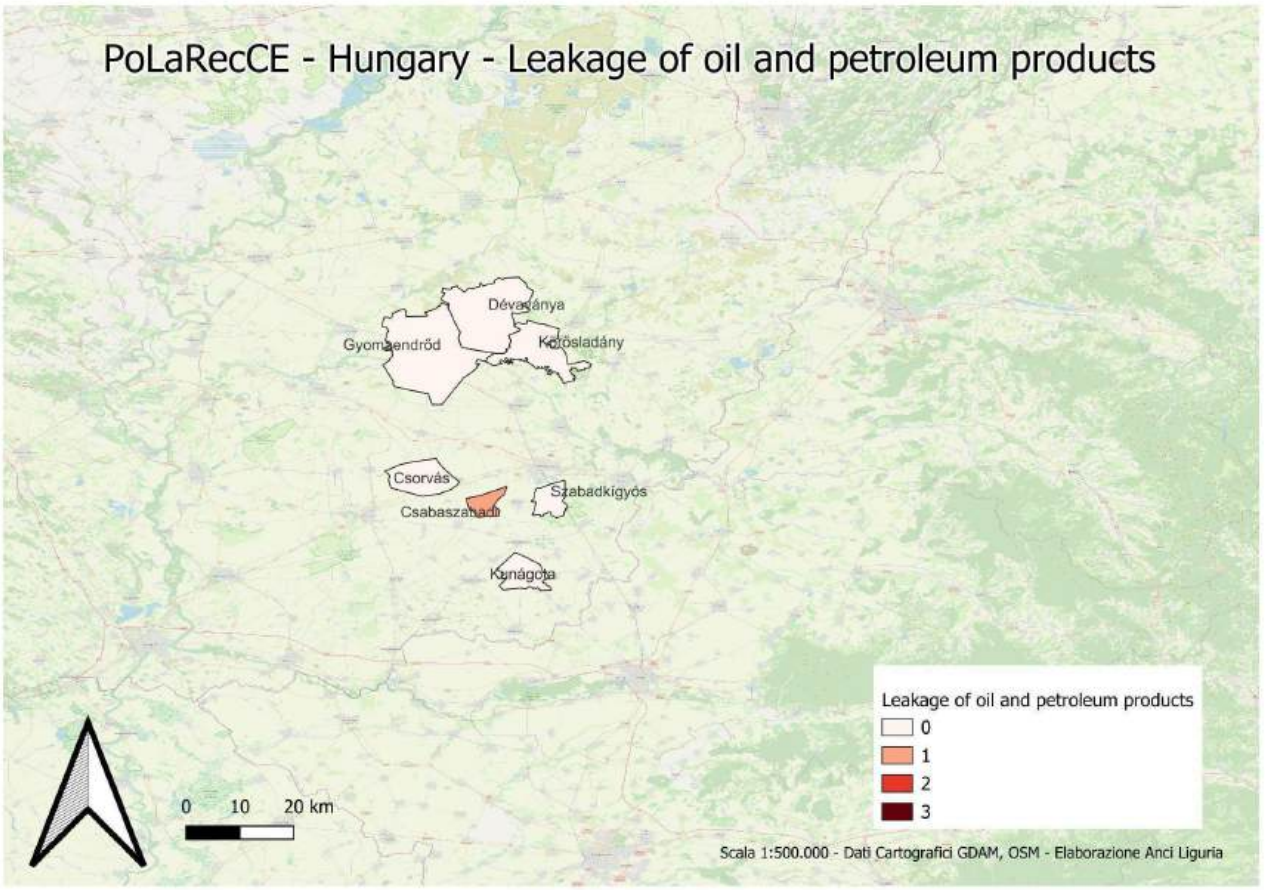

Fig. 74 - Leakage of oil and petroleum products - HUN

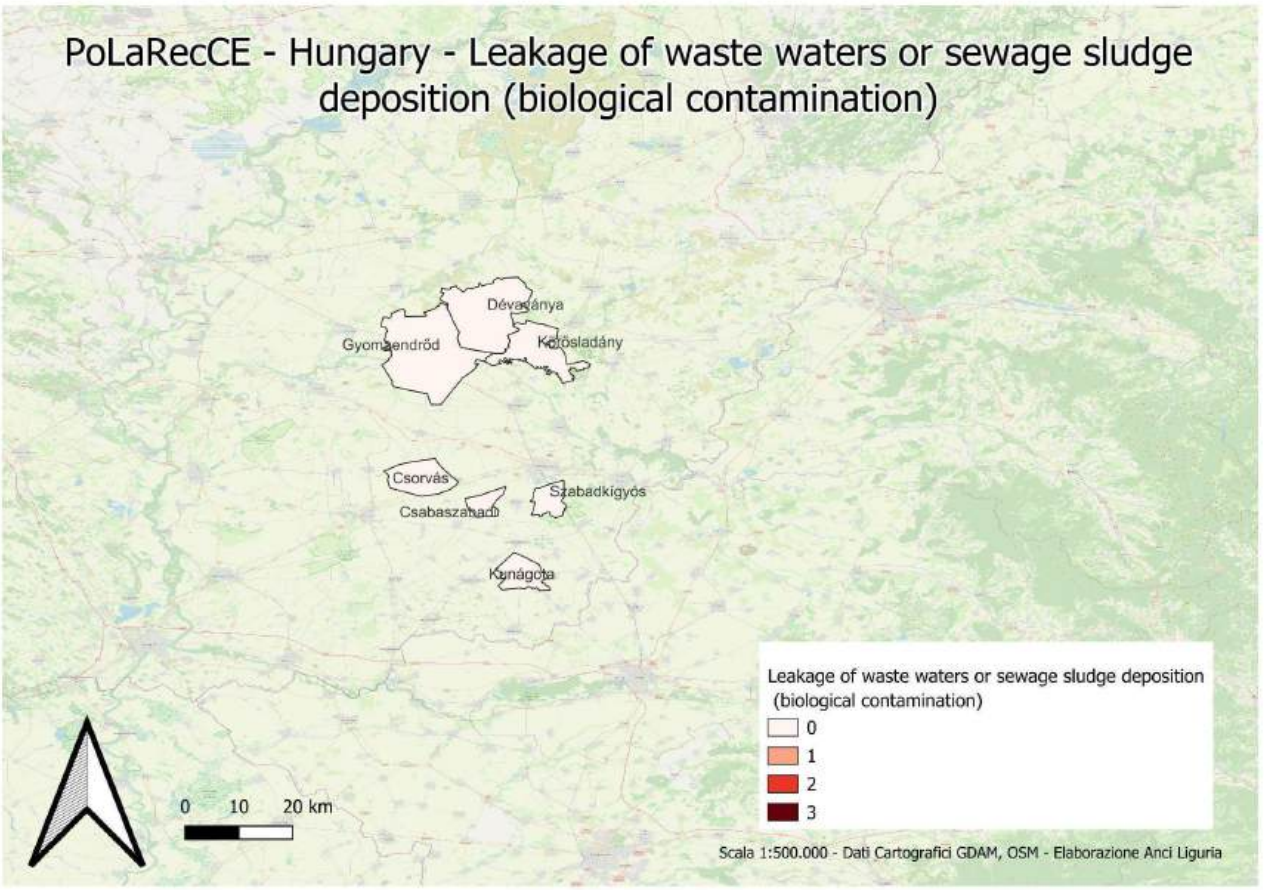

Fig. 75 - Leakage of waste waters or sewage sludge deposition (biological contamination) - HUN

Leakage of Wastewater and Sewage Sludge Deposition

Wastewater irrigation has historically been prohibited, and although a legal framework introduced in 2024 now permits it, no applications have been submitted to date. Municipalities reported that illegal wastewater discharges largely ceased after 2000, when households were connected to sewage grids and industrial activities became more strictly monitored. Controlled sewage sludge application continues under strict environmental rules, covering about 1,200 ha annually.

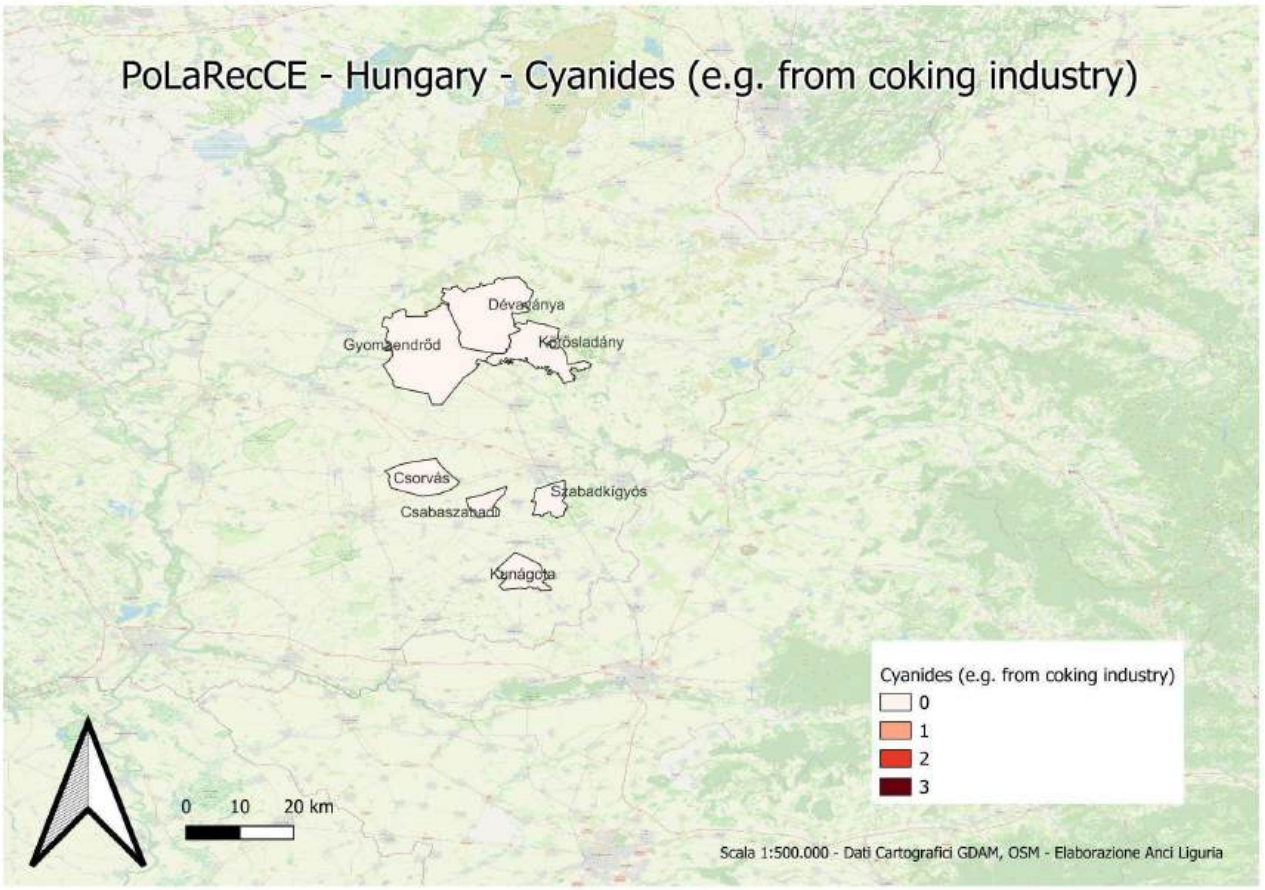

Fig. 76 - Cyanides (e.g. from coking industry) - HUN

Fig. 77 - Dumping of wastes materials from coal mining - HUN

Fig. 78 - Dumping of wastes materials from ore mining - HUN

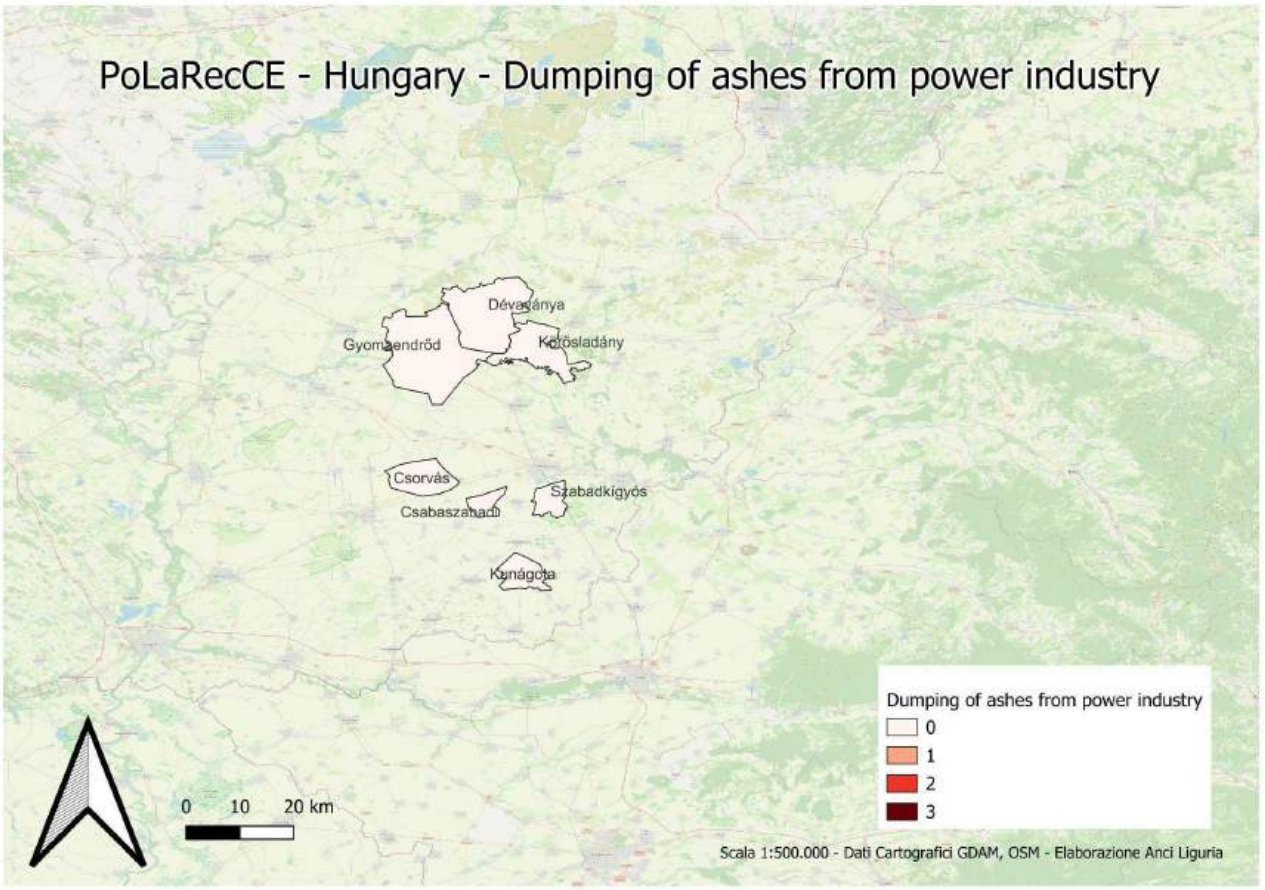

Fig. 79 - Dumping of ashes from power industry - HUN

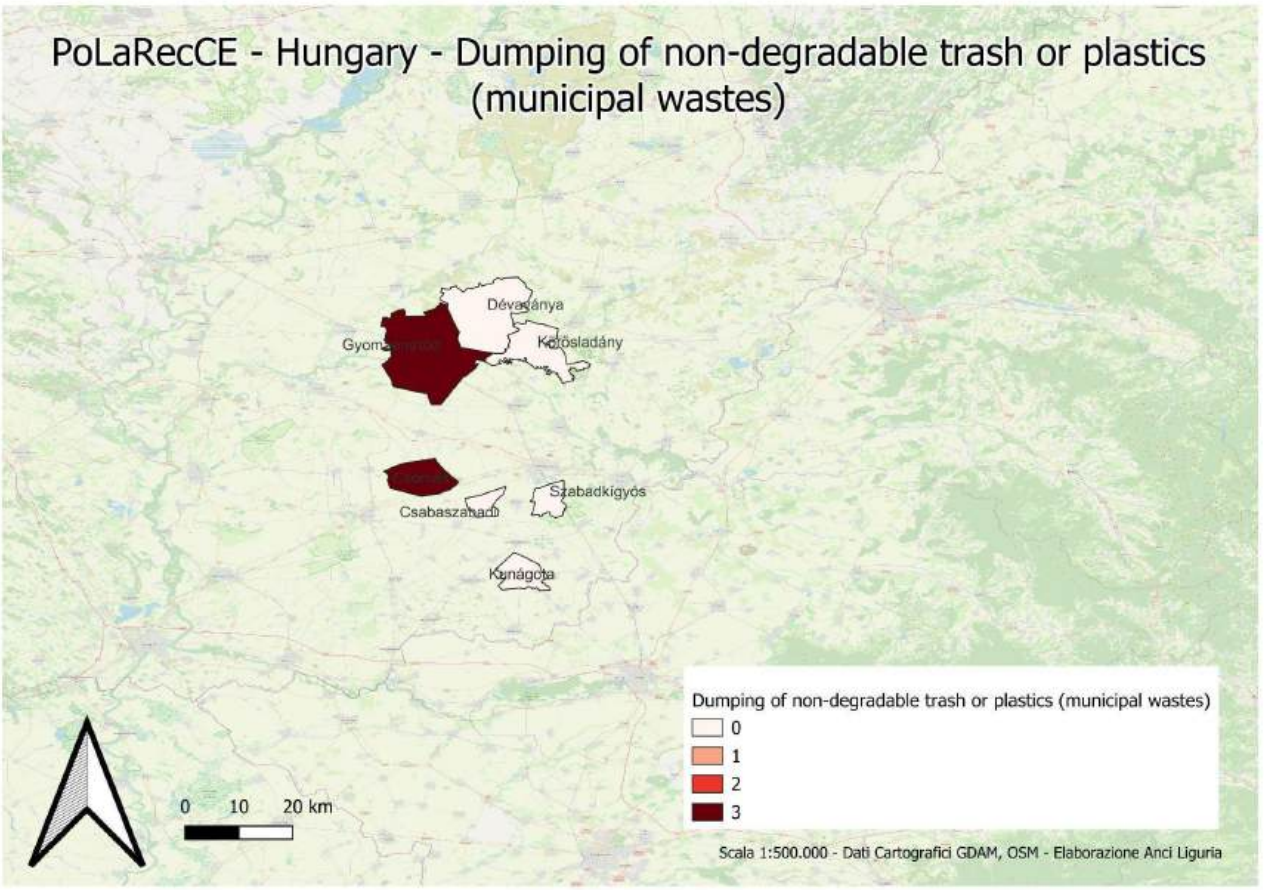

Fig. 80 - Dumping of non-degradeted trash or plastic (municipal wastes) - HUN

Dumping of Non-Degradable Trash or Plastics

Illegal dumping of municipal waste was once widespread, but recent reforms in waste management—particularly after the entry of a large public waste company in 2023—have drastically improved the situation. Nevertheless, isolated cases of illegal dumping persist in some small settlements. One of the project's pilot sites was a former illegal dump successfully rehabilitated using energy forest cultivation, illustrating the potential for innovative reclamation practices.

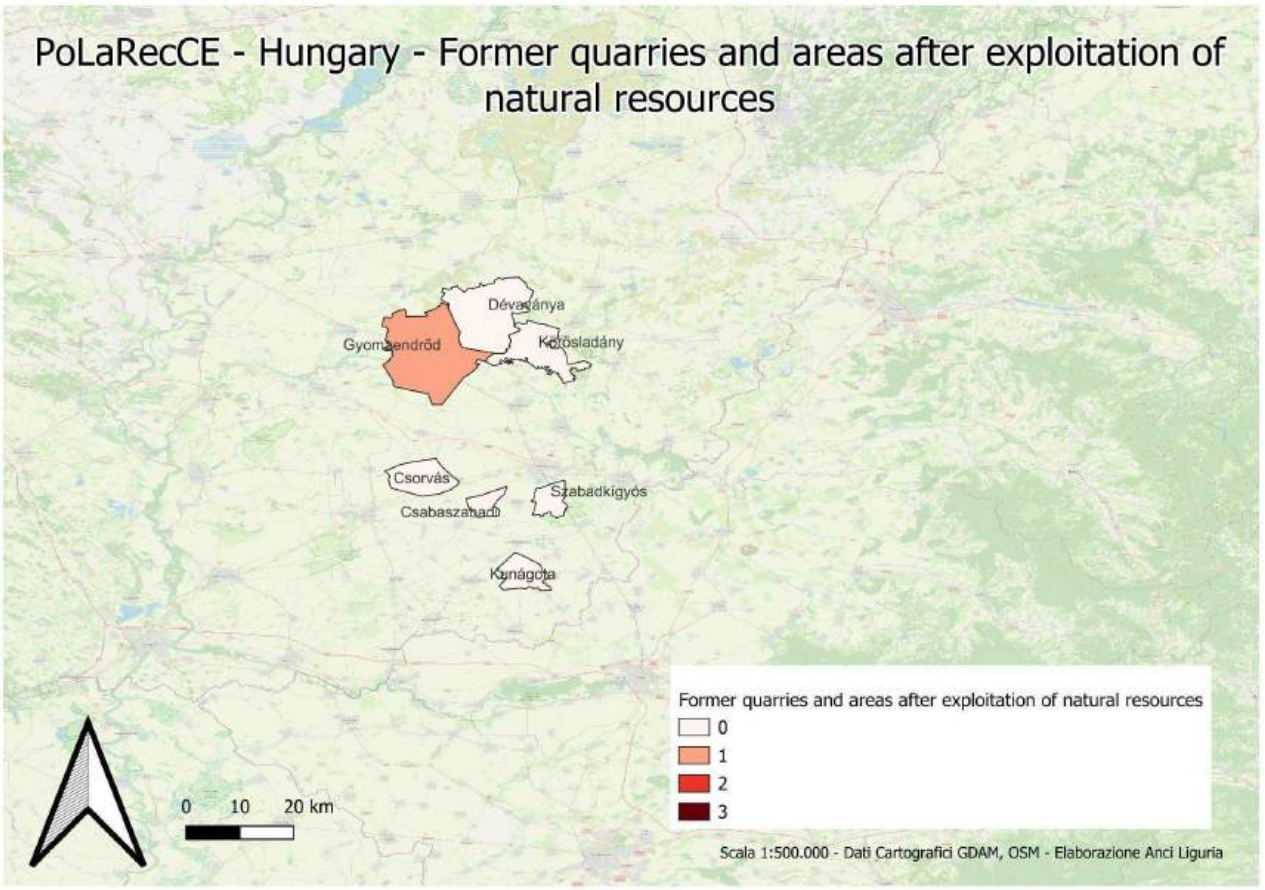

Fig. 81 - Former quarries and areas after exploitation of natural resources - HUN

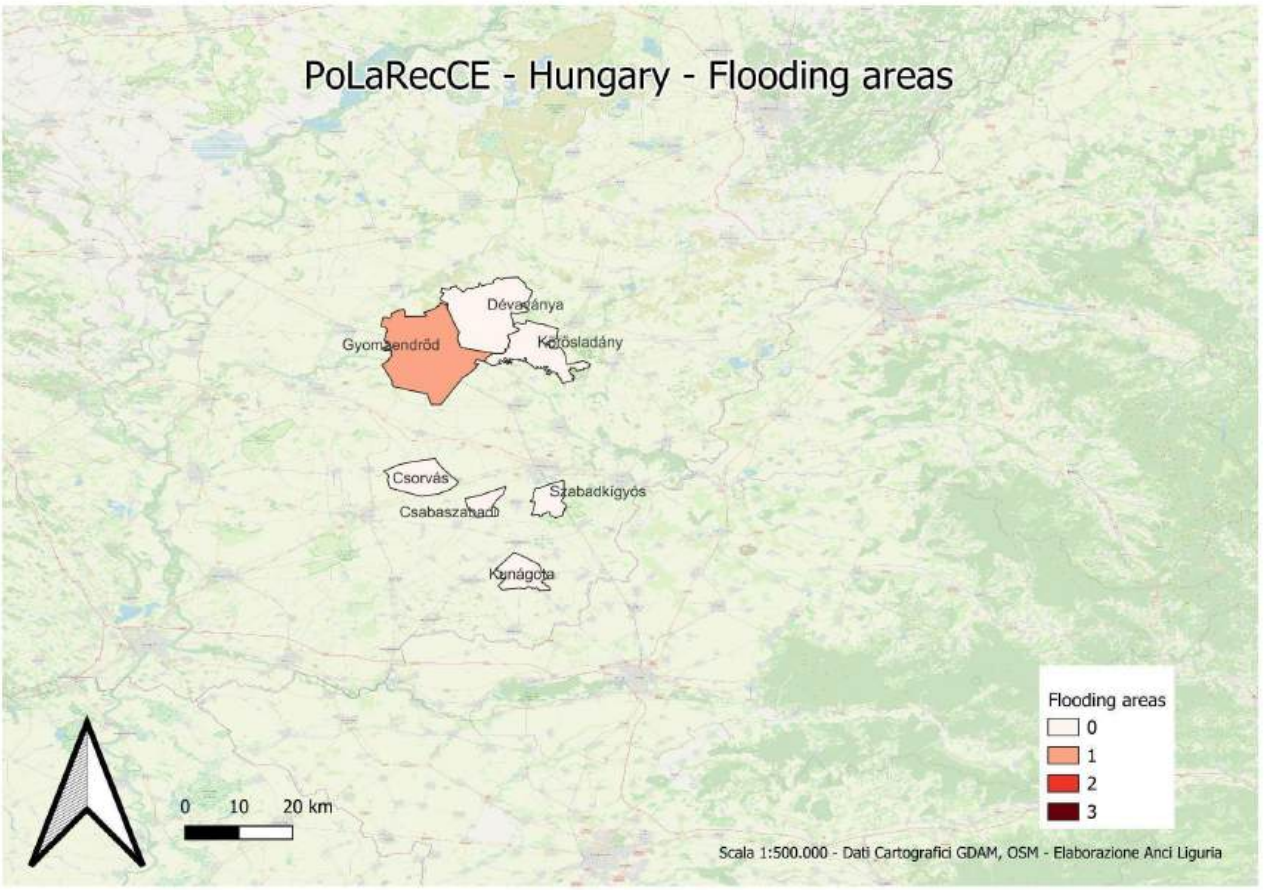

Fig. 83 - Flooding areas - HUN

Flooding Areas

While significant portions of Békés County are officially designated as flood-prone, these zones are mostly protected natural areas with restrictions on agriculture and industry. Large-scale flood protection systems constructed along the Körös and Maros rivers have effectively reduced the frequency of major floods. However, these interventions have also altered hydrological balances, contributing to soil desiccation and a lowering of groundwater levels, with serious consequences for agriculture and forestry.

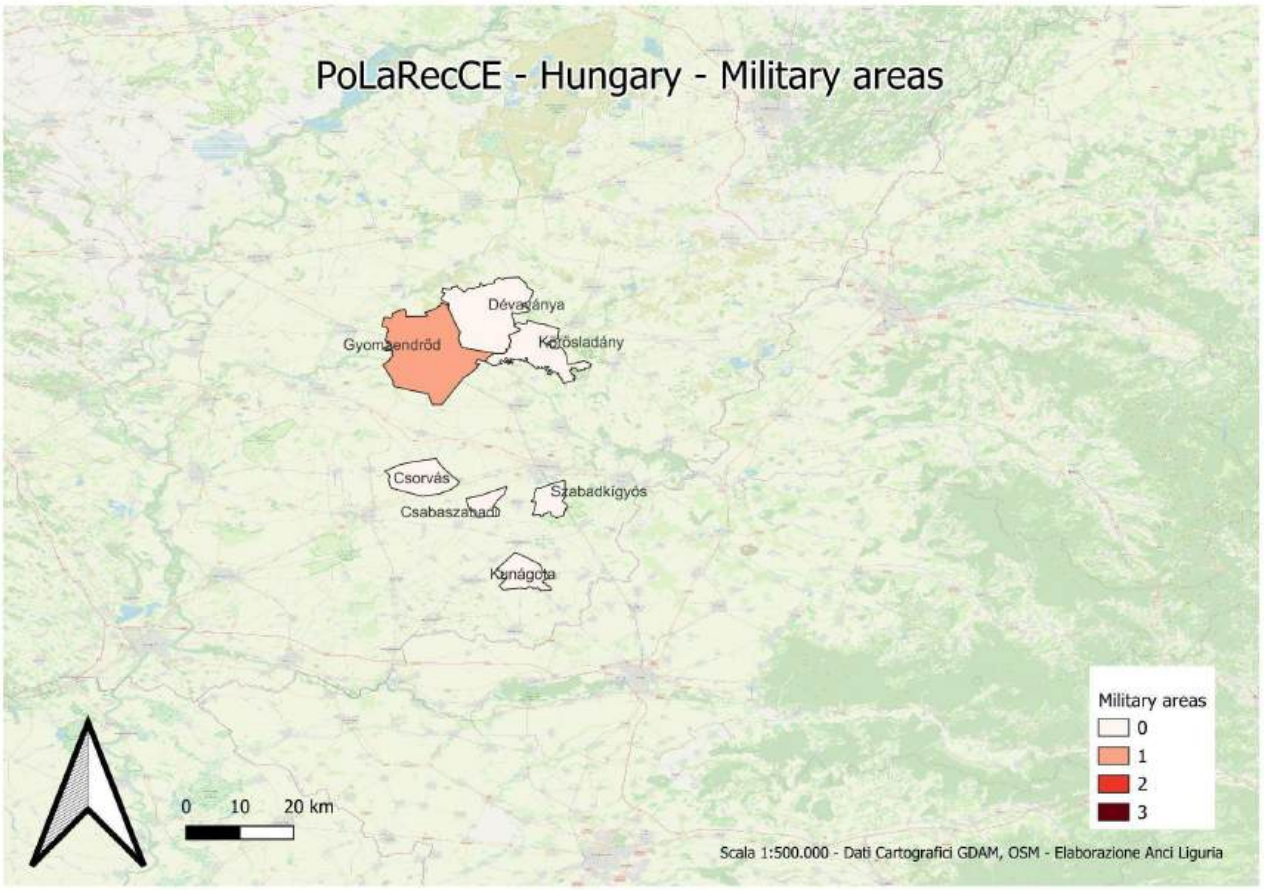

Fig. 84 - Military areas - HUN

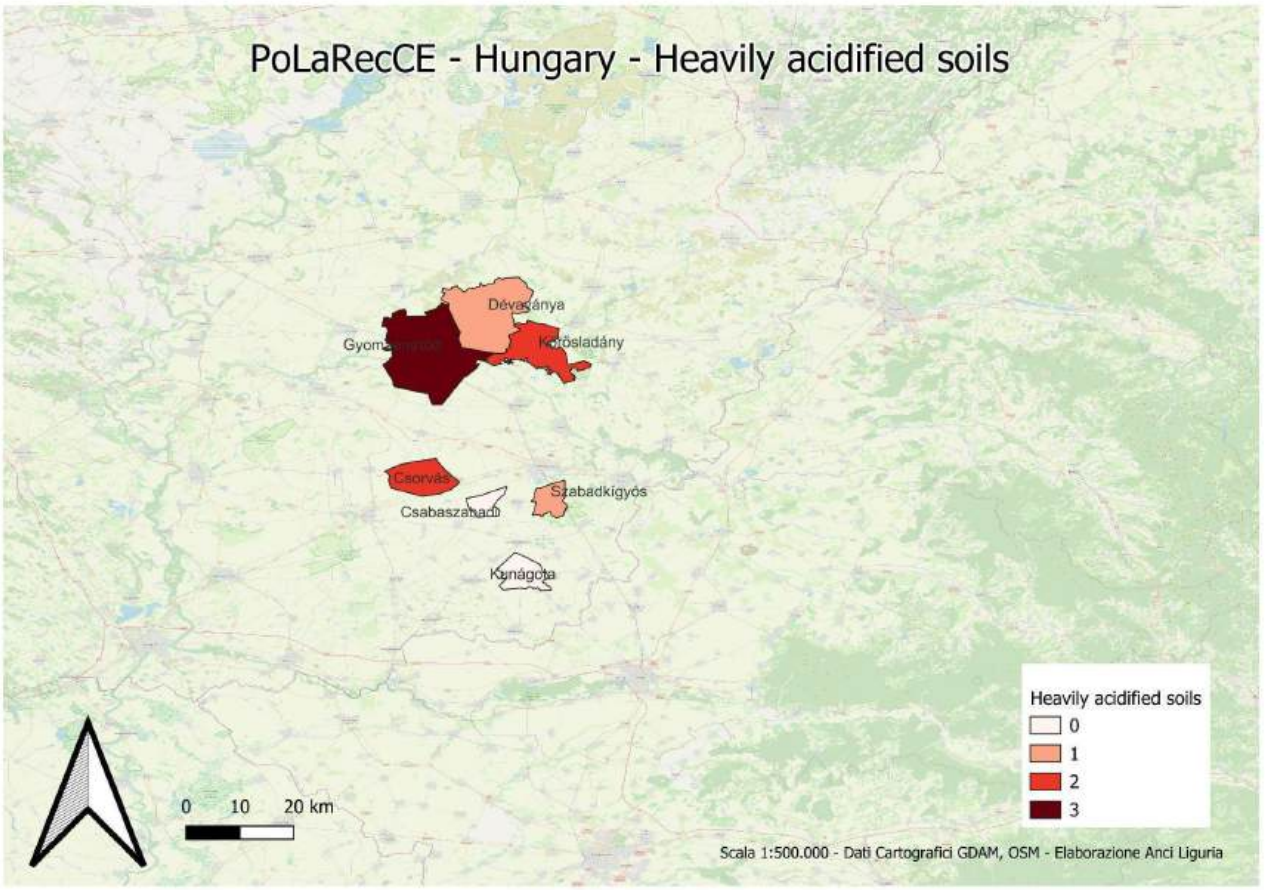

Fig. 85 - Heavily acidified soils - HUN

Heavily Acidified Soils

Acidification was reported as a significant issue, particularly in intensively cultivated areas where fertilizers and pesticides have been applied over decades. In Gyomaendrőd, heavily acidified soils were estimated to affect more than 200 km², representing one of the most extensive forms of degradation in the county.

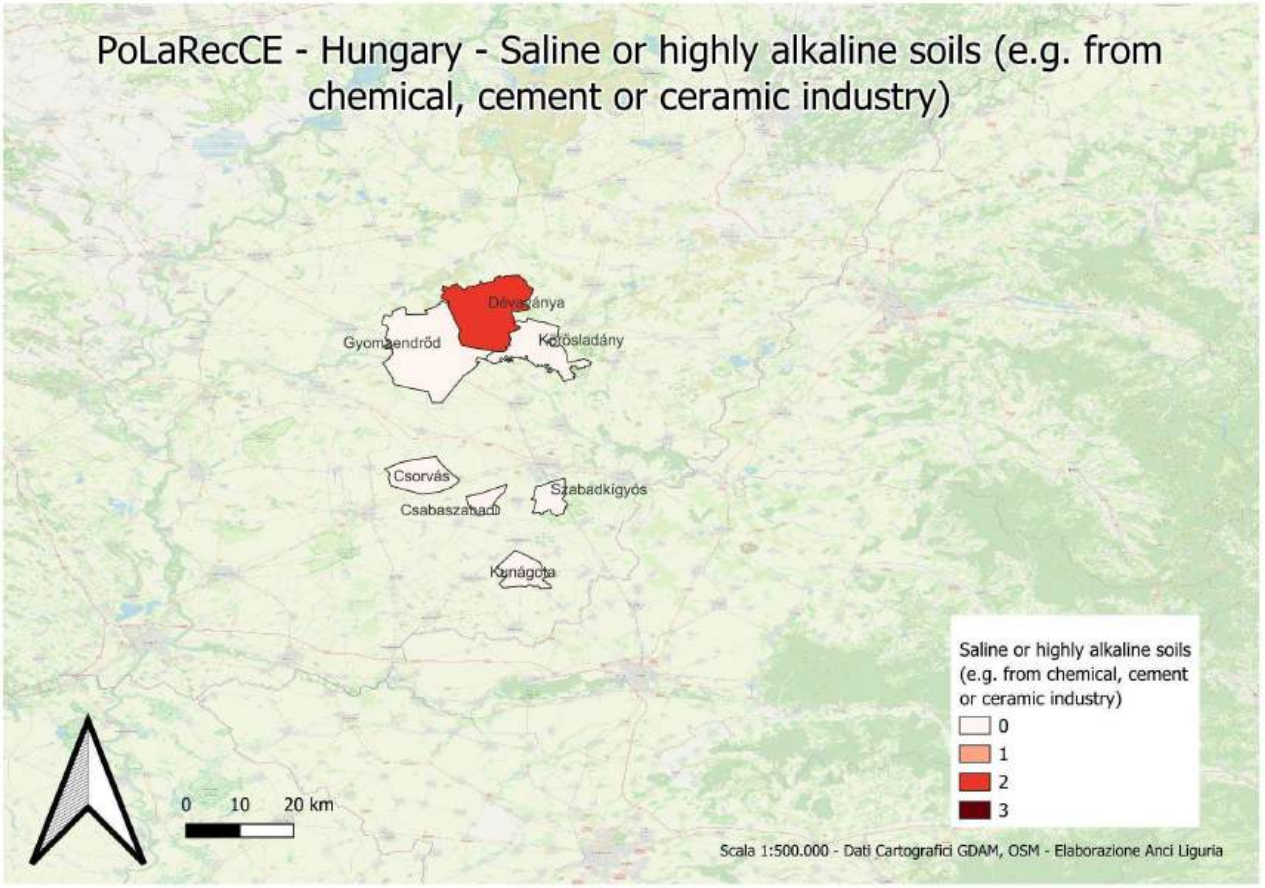

Fig. 86 - Saline or highly alkaline soils (e.g. from chemical, cement or ceramic industry) - HUN

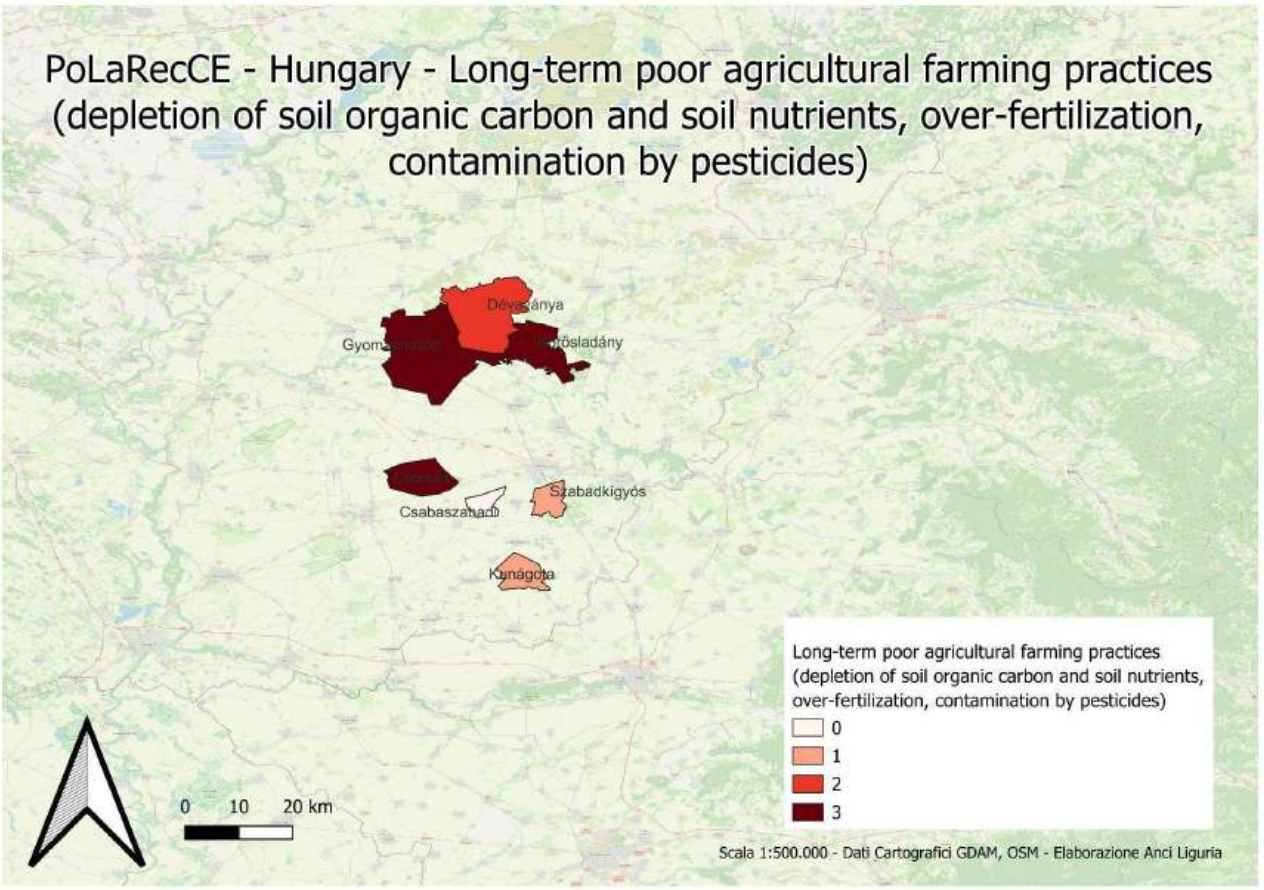

Fig. 87 - Long-term poor agricultural farming practices - HUN

Poor Agricultural Practices

Closely linked to acidification, poor agricultural practices—including depletion of soil organic matter, over-fertilization, and pesticide contamination—were highlighted as critical problems. In Gyomaendrőd, these practices were assessed at the highest level of severity (level 3), affecting a surface area comparable to that impacted by acidification. The findings reflect the long-term exploitation of agricultural land, much of which has been cultivated since the Middle Ages or after the river regulation works of the late 19th century.

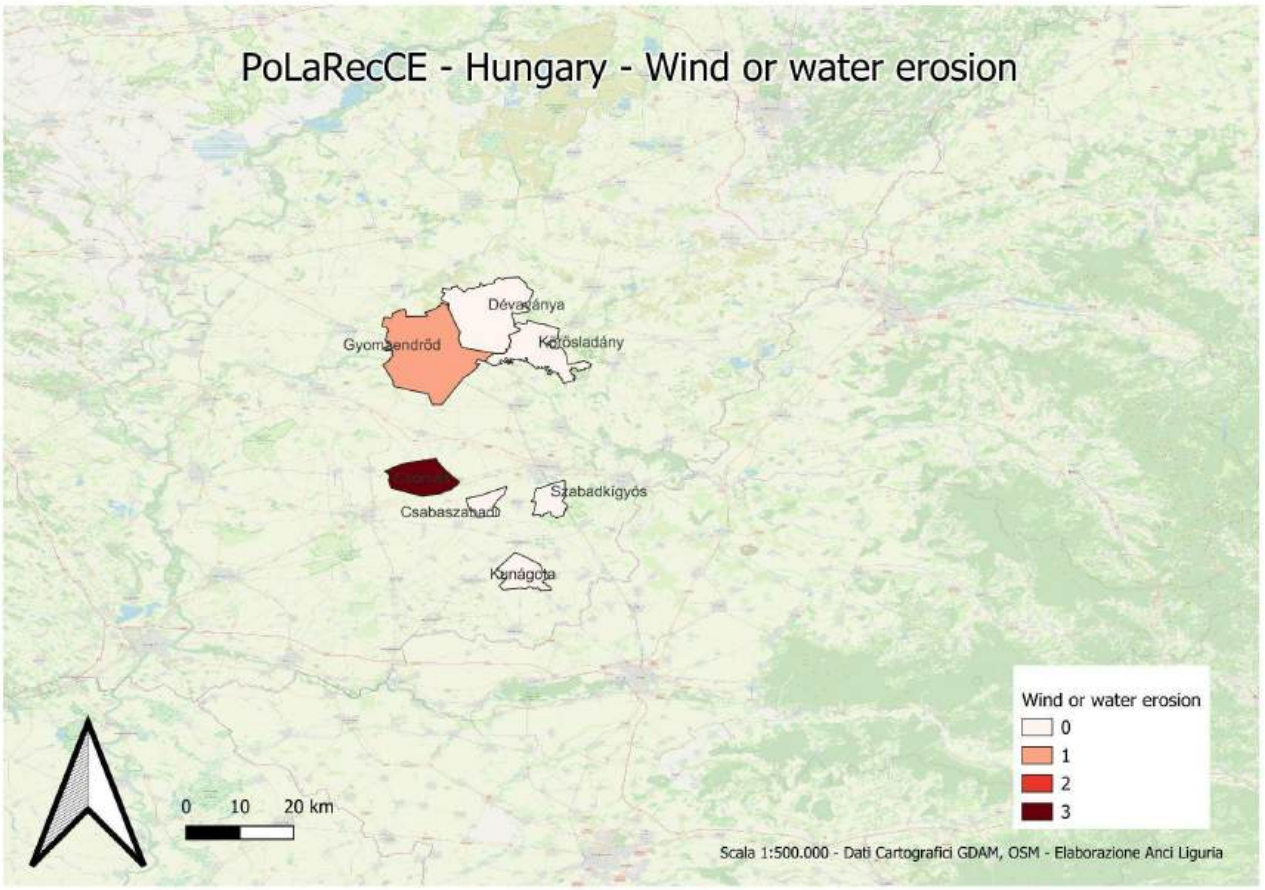

Fig. 88 - Wind or water erosion - HUN

Wind and Water Erosion

The drying climate, high summer temperatures, and declining groundwater levels have increased susceptibility to erosion. Farmers in the county reported that soils have become dusty and fragile, with reduced capacity to retain water. Although erosion was not quantified in the survey as a widespread problem, interviews revealed strong concerns about its growing impact under climate change.

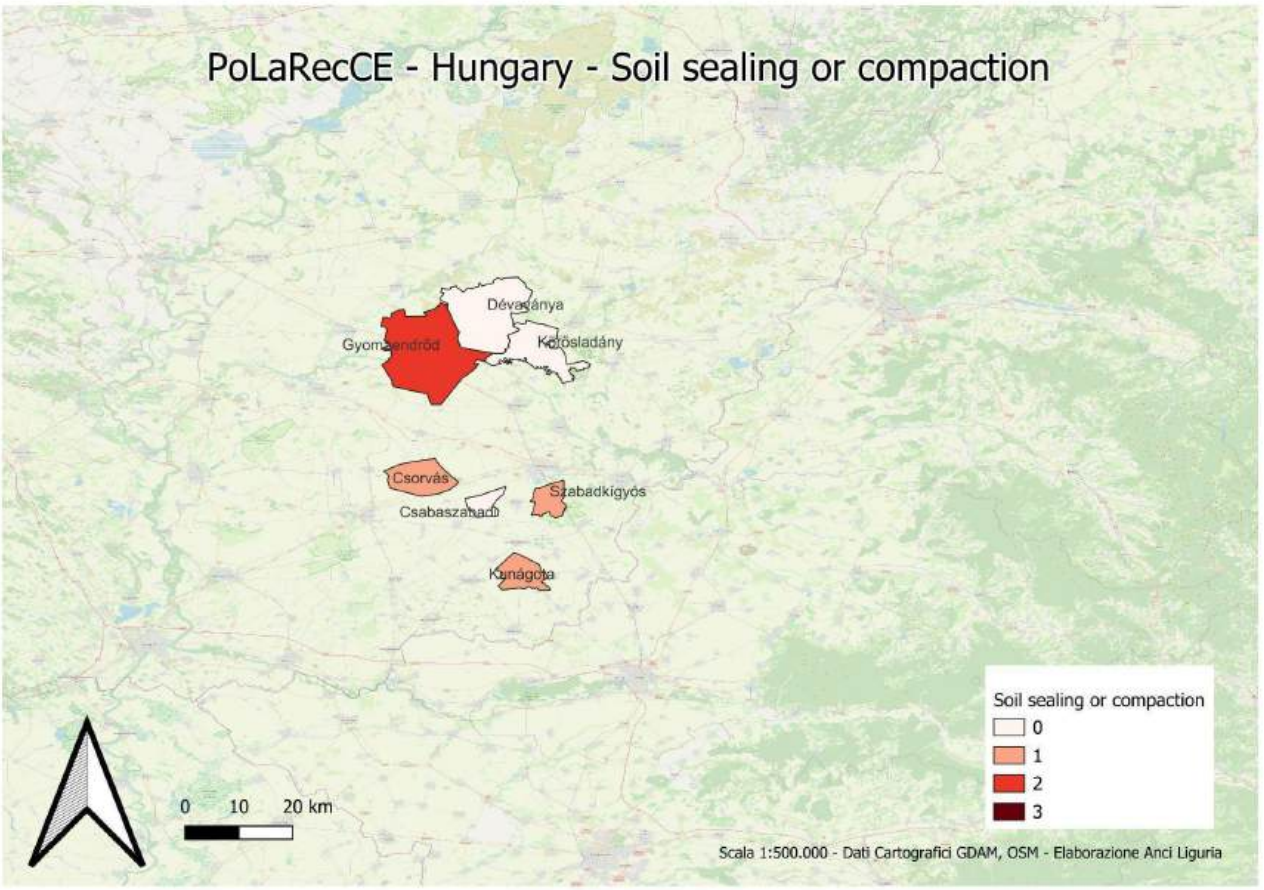

Fig. 89 - Soil sealing or compaction - HUN

Soil Sealing and Compaction

Urbanized areas in Békés County are relatively small, but soil compaction is a recurring problem in towns such as Gyomaendrőd. Roads, yards, and unpaved urban surfaces were reported as degraded, illustrating the vulnerability of soils to urban land uses even in predominantly rural regions.

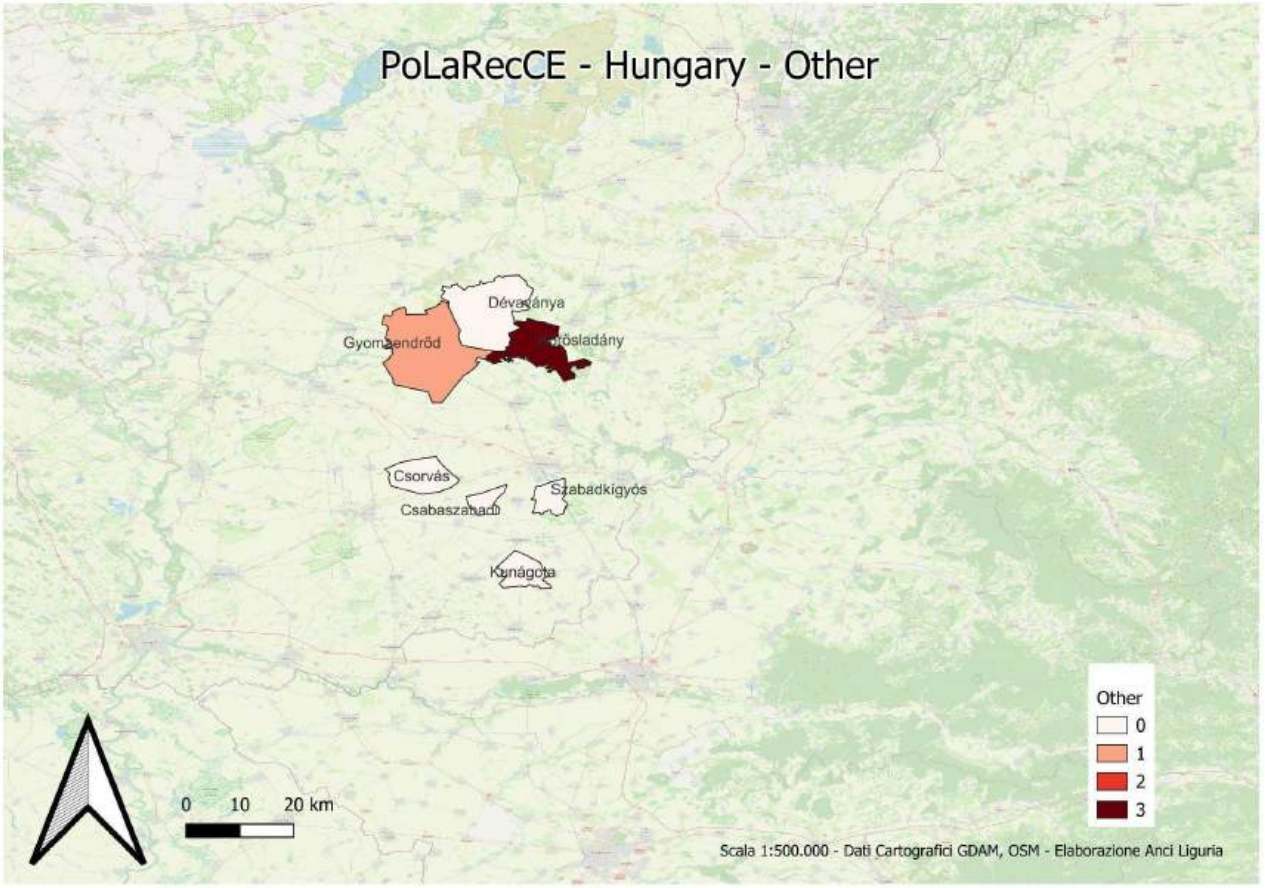

Fig. 90 - Other - HUN

Other Issues

The overarching concern in Békés County is soil desiccation and groundwater depletion. Farmers and municipalities alike expressed anxiety over the drying of soils and the difficulties posed by extreme droughts. A focus group with local farmers highlighted interest in solutions such as agroforestry (tree rows and alleys), soil aeration, and reduced tillage, though knowledge and technical support remain limited. Municipalities acknowledged that their own land (e.g., parks, roadside areas, small agricultural plots) could be managed more sustainably but also recognized a lack of expertise.

Synthesis

The results from Békés County paint a picture of soils under severe stress from climatic change and long-term agricultural intensification. Acidification, nutrient depletion, and soil desiccation stand out as the most pressing issues, threatening both productivity and ecological balance. The case of Gyomaendrőd illustrates the convergence of multiple forms of degradation, making it a key site for pilot interventions. More broadly, the survey underlines the need for knowledge

transfer and demonstration of practical soil protection measures, both for municipalities and for the farming community, which remains central to land stewardship in the Great Hungarian Plain.

3.6. Results in Austria

The survey in Austria focused on Carinthia, the southernmost province and location of the project's pilot site in Arnoldstein. Questionnaires were distributed to all 132 municipalities, with 48 responses collected (36% response rate). This represents one of the most comprehensive regional datasets of the survey and provides a detailed picture of soil degradation in a predominantly mountainous but industrially active region.

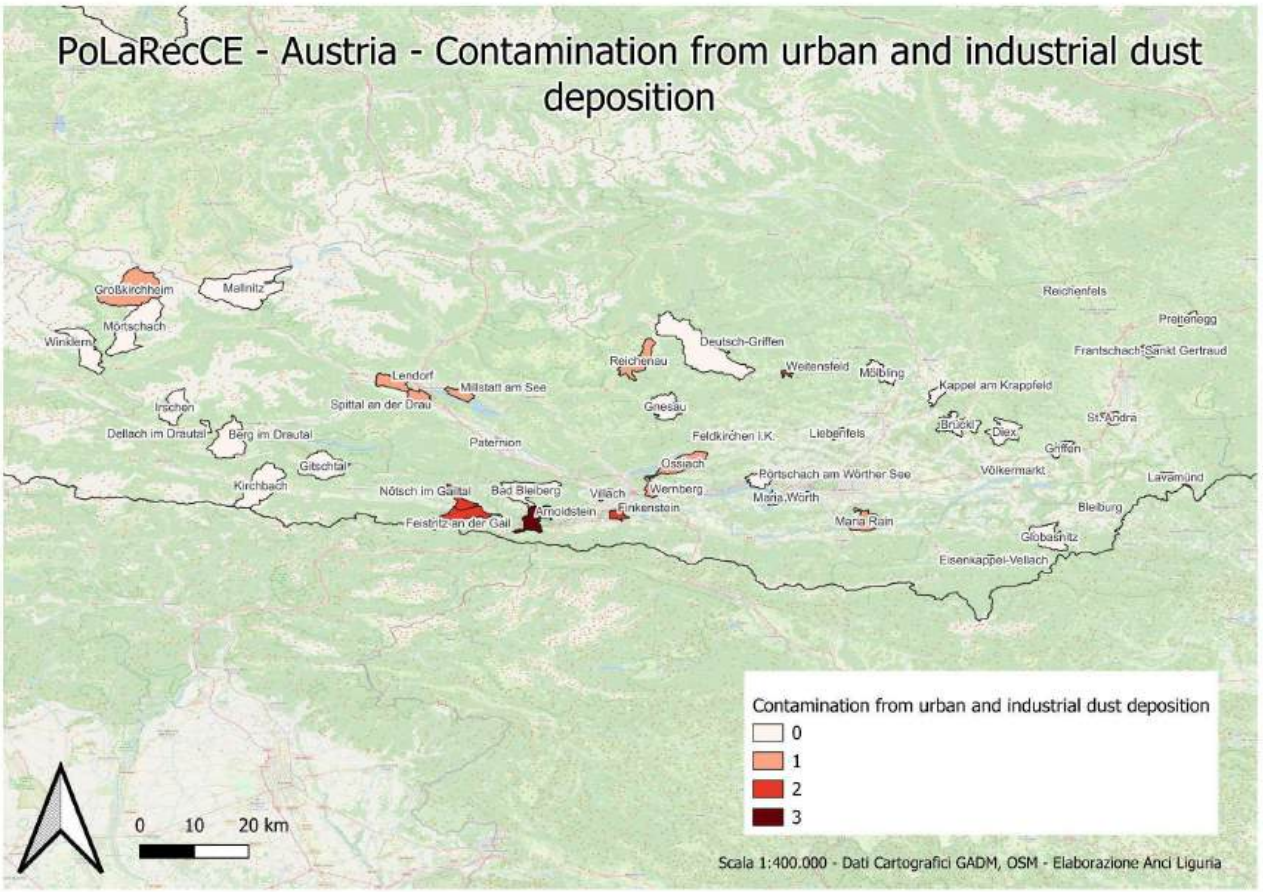

Fig. 91 - Contamination from urban and industrial dust deposition - AUT

Urban and Industrial Dust Deposition

Contamination from industrial and urban dust emerged as a recurrent issue. Several municipalities—including Lavamünd, Nötsch im Gailtal, St. Gertraud, Weitensfeld, Finkenstein, and Feistritz an der Gail—reported medium levels of concern, often affecting several square kilometers. The most critical case was Arnoldstein, where around 50% of the municipal territory is considered contaminated, largely due to its industrial history.

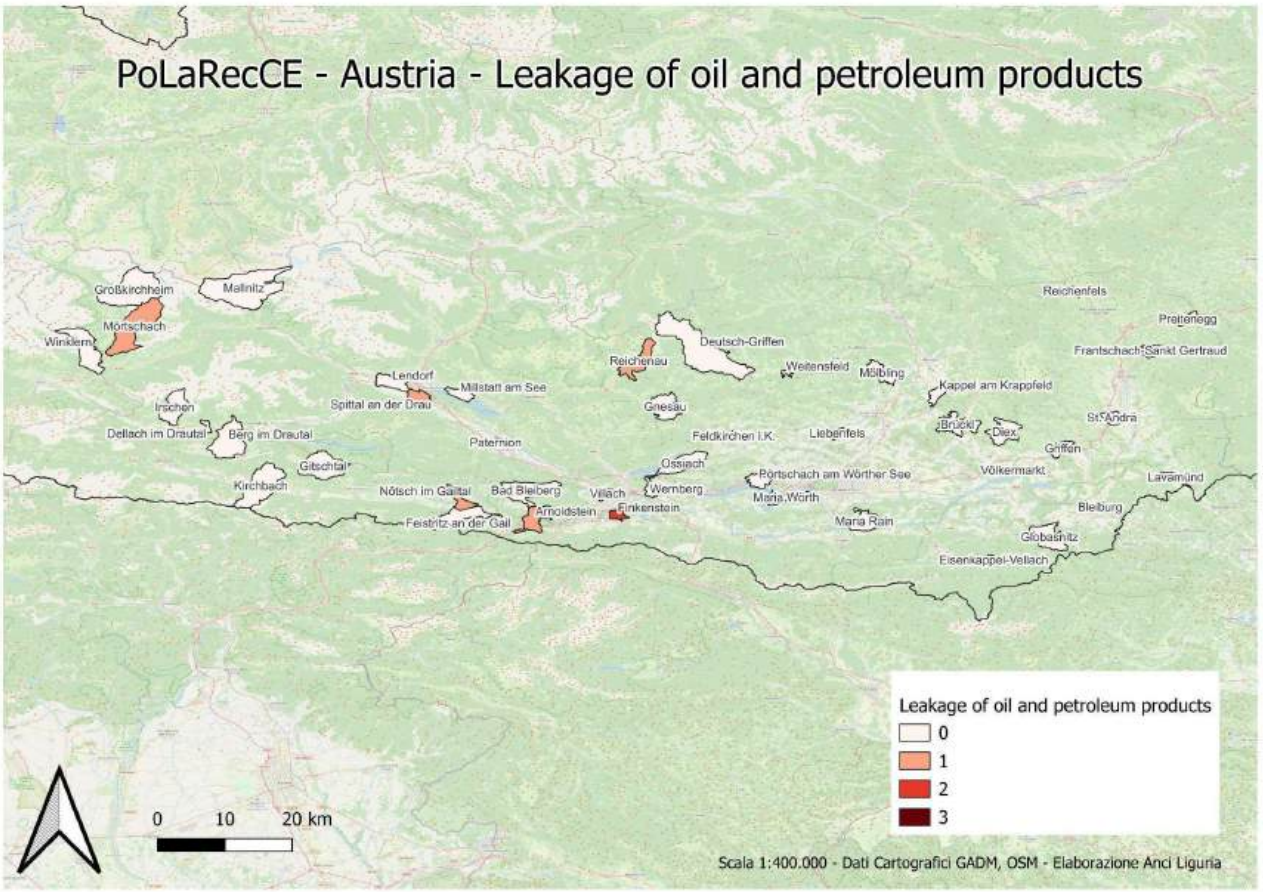

Fig. 92 - Leakage of oil and petroleum products - AUT

Leakage of Oil and Petroleum Products

Oil-related contamination was mentioned in St. Gertraud and Finkenstein. While not extensive, these cases point to localized vulnerabilities linked to industrial activities and transport infrastructures.

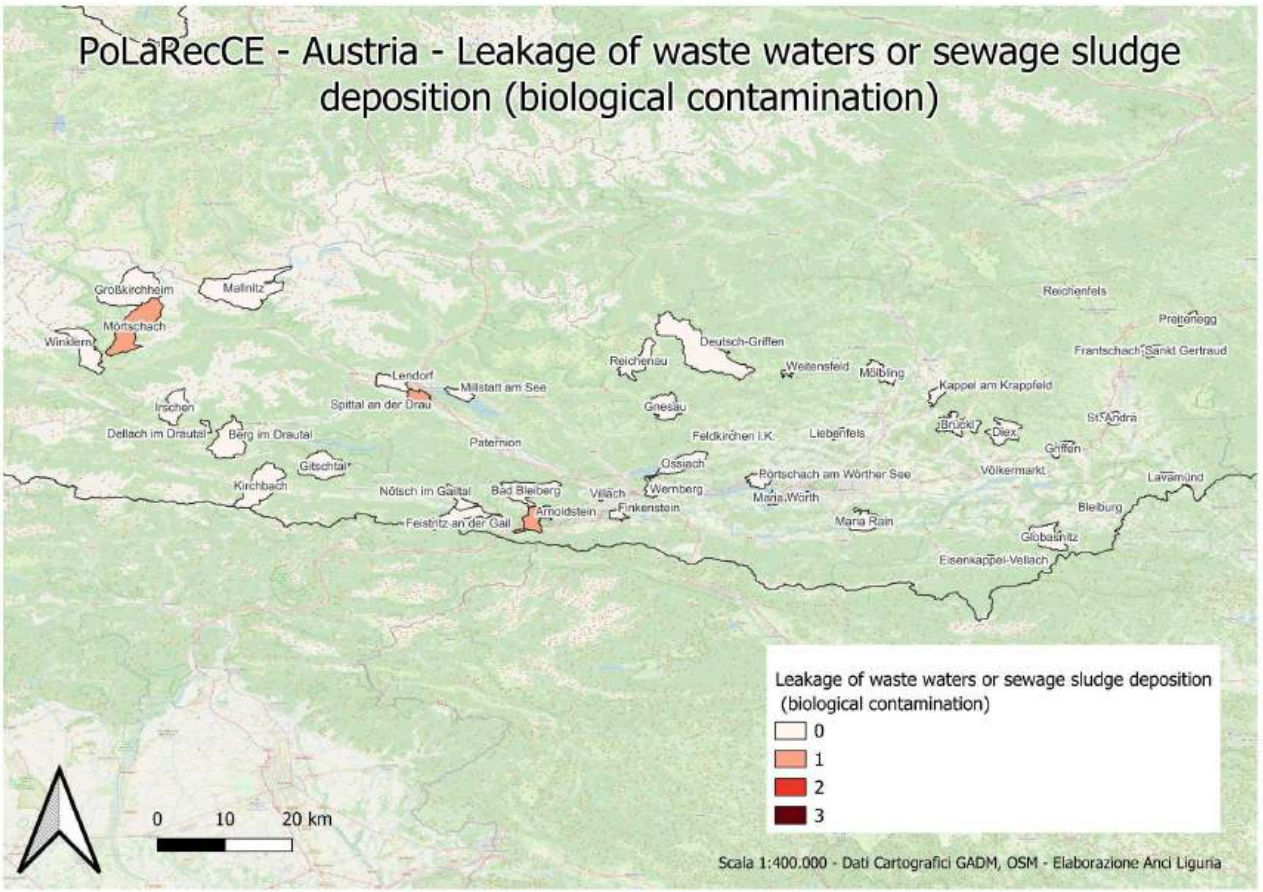

Fig. 93 - Leakage of waste waters or sewage sludge deposition (biological contamination) - AUT

Leakage of Wastewater and Sewage Sludge Deposition

No significant problems related to wastewater leakage were reported, reflecting the generally high standards of wastewater treatment in Austria.

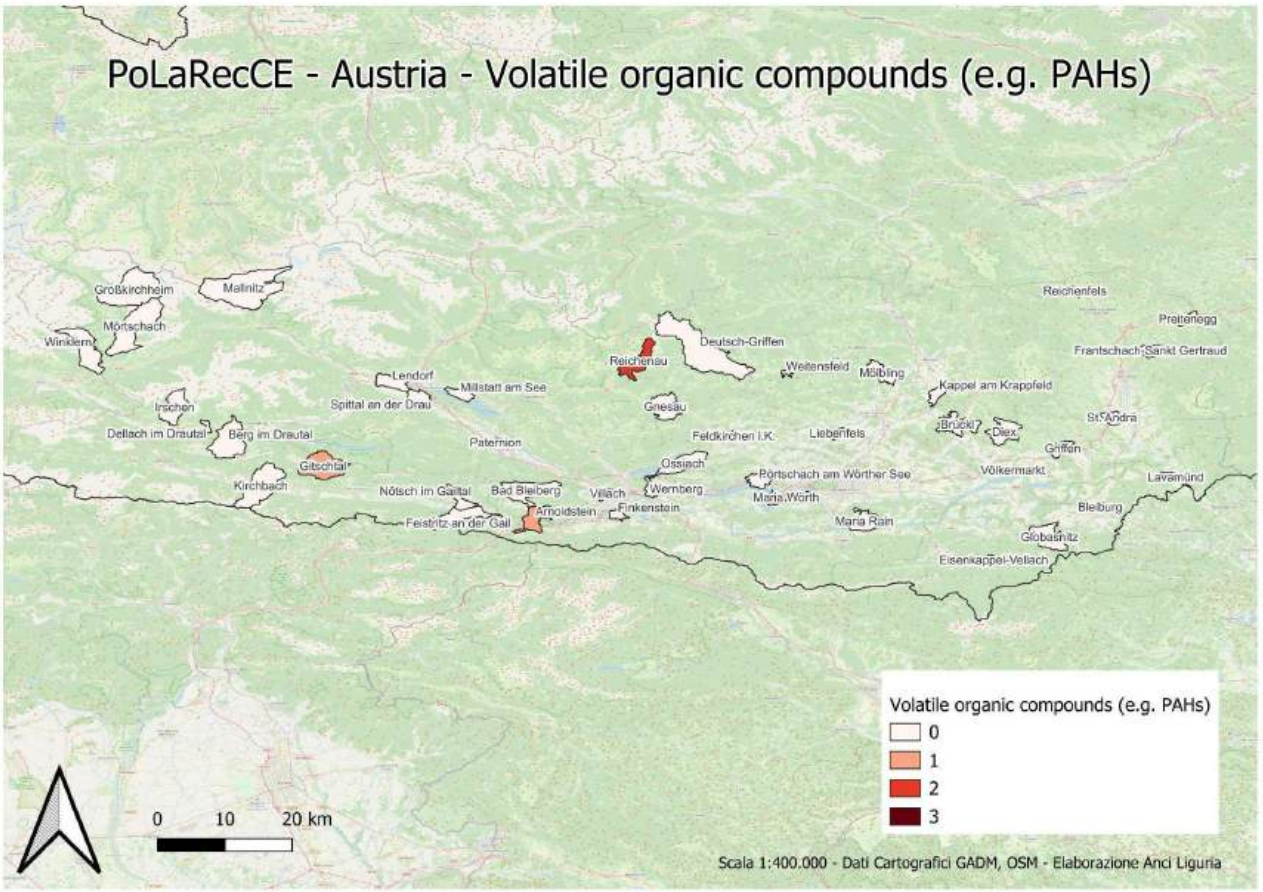

Fig. 94 - Volatile organic compounds (e.g. PAHs) - AUT

Volatile Organic Compounds (VOCs, PAHs)

Ebene Reichenau reported a medium-level problem with organic contaminants, estimated to affect 30 km². This represents the most notable case of VOC-related degradation in the Austrian dataset.

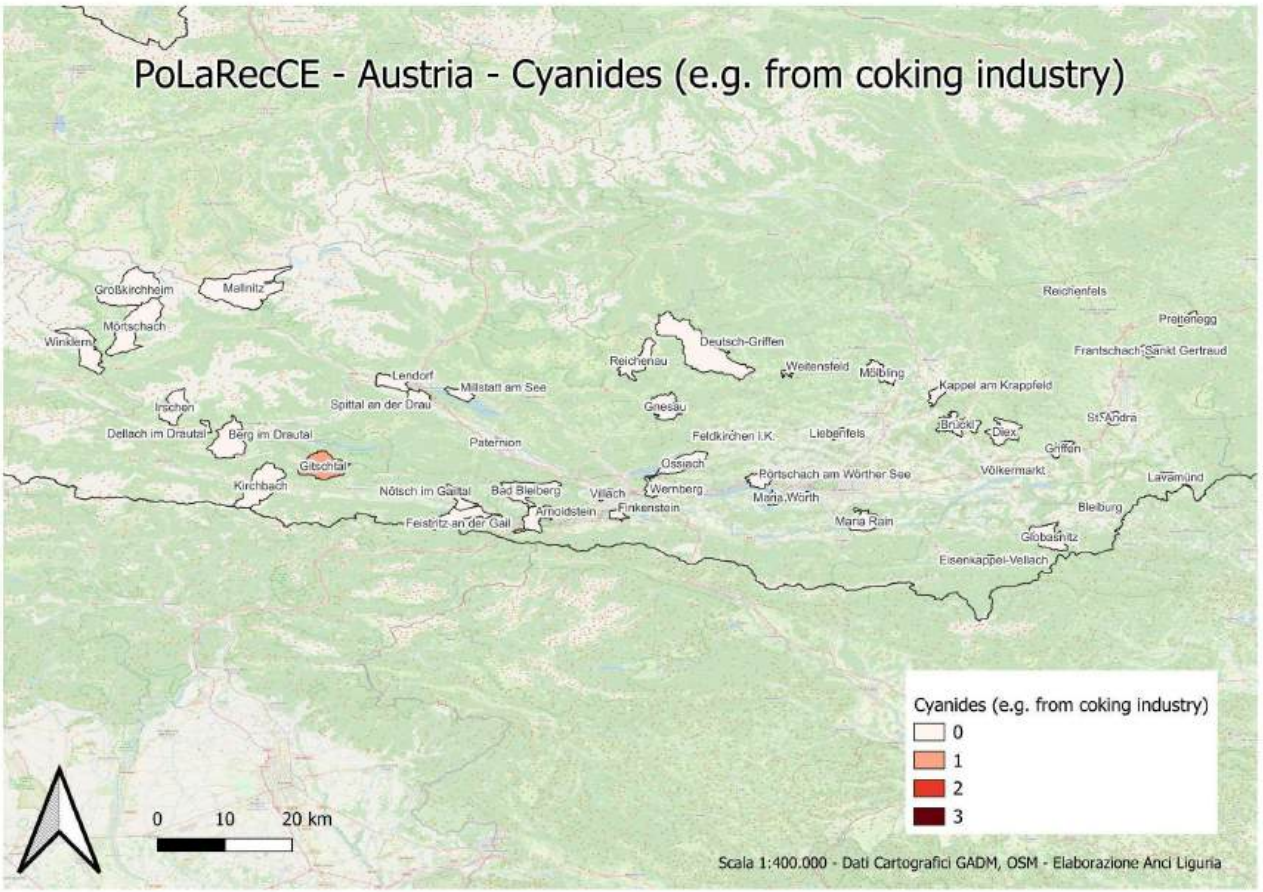

Fig. 95 - Cyanides (e.g. from coking industry) - AUT

Cyanides

No cases of cyanide-related degradation were reported.

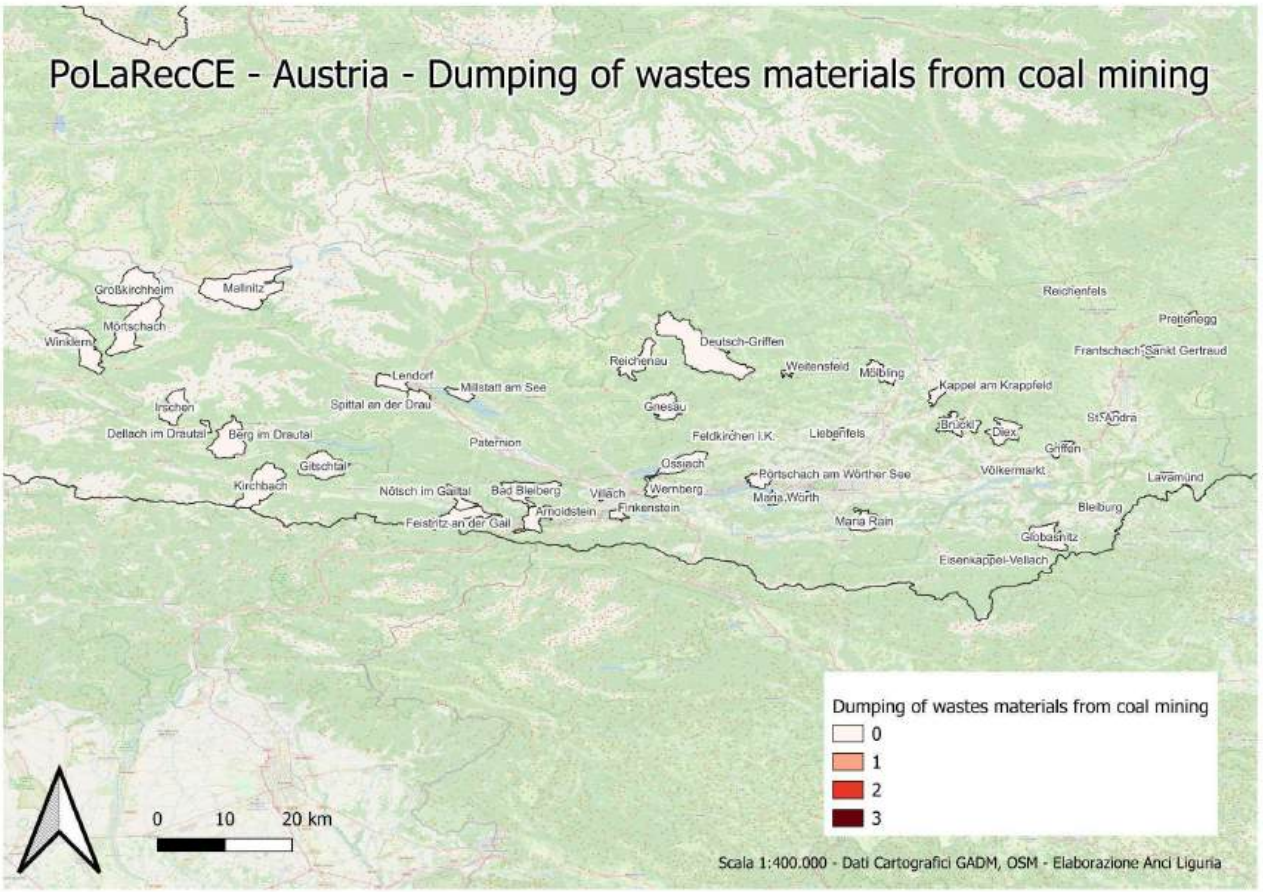

Fig. 96 - Dumping of wastes materials from coal mining - AUT

Dumping of Waste Materials from Coal or Ore Mining, and Ashes from Power Industry
These forms of degradation were not reported as relevant in Carinthia, confirming the limited role of extractive industries in the province.

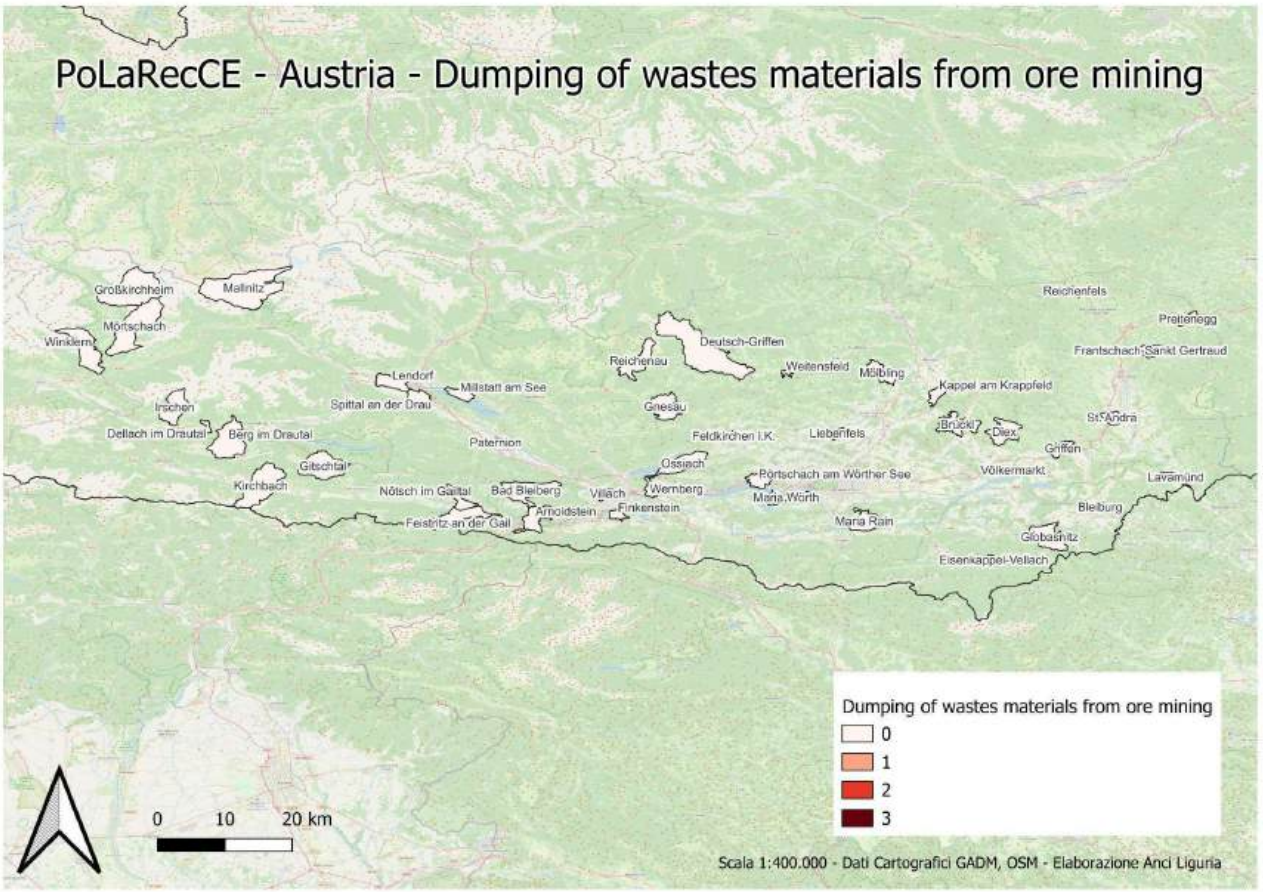

Fig. 97 - Dumping of wastes materials from ore mining - AUT

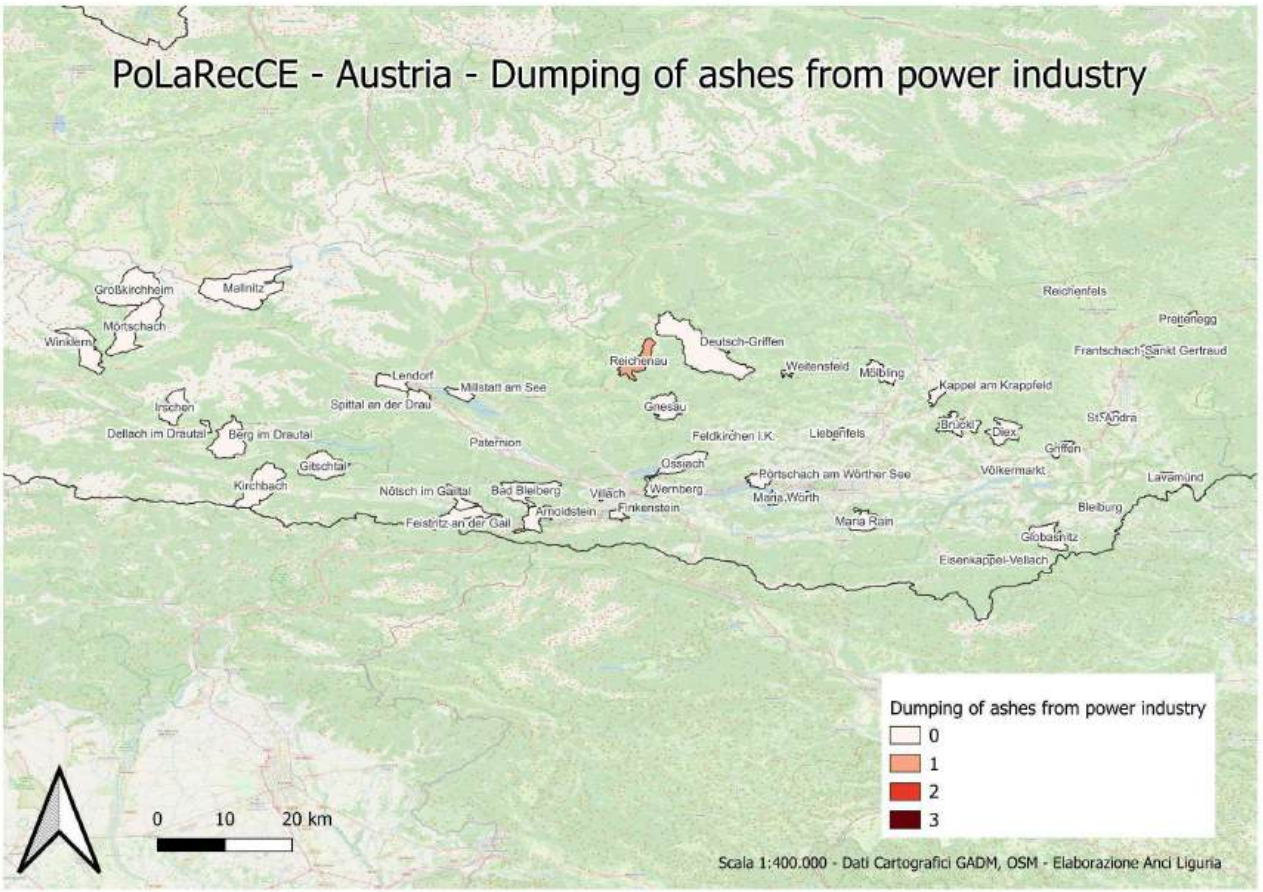

Fig. 98 - Dumping of ashes from power industry - AUT

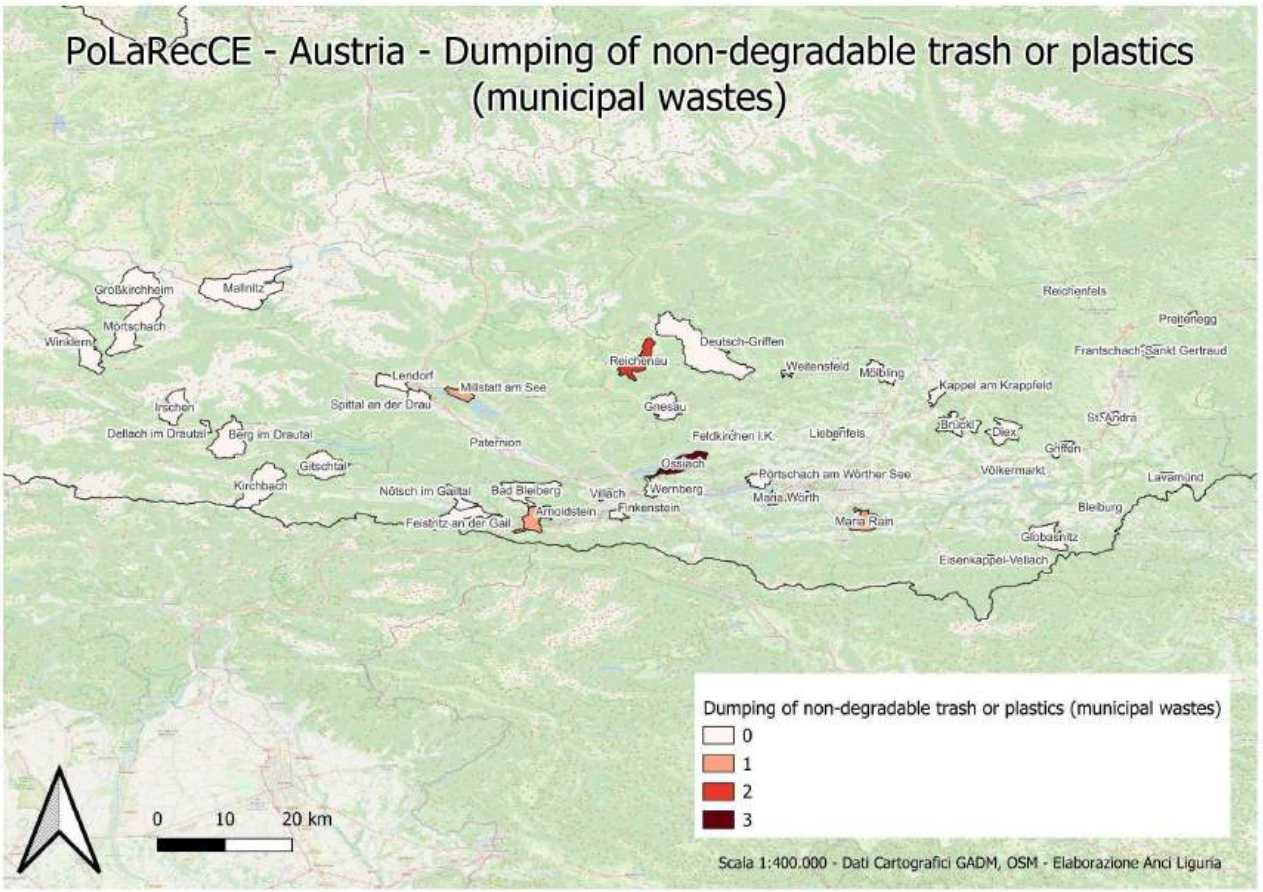

Fig. 99 - Dumping of non-degradeted trash or plastic (municipal wastes) - AUT

Dumping of Non-Degradable Trash or Plastics

Ebene Reichenau and Arnoldstein identified soil degradation caused by non-degradable waste and plastics. Although not widespread, these cases highlight the persistence of improper waste disposal even in regions with otherwise well-developed waste management systems.

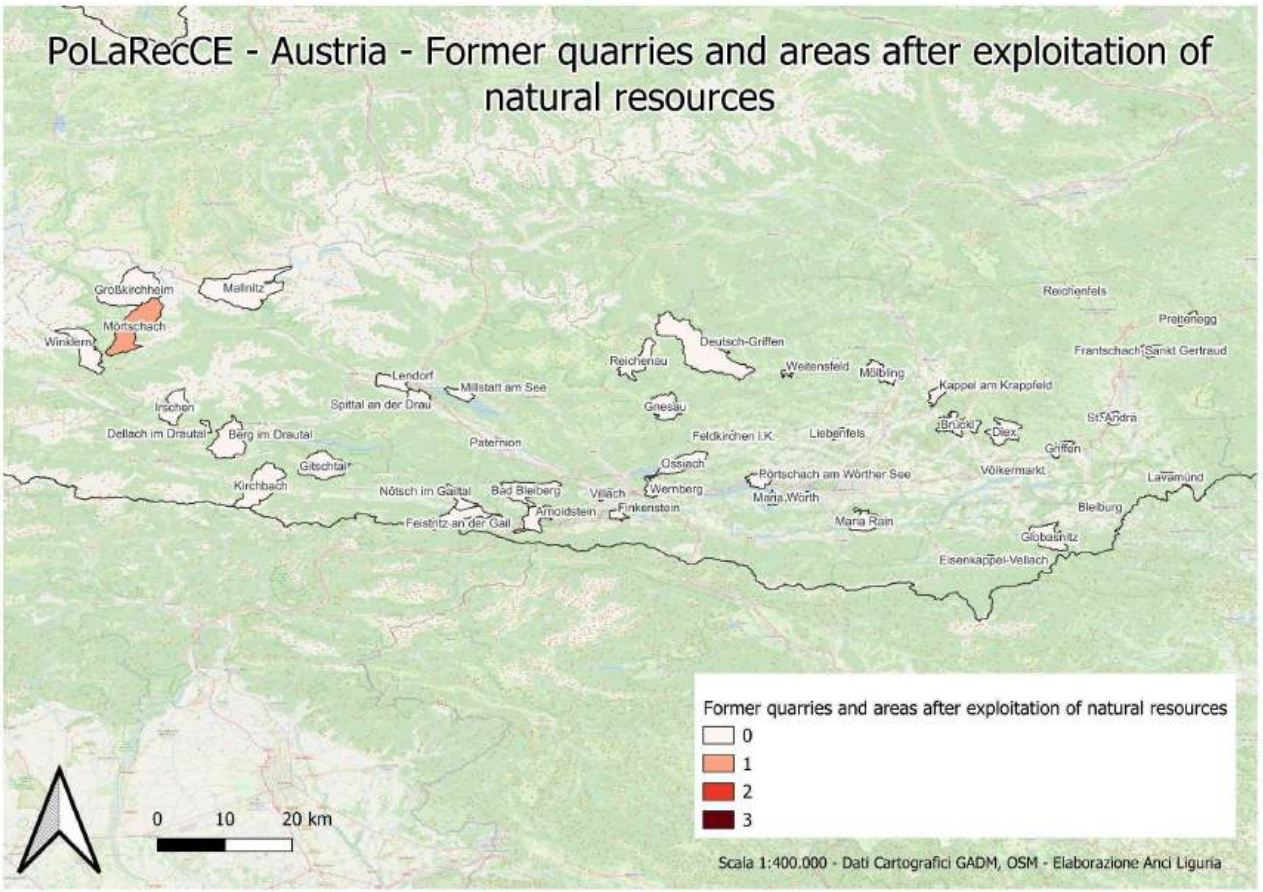

Fig. 100 - Former quarries and areas after exploitation of natural resources - AUT

Former Quarries and Resource Exploitation Areas

Paternion reported medium-level degradation linked to former quarries and resource extraction areas. While not a generalized issue, this finding illustrates how localized land uses can produce lasting impacts on soil quality.

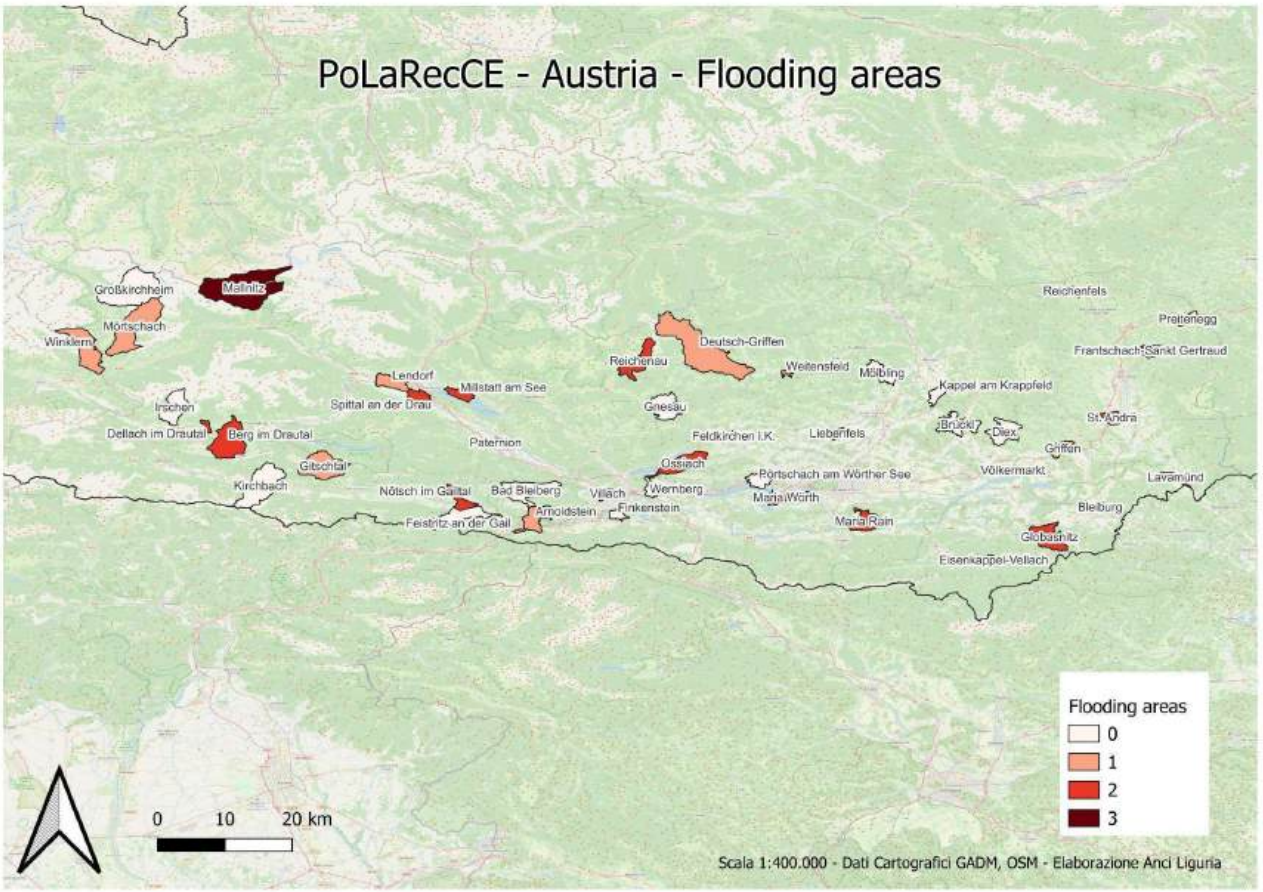

Fig. 101 - Flooding areas - AUT

Flooding Areas

Flooding emerged as one of the most widespread problems, mentioned by a large number of municipalities. Concern intensified after the severe floods of September 2024, which drew attention to the vulnerability of the region's soils to extreme hydrological events.

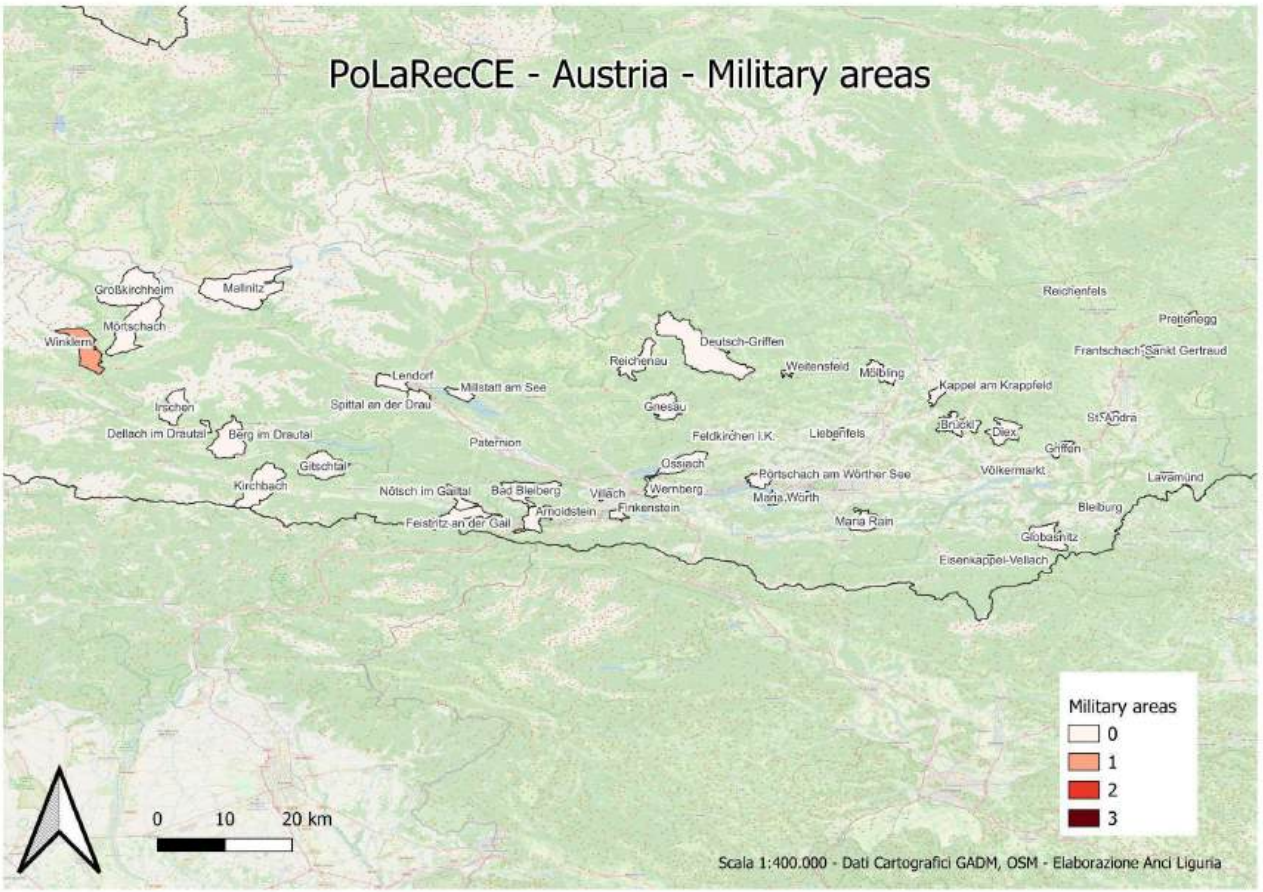

Fig. 102 - Military areas - AUT

Military Areas

Spittal an der Drau and Globasnitz reported the presence of military areas, though the associated soil degradation was assessed as low or negligible.

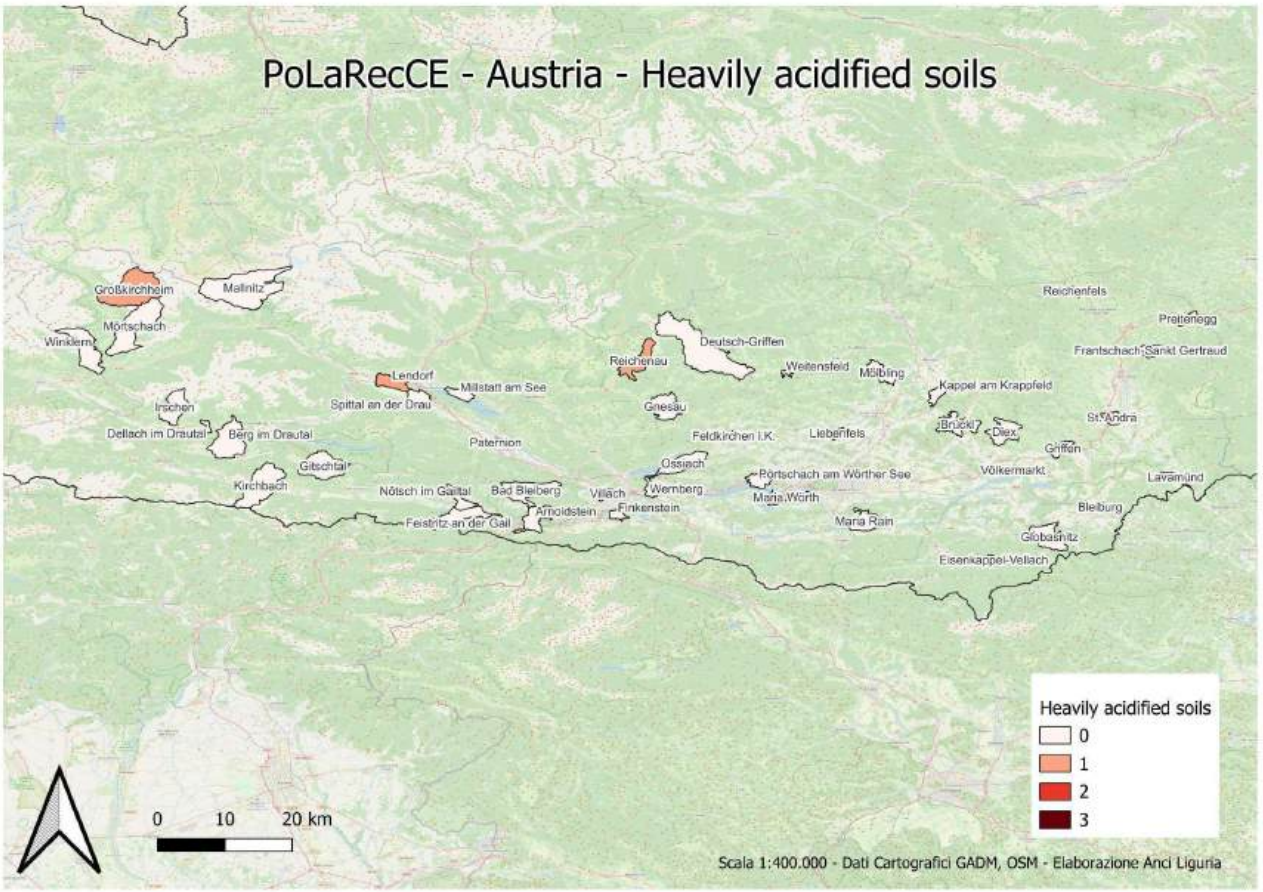

Fig. 103 - Heavily acidified soils - AUT

Heavily Acidified Soils

Ebene Reichenau reported heavily acidified soils affecting approximately 5 km². Other municipalities did not identify significant problems of acidification or alkalinization.

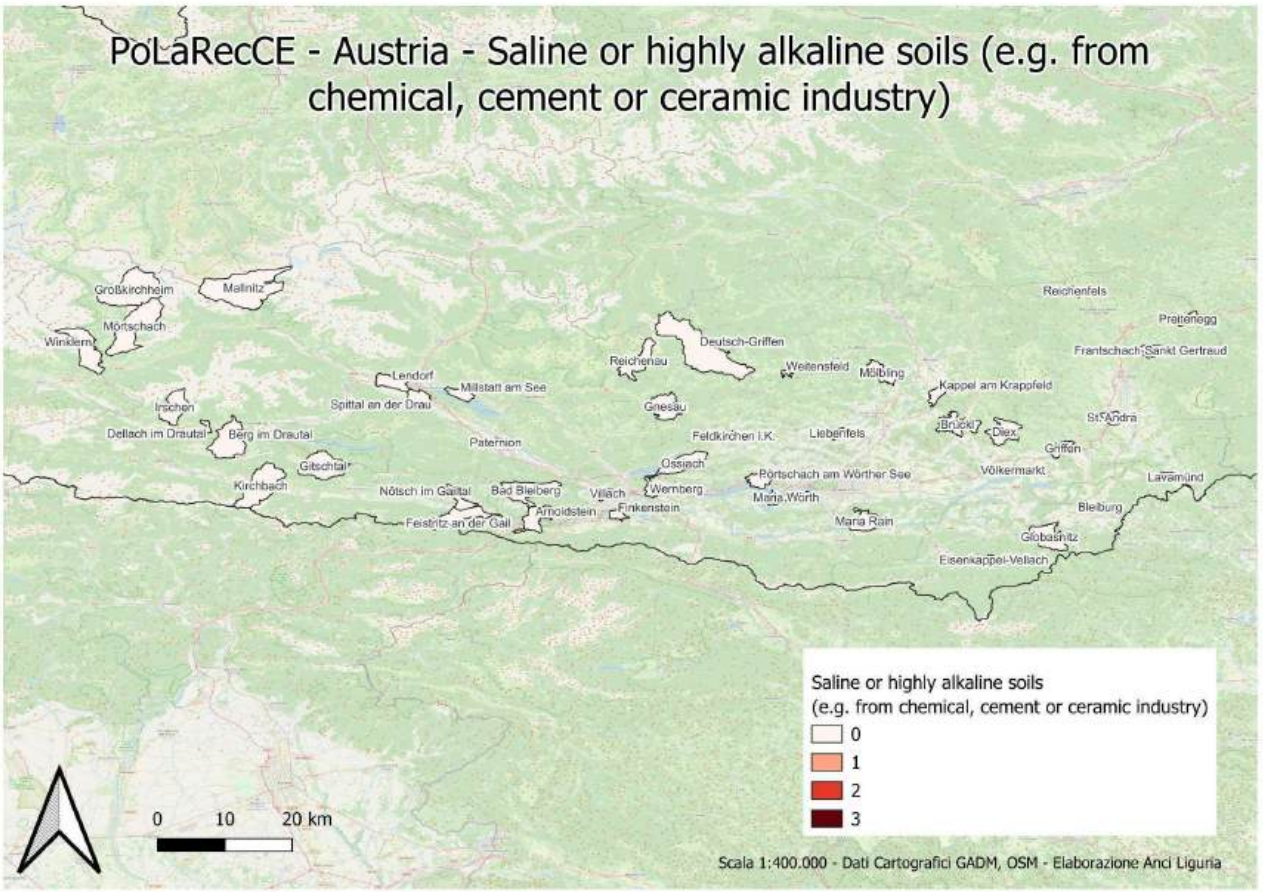

Fig. 104 - Saline or highly alkaline soils (e.g. from chemical, cement or ceramic industry) - AUT

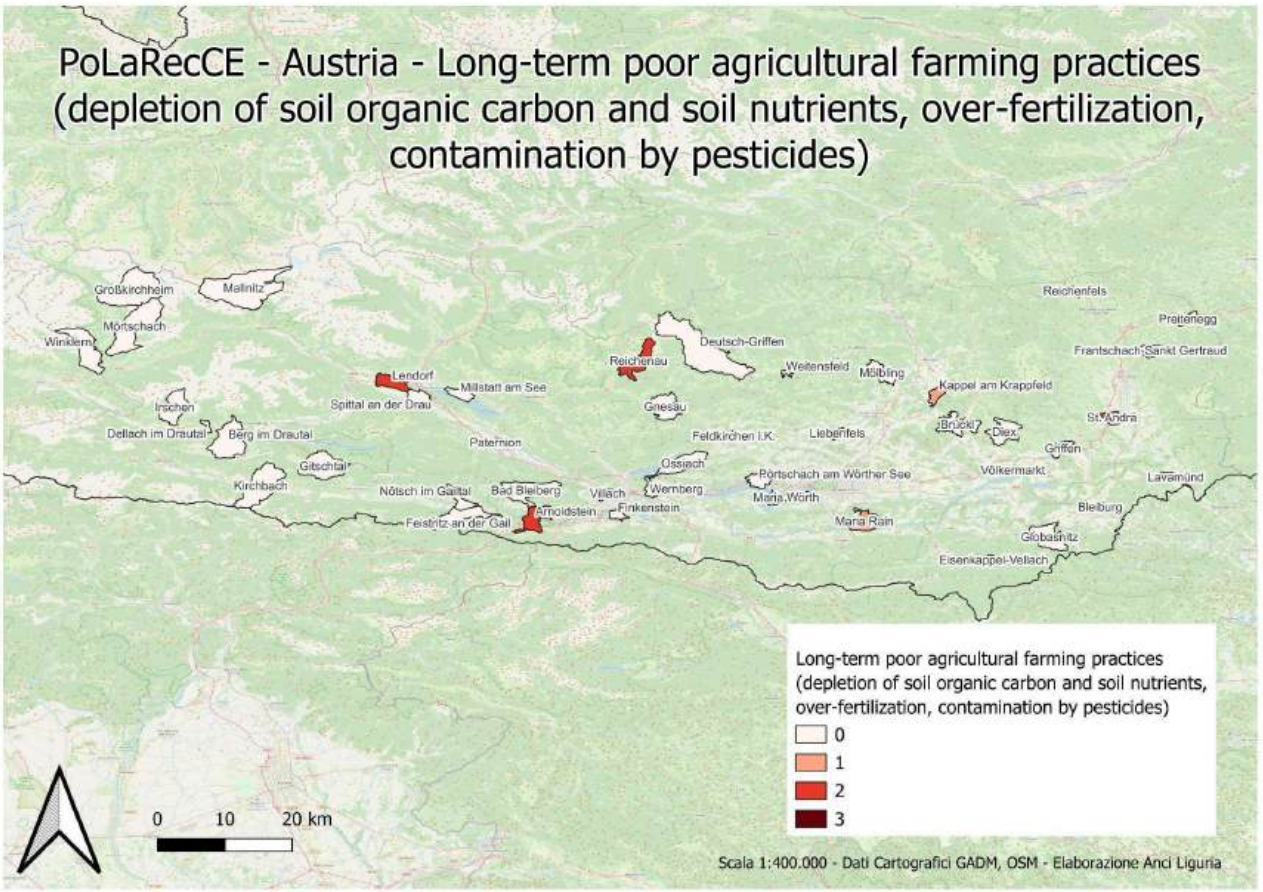

Fig. 105 - Long-term poor agricultural farming practices - AUT

Poor Agricultural Practices

Only a few municipalities mentioned soil degradation linked to poor farming practices. However, this likely underestimates the problem, as nutrient depletion, pesticide contamination, and fertilizer-related impacts (such as nitrate leaching) are well documented across Europe.

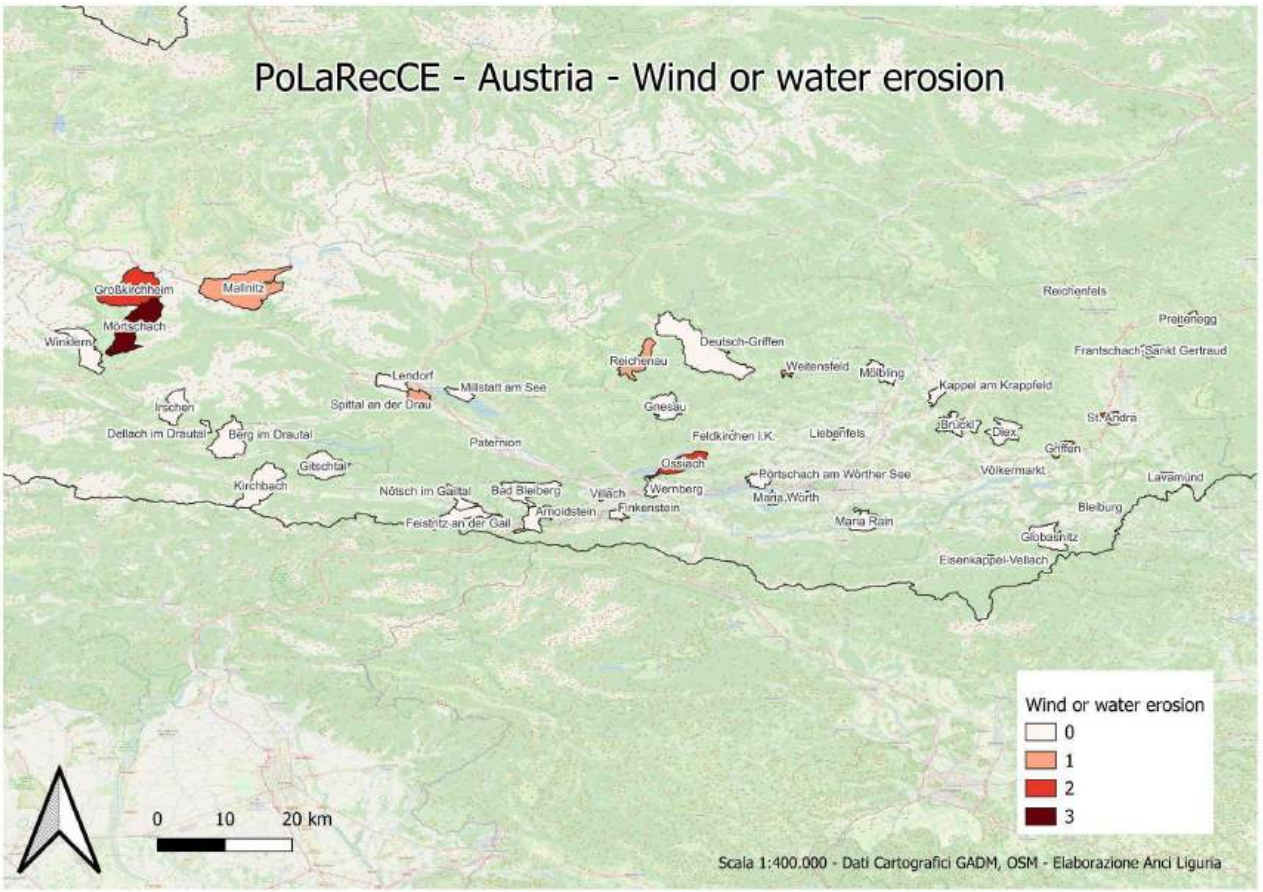

Fig. 106 - Wind or water erosion - AUT

Wind and Water Erosion

Wind and water erosion were highlighted in several municipalities, with Mörtschach reporting severe problems and Großkirchheim and Bad Eisenkappel identifying medium levels of concern. These findings underline the sensitivity of mountain and valley soils to erosive forces, especially under the influence of climate change.

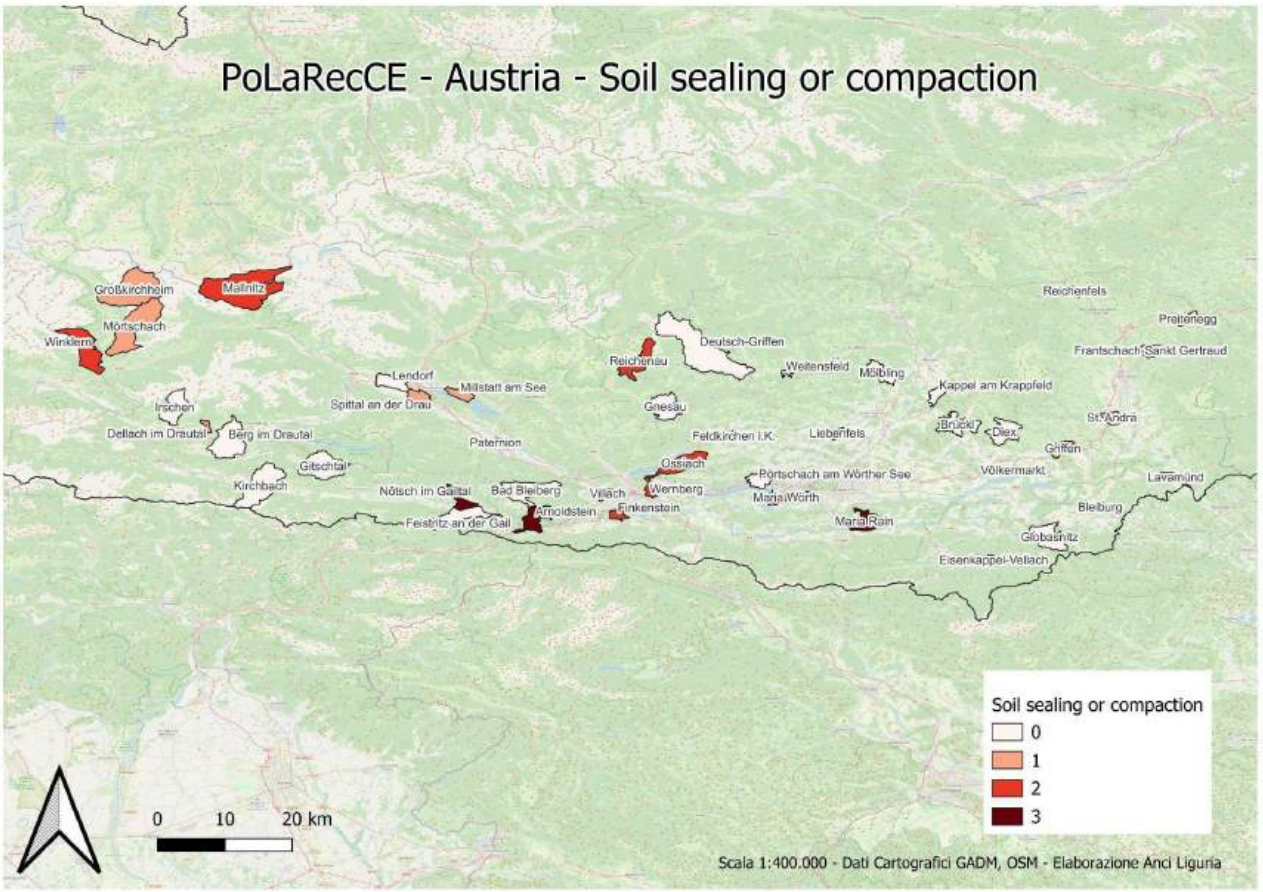

Fig. 107 - Soil sealing or compaction - AUT

Soil Sealing and Compaction

Many municipalities rated soil sealing and compaction as medium or high. This reflects broader national trends: Austria is among the European countries with the highest rates of soil sealing, driven both by urban expansion and the use of heavy agricultural machinery.

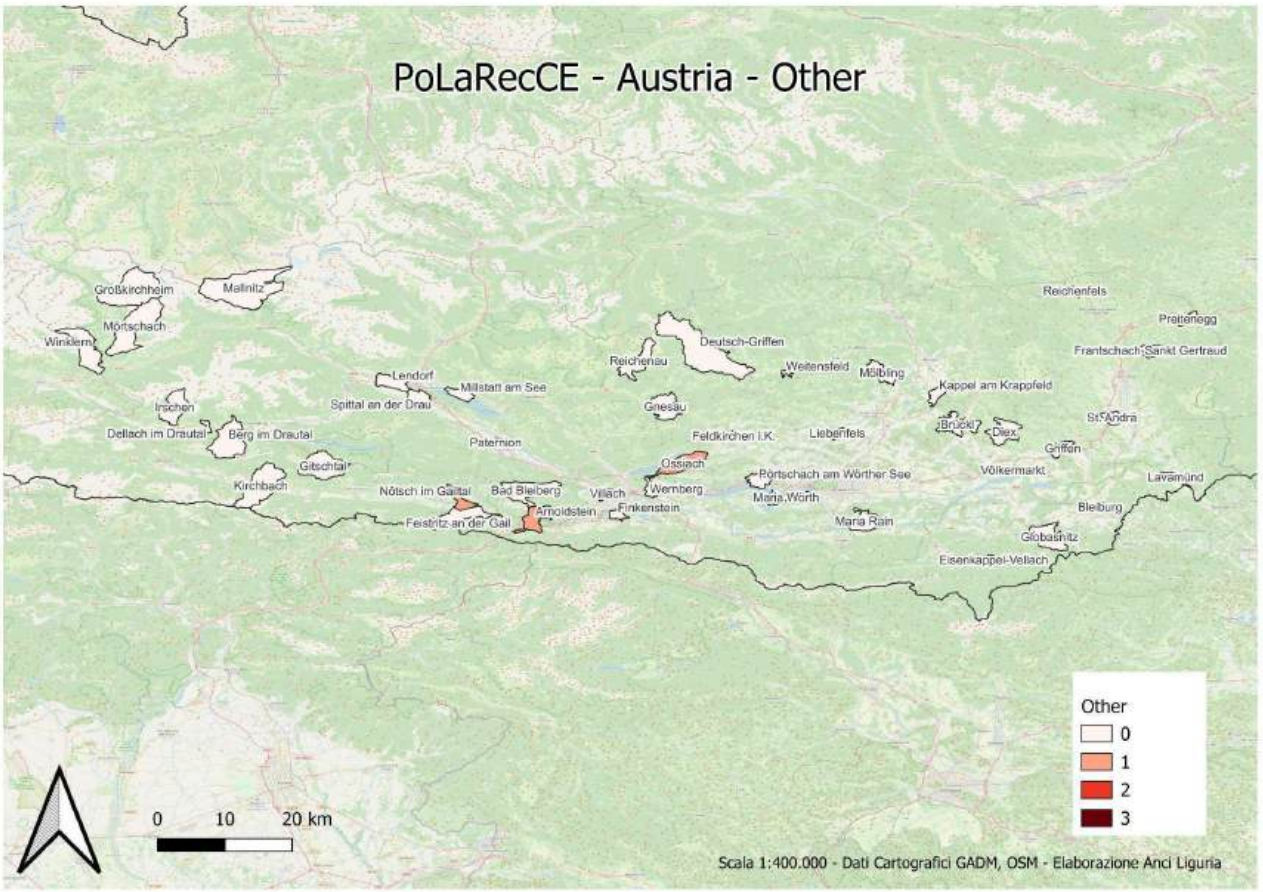

Fig. 108 - Other - AUT

Other Issues

Two municipalities reported additional forms of degradation not explicitly listed in the questionnaire. Arnoldstein indicated widespread lead dust contamination (around 70 hectares), while Villach noted problems with noise pollution, highlighting the diversity of local environmental pressures.

Synthesis

The results from Carinthia depict a region where both natural processes and human activities contribute to soil degradation. Flooding, erosion, and soil sealing stand out as widespread and pressing concerns, exacerbated by climate change and land-use pressures. Industrial legacies, particularly in Arnoldstein, remain highly relevant, while localized problems such as waste disposal and acidification further enrich the regional picture. Together, these findings confirm the selection of Arnoldstein as a pilot site, as it represents a microcosm of the challenges faced across Carinthia and, more broadly, Central Europe.

3.7. Main problems in CE regions

A cross-regional comparison of the survey results allows for the identification of recurring patterns as well as region-specific issues. While some forms of soil degradation appear consistently across Central Europe, others are strongly localized, reflecting differences in geography, industrial history, agricultural intensity, and data availability.

Flooding and Erosion

Flooding and erosion represent the most transversal problems, recognized in nearly all participating regions. More than 70% of municipalities in Emilia-Romagna and Liguria identified flooding as a major concern, and similar levels of attention were reported in Austria and Slovenia. Even in regions where the problem is less pronounced, such as Hungary, municipalities acknowledged localized risks, particularly in areas affected by hydrological alterations. These findings underline the close relationship between climate variability, hydrogeological fragility, and soil degradation across Central Europe.

Urban and Industrial Dust Deposition

Contamination from dust deposition is another recurrent issue, with approximately 30% of respondents reporting its presence. It was most significant in Emilia-Romagna and Austria, where around 40–45% of municipalities considered it relevant, while in Poland and Hungary the percentage was closer to 28–29%. This pattern reflects the historical concentration of industrial activity in certain regions, as well as the persistence of airborne pollutants in urbanized and industrialized landscapes.

Wastewater and Biological Contamination

Responses regarding wastewater leakage and sewage sludge deposition were highly variable. In Austria and Hungary, municipalities reported little to no impact, whereas in Slovenia more than 60% of respondents considered it a major issue. Italy and Poland presented intermediate levels, with around 20–30% of municipalities acknowledging its presence. This inconsistency points both to real regional differences and to uneven monitoring capacity.

Volatile Organic Compounds (VOCs, PAHs)

On average, about 15% of municipalities reported problems related to volatile organic compounds, with peaks of 22–23% in Emilia-Romagna and Slovenia. Although less frequently

mentioned than other forms of contamination, these pollutants remain relevant in areas with an industrial past.

Cyanides and Mining Residues

Cyanide contamination was only rarely acknowledged, with Slovenia reporting up to 17% of municipalities affected and other regions reporting much lower percentages (below 7%) or none at all. Similarly, degradation linked to coal mining waste was mainly confined to Poland (18% of responses), reflecting the historical intensity of extractive industries there. Ore mining residues were even less common, though reported in Liguria and in some Polish municipalities.

Ash Disposal from Power Industry

Ash-related degradation was not widely recognized, with Slovenia the only region to exceed 10% of responses. Elsewhere, the problem appeared negligible.

Non-Degradable Waste and Plastics

The issue of municipal waste and plastics was far more widespread, though with strikingly inconsistent results. Positive responses ranged from 16% in Liguria to nearly 50% in Slovenia, indicating that waste management remains uneven across the participating regions.

Former Quarries and Resource Exploitation

This form of degradation was identified in several regions, with particularly high levels in Emilia-Romagna and Slovenia (50% of municipalities), while Austria reported a lower but still notable figure (above 12%). Such sites remain a legacy of industrial and construction activities and represent localized yet persistent risks.

Agricultural Degradation

Long-term unsustainable agricultural practices emerged as a severe problem in Hungary and Slovenia, where 80% and 60% of municipalities respectively reported impacts. In other regions, the issue was recognized by about 20% of municipalities, while in Liguria it was not mentioned at all. This divergence reflects both differences in agricultural intensity and regional variations in soil and climate suitability.

Acidification and Salinization

Heavily acidified soils were reported as particularly problematic in Hungary and Slovenia, where more than half of the municipalities identified them as a concern. Poland and Austria reported intermediate levels (20% and 12%, respectively), while Italy reported very low levels (below 7%). Saline or alkaline soils were less frequently mentioned, but still present in Poland, Emilia-Romagna, and Hungary, usually linked to industrial emissions or chemical industries.

Soil Sealing and Compaction

This issue was recognized as significant in Austria, Slovenia, Hungary, and Emilia-Romagna, where more than 40% of respondents reported impacts. By contrast, Poland and Liguria showed lower values (12% and 6%, respectively). These findings mirror differences in urbanization rates, infrastructure expansion, and agricultural mechanization.

Synthesis

The comparative analysis highlights a dual picture. On one side, there are transversal problems—above all flooding, erosion, dust deposition, and soil sealing—that are consistently observed across Central Europe. On the other side, highly localized issues—such as cyanide contamination in Liguria and Poland, wastewater impacts in Slovenia, or agricultural degradation in Hungary—reflect the specific economic histories, land uses, and ecological conditions of each region. This diversity underscores the need for both common strategies to address widespread threats and tailored interventions for region-specific challenges.

4. Conclusion

The survey conducted within Deliverable 1.3.1 represents the first structured effort to document the state of soil degradation across Central European regions. With more than 200 municipal responses collected, the study offers a broad and informative dataset, although participation was uneven and coverage not fully representative of all territories.

A recurring finding is the limited awareness of soil degradation among local administrations. Many municipalities demonstrated only partial recognition of the risks posed by processes such as industrial contamination, erosion, or unsustainable land use. In some cases, responses underestimated or even denied the existence of problems that are well documented at regional or national level. This discrepancy highlights the need for enhanced environmental monitoring, better knowledge transfer, and capacity building at the local scale.

Despite these limitations, the survey clearly identifies several cross-cutting threats—flooding, erosion, dust deposition, soil sealing, and waste mismanagement—that affect most regions to varying degrees. These processes reflect the combined influence of climatic variability, urban expansion, and historical industrial activity. At the same time, other problems emerge as highly localized but no less significant, such as cyanide contamination in Liguria and Silesia, wastewater-related issues in Slovenia, and severe agricultural degradation in Hungary. Such diversity illustrates how soil health is shaped not only by natural factors, including geology, climate, and topography, but also by region-specific economic trajectories and land-use practices.

The analysis also demonstrates the relevance of the pilot sites selected within the project. These areas concentrate some of the most emblematic forms of soil degradation, making them particularly suitable for testing innovative, eco-sustainable remediation and management approaches. Their role as demonstration sites will be crucial for developing methodologies that can be adapted and transferred to other contexts.

Ultimately, the survey underscores that soil degradation in Central Europe is both a widespread and heterogeneous phenomenon. It demands coordinated strategies to address common threats, while also requiring tailored interventions to respond to region-specific challenges. Strengthening the capacity of municipalities to recognize, monitor, and act upon soil degradation will be essential to safeguarding land resources, supporting sustainable development, and mitigating biodiversity loss across the region.

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ANNEX 1. - QUESTIONNAIRE - "What kind of degraded land have you dealt with, or which are characteristic of the region?"

N	Land degraded by:	Problem	area in km^2	area in%	Comments	
1	contamination from urban and industrial dust deposition					
2	leakage oil and petroleum products					
3	leakage of waste waters or sewage sludge deposition (biological contamination)					
4	volatile organic compounds					
5	cyanides (e.g. from coking industry)					
6	dumping of wastes materials from coal mining					
7	dumping of wastes materials from ore mining					
8	dumping of ashes from power industry					
9	dumping of non-degradable trash or plastics (municipal wastes)					
10	former quarries and areas after sand exploitation					
11	flooding areas					
12	military areas					
13	heavily acidified soils					
14	saline or highly alkaline soil (e.g. from chemical, cement or ceramic industry)					
15	long-term poor agricultural farming practices (depletion of soil nutrients, over-fertilization, contamination by pesticides)					
16	wind or water erosion					
17	compacted soils					
18	others (give additional information)					