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PoLaRecCE

Report with the summary of the conducted survey

WP1 – Identification of the main problems related to degraded agricultural land in CE regions

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Table of contents

List of figures

Executive summary

The PoLaRecCE project's Deliverable 1.3.1 Report with the summary of the conducted survey concludes a first in-depth knowledge phase.

The main goal of the survey is to describe the starting point in the different CE regions in matter of contaminated soils, forms and common environmental and ecological problems.

A questionnaire has been developed to collect data from a large number of municipalities in the CE regions involved.

In the previous period, an easy and simple survey was prepared, and it was shared with the municipalities.

Each partner contacted municipalities in its region, asking them to complete the questionnaire.

At the end, the distribution was very wide in 8 regions and 6 countries.

The final collection consists of 200 Questionnaires, that can help to define the main characteristic of these areas, and it indicates the main trends.

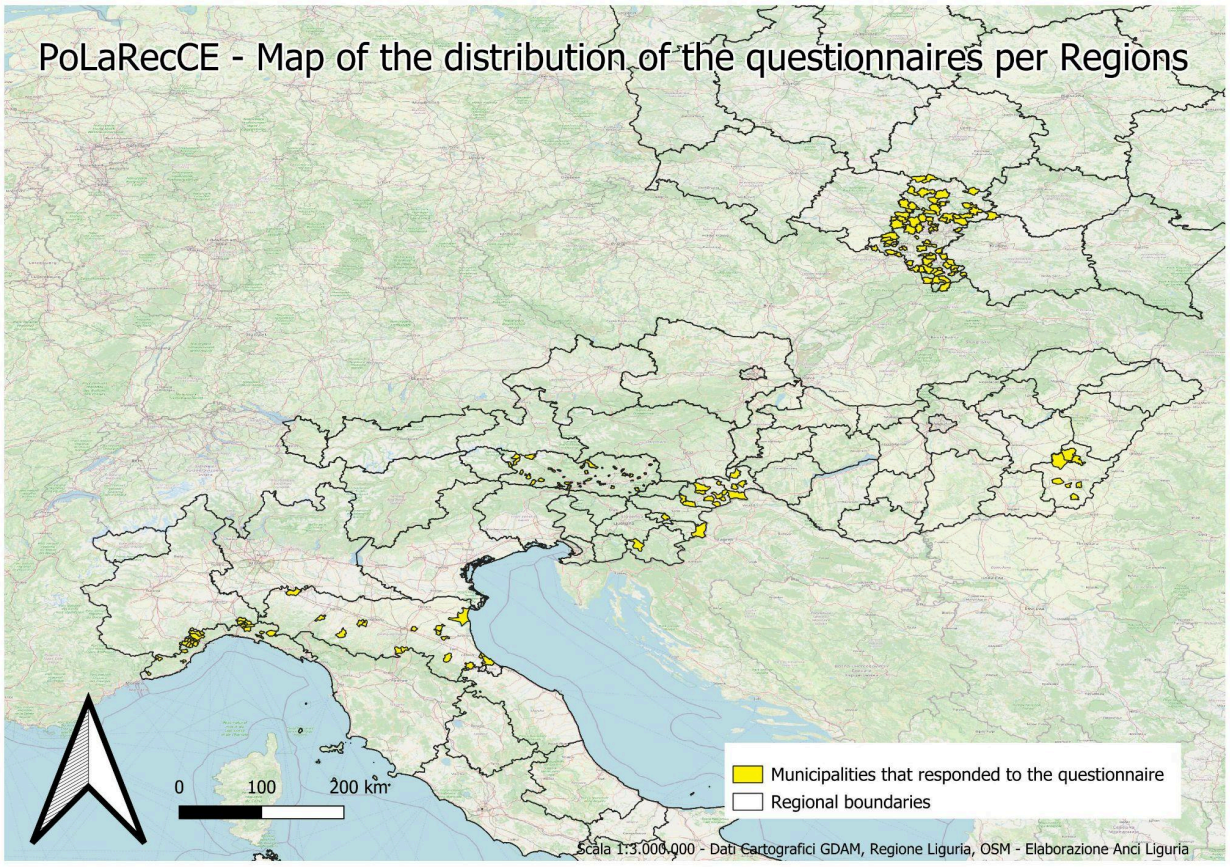


Fig. 1 - Map of the distribution of the questionnaires per Regions

1. Introduction

1.1. Objectives

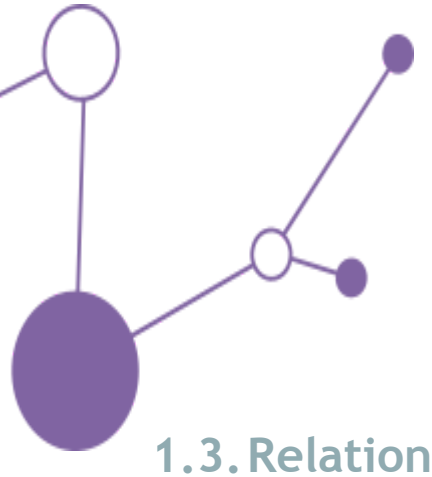
The objective of Deliverable 1.3.1 is to understand the main problems and risks associated with the degraded agricultural soils and to have a state of art of the common, but also the different criticism that each area has to solve or to consider.

1.2. Scope

The survey identifies 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)*

For each of these problematic situations was asked to the municipality to define the degree of importance in their own municipality. They should indicate the percentage or the surface in km2 in comparison with the whole municipality.



1.3. Relations to other documents

The report is strictly connected to the Deliverables 1.2.1 Questionnaire for regional survey that was the instrument to collect data, but furthermore it is functional to Deliverable 1.4.1 Open electronic database. An open database will be created about the degraded soils and other additional information will be available on the website and it could be useful for future strategic planning activities in the different CE regions.

1.4. Intended Audience

This document is intended for project partners, because it's a first step toward the database, that is the next deliverable.

2. The survey

2.1. Definition of the content of the survey

The construction of the questionnaire was complex because it should be simple enough for the policy makers and the technicians working in municipalities, that are not experts in the field of degradation of soils.

The first main step was to introduce a language easy to understand. The second step was to define a simple estimation that could be sufficient to describe a trend, but also that each Mayor or technician can be able to make by himself, in order do not discourage the target group and to collect as much questionnaires as possible.

Anci Liguria prepared the last version of the survey, including all the indications and contributions of the PPs, particularly from the scientific community, that guarantee a level of significance (ANNEX 1 – QUESTIONNAIRE)

2.1.1. Objective

The survey wants to describe the state of art in the 8 regions partner of the project, regarding the polluted lands. It can give the trend of the dimension and the main problems that can be solved in the different areas. The investigation is prodromal to the activities to be carried out in the pilot sites to propose possible solutions to the critical issues found, through non-edible farming solutions.

The interviews aim to explore the dimensions of the phenomenon of agricultural land degradation and to start thinking about eco-sustainable solutions for land rehabilitation and mitigation of biodiversity loss.

FAO estimates that 30 per cent of our planet's land is unsuitable for cultivation because it is polluted, acidified, eroded, too saline or low in nutrients. And the main suspects are of course man and the pollution he causes.

Years of unsustainable soil management practices have led to an explosive situation, so much so that unless more sustainable approaches are adopted, it is estimated that in 2050 the global amount of arable and productive land per capita will be only a quarter of the 1960 level (source: FAO, The State of the World's Land and Water Resources for Food and Agriculture, December 2011).

The challenge for the future is to preserve the land ensuring a balanced and sustainable use of the soils, that is one of the primary resources for all the people.

2.1.2. Target

The target group of the survey are the municipalities, mayors and technical offices, that are the one who are responsible for local planning and activities.

2.1.3. Sample and distribution

The minimum sample was around 10 questionnaires for each partner, considering the region around the pilot site. At the end we received much more samples and we overcome 200 answers.

At the end the collection was much more reach and credible as result. In fact, in Italy were collected 51 questionnaires, 33 in Liguria Region and 17 in Emilia Romagna Region; in Austria we received 48 questionnaires; In Slovenia they obtained 17 questionnaires; in Poland the performance was the highest with 74 questionnaires and in Hungern we had 7 questionnaires and in Croatia 3 have been completed.

The distribution and the collection of the questionnaires was organized in two phases:

Phase 1 – sending a letter with the description of the aim of the project and the main objective of the survey to a wide as possible sample of municipalities.

Phase 2 – collecting the fulfilled questionnaires.

3. The results

3.1. Results in Italy

LIGURIA REGION

Liguria Region consists of 234 Municipalities, 3 of them are urban area: Genova, Imperia and La Spezia; 123 are rural areas and 109 are disadvantaged rural areas. For the survey Anci Liguria distributed the PoLaRecCE questionnaires (50) in the rural areas (particularly in the first case that represents Ligurian productive agricultural and industrial areas). Anci Liguria received 33 questionnaires. Some of them were accurate, others a bit less detailed.

The results of the survey in Liguria show that the Region does not have a wide situation of risk and degradation, these situations are visible in some specific areas, those ones that had in the last century, at least, an industrial development that created important modification in the soil.

One of the most contaminated areas is the pilot one: Val Bormida, and it confirms the correctness of the choice.

Two problems are evident everywhere: flooding and wind and water erosion. These two elements are the main factors of risk in Liguria Region, and they become even more important due to the climate change.

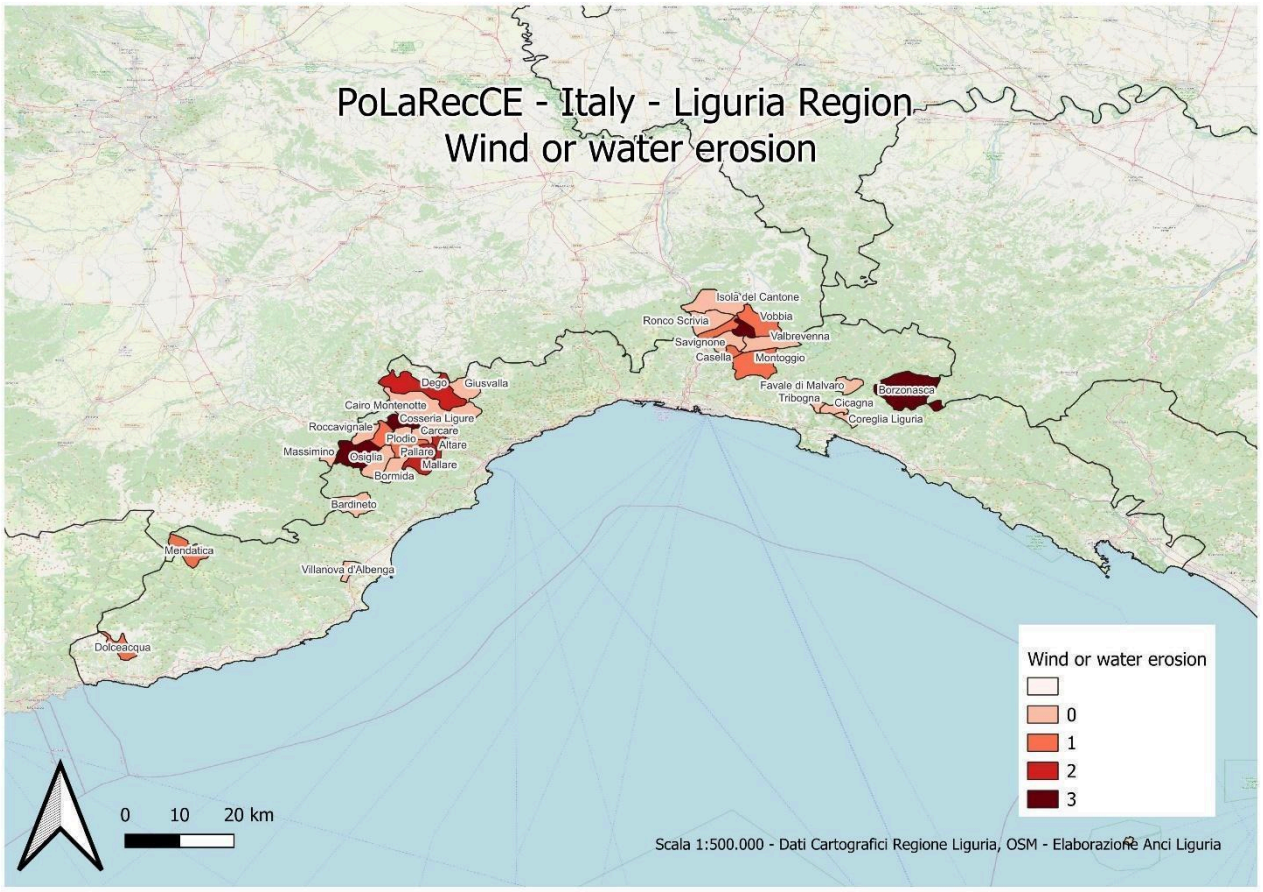


Fig. 2 - Wind and water erosion - IT - LIG

Almost the whole sample presented this kind of degradation due to the fragile morphology that characterized the landscape of Liguria Regione and for the climate that alternates periods of drought with heavy rains that determinants important risk of erosion and hydrogeological instability of the slope.

Two areas show the main problems, one is the Bormida Valley, where the pilot activity of the project will be developed and the other one is Sturla Valley, an area prone to flooding.

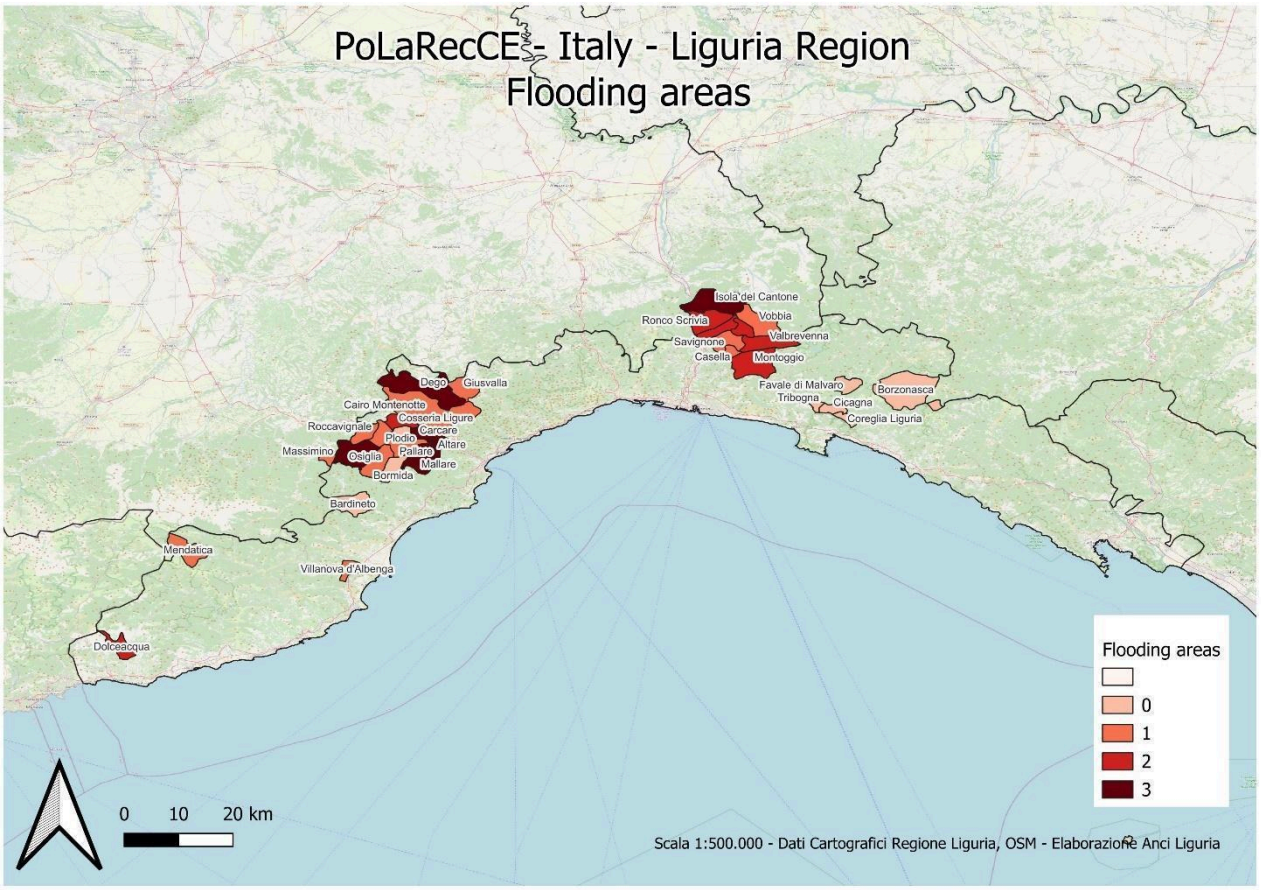


Fig. 3 - Flooding areas - IT - LIG

As it emerges from the maps, this is one of the main problems in the whole region, particularly in those areas that have industrial development such as Val Bormida and Valle Scrivia. This problem is also much clearer to the Majors as well as to the technical offices because it is a problem that each year determines damages and this risk becomes bigger with the effect of the climate change.

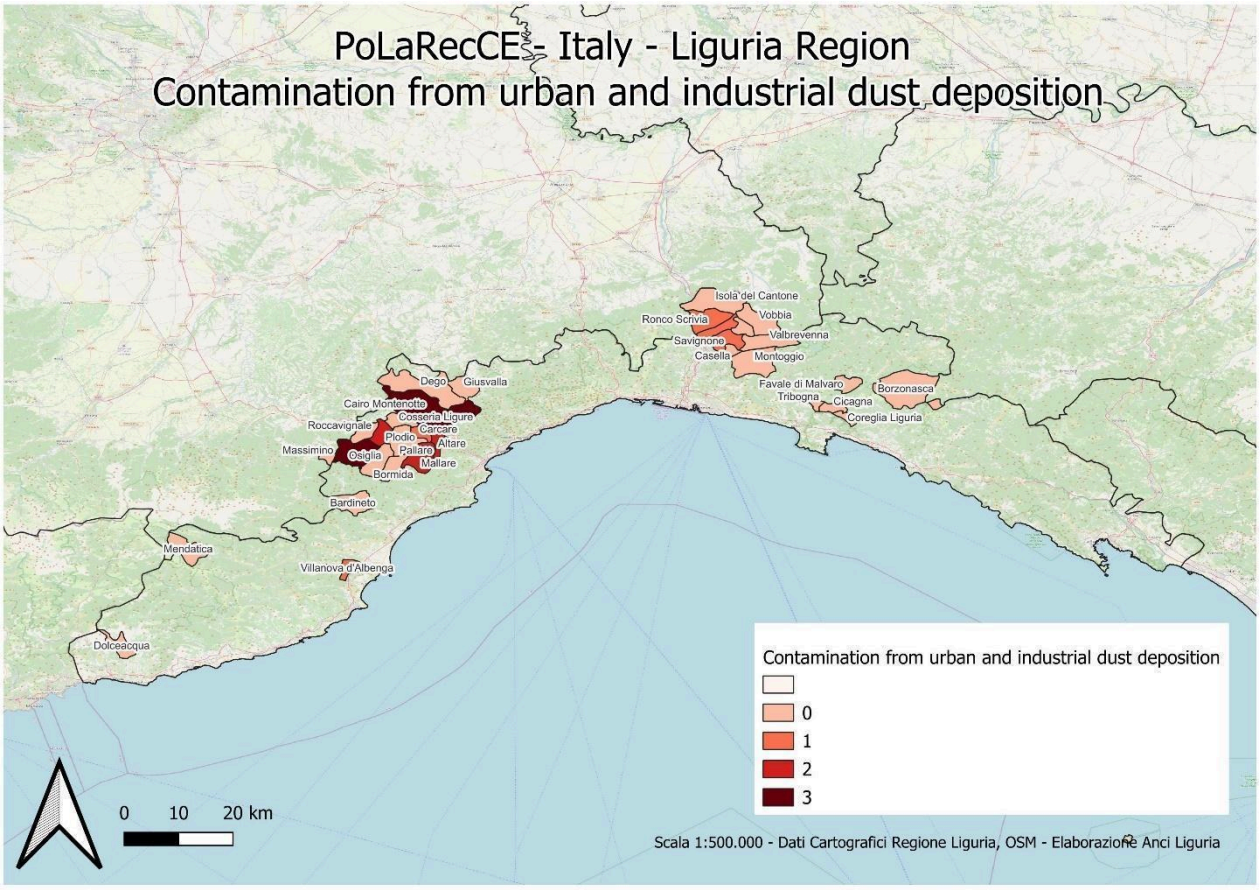


Fig. 4 - Contamination from urban and industrial dust deposition - IT - LIG

The contamination from urban and industrial dust deposition is strongly highlighted in the cartogram in the pilot area: Val Bormida and the other area that show some similar problems is another industrial area: Valle Scrivia not far from Genoa. In Val Bormida the most critical situation is by Millesimo with the (50% of the surface) and then Cairo Montenotte with the (10%).

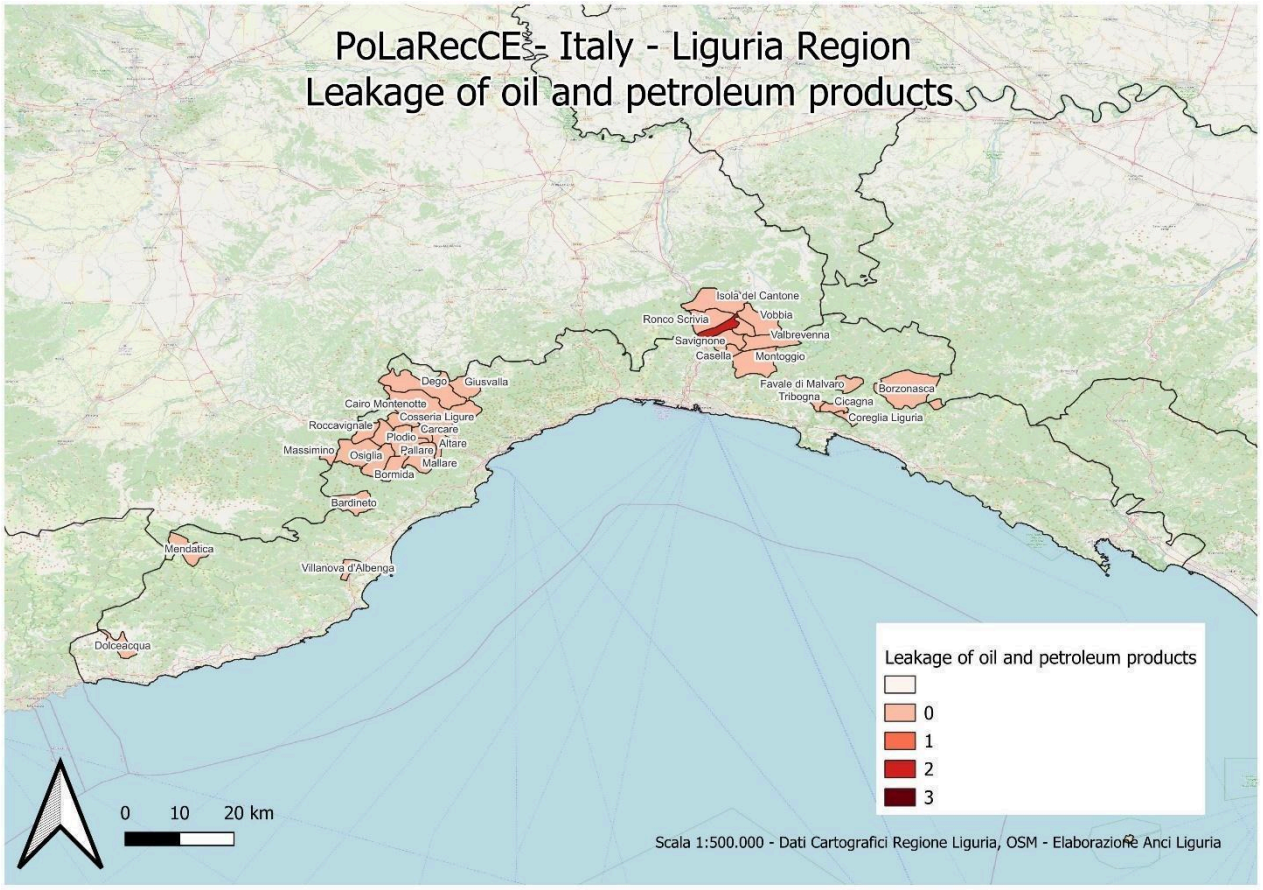


Fig. 5 - Leakage of oil and petroleum products - IT - LIG

Traces of this kind of degradation are visible in the area where there is the main petroleum industry in Valle Scrivia. Pipelines cross through the territory and some residuals can be present in some areas, even though not in a critical way.

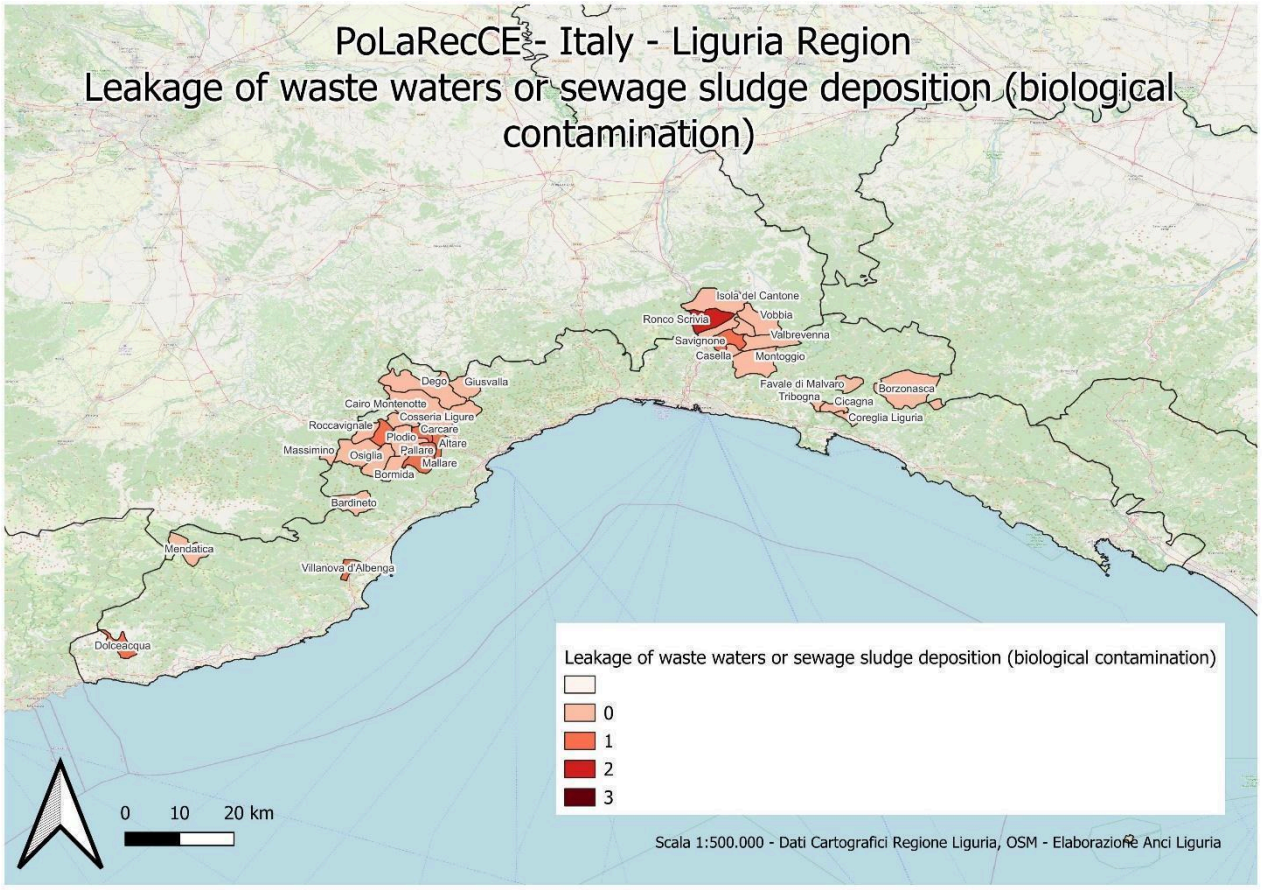


Fig. 6 - Leakage of waste waters or sewage sludge deposition (biological contamination) - IT - LIG

3 areas show this kind of degradation: Dolceacqua, where agricultural activities (olive oil and wine production), in Val Bormida and in Valle Scrivia where industrial activities are present.

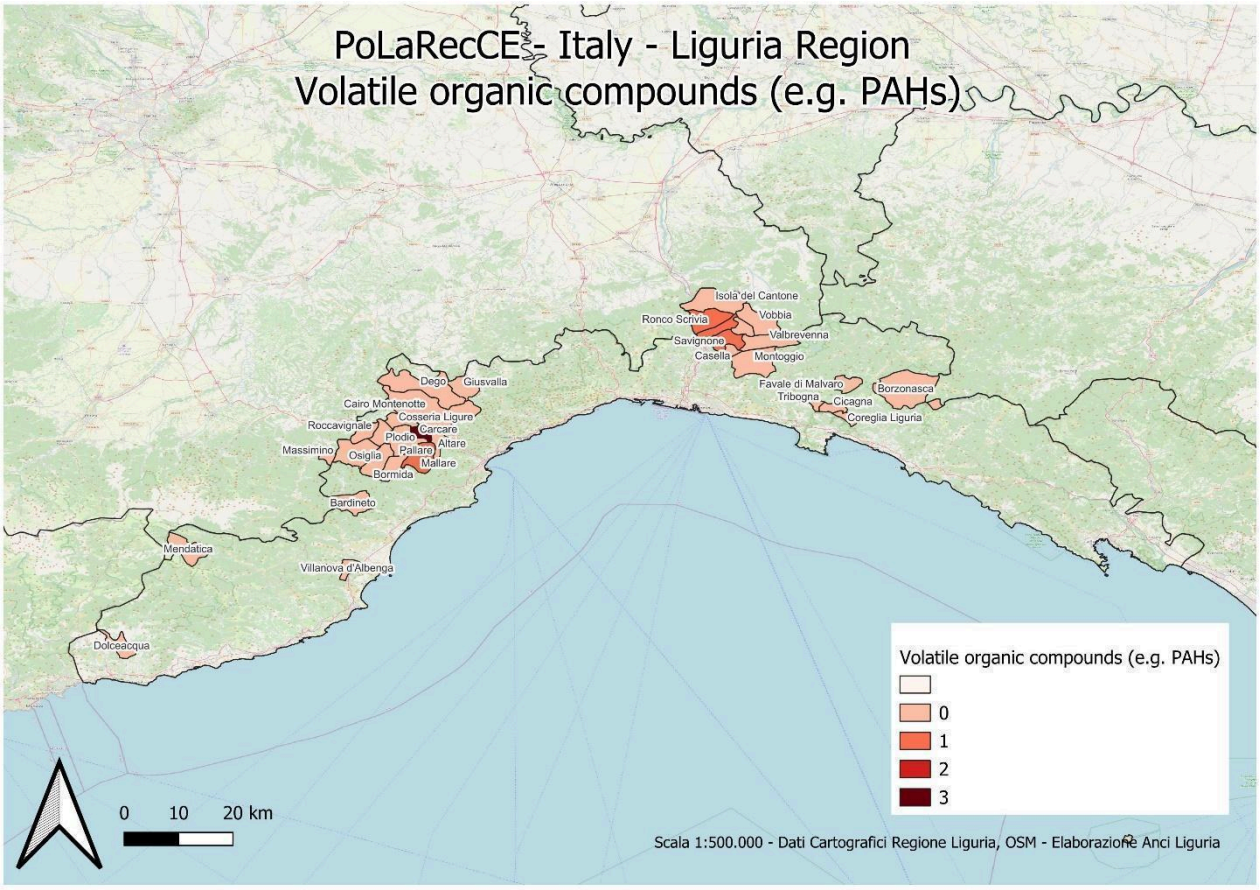


Fig. 7 - Volatile organic compounds (e.g. PAHs) - IT - LIG

Some volatile organic compounds are present in Cairo Montenotte, Mallare and Casella the valley are always the 2 industrial valleys of the region.

Some other problems emerged from some municipalities: the abandonment of the territory, that created situations of degradation, the degradation of the slope and in Cosseria some noise pollution.

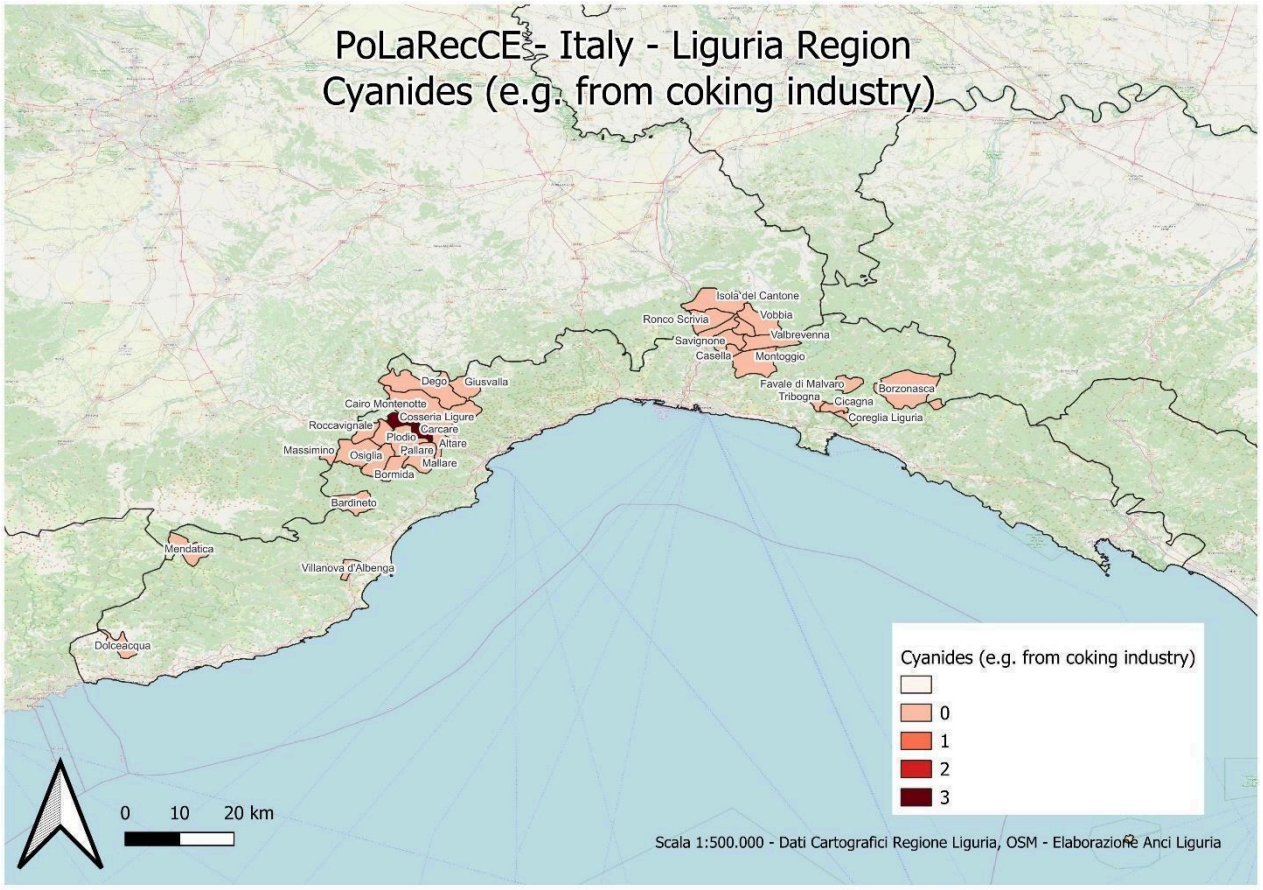


Fig. 8 - Cyanides (e.g. from coking industry) - IT - LIG

The degradation for the presence of Cyanides is mainly concentrated in the Municipality of Cosseria in Val Bormida, where 80% of the surface can present this contamination. No problems for all the other municipalities considered in the survey.

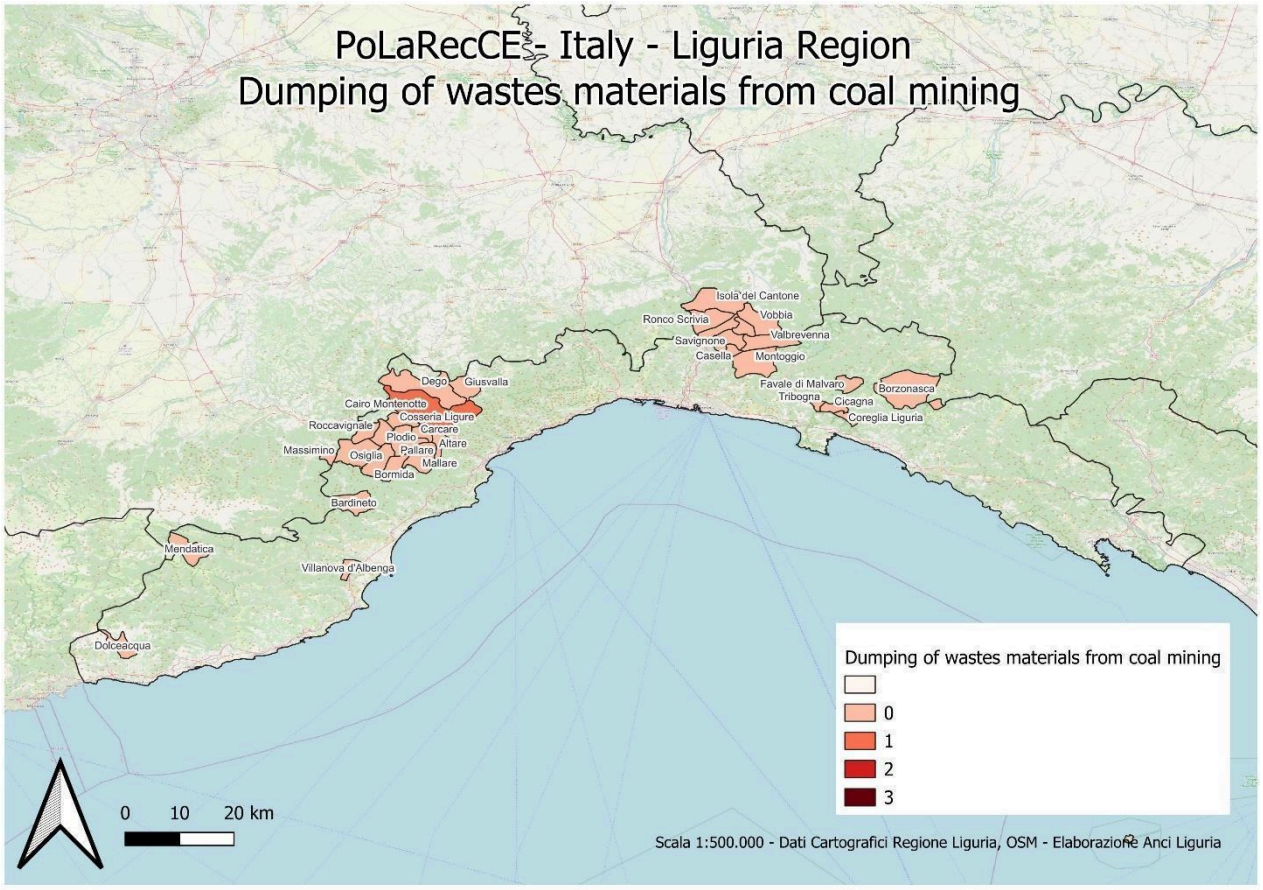


Fig. 9 - Dumping of wastes materials from coal mining - IT - LIG

An old activity of coal mining in Cairo Montenotte shows some contaminated residues in the territory of Cairo Montenotte.

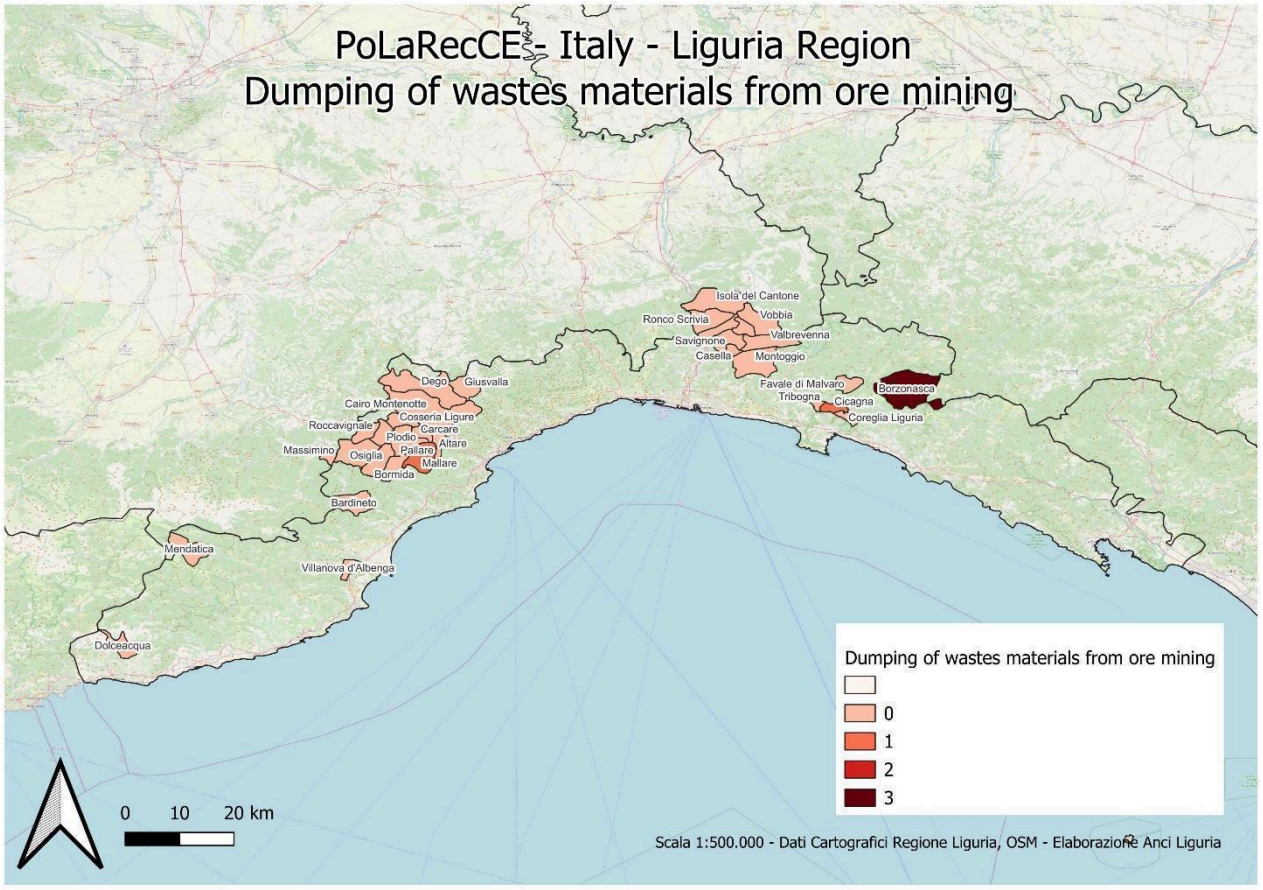


Fig. 10 - Dumping of wastes materials from ore mining - IT - LIG

The activity of ore mining is not so common in Liguria Region, because only in some areas are some economical interesting ores present. The stronger concentration is in the Municipality of Borzonasca

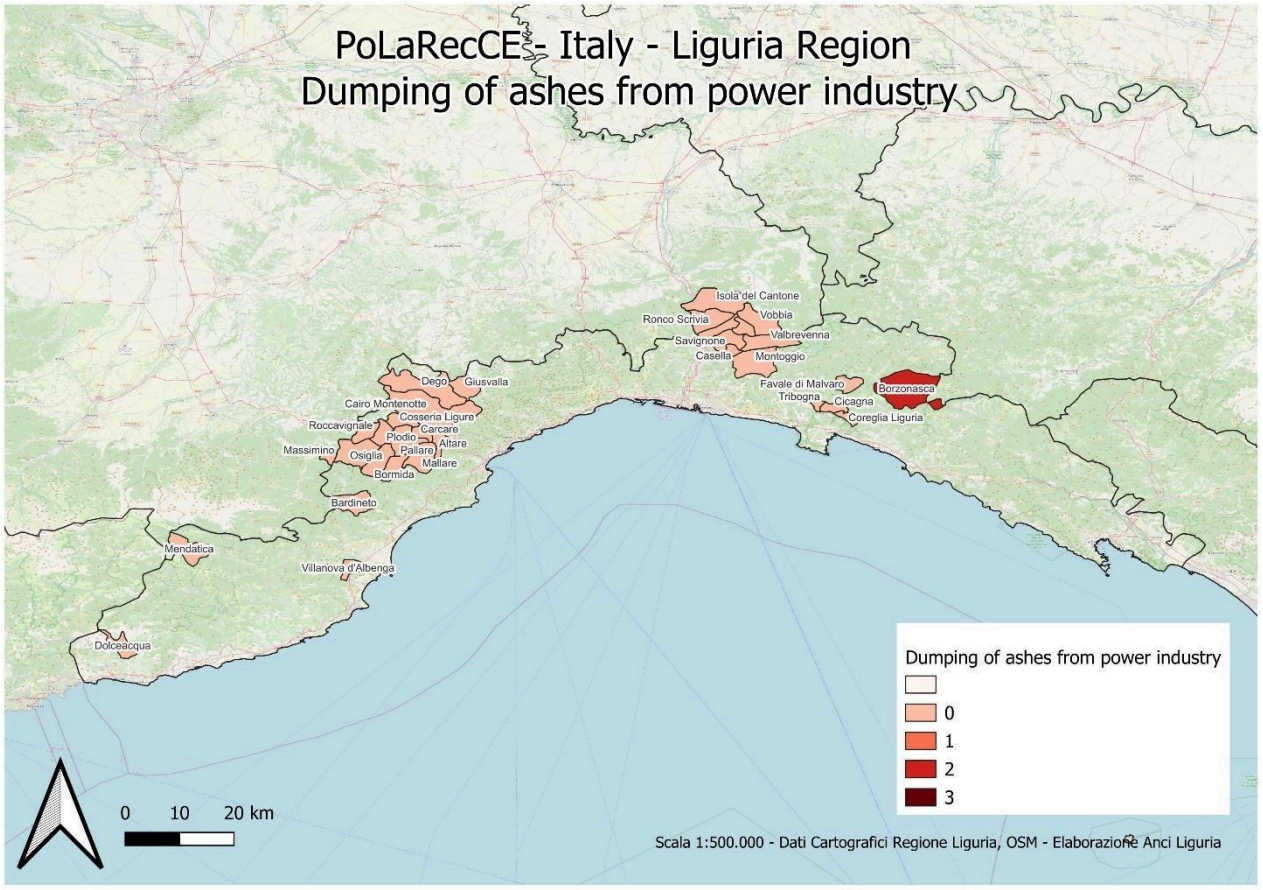


Fig. 11 - Dumping of ashes from power industry - IT - LIG

The is only some problems in the municipality of Borzonasca where there is an important power plant that creates some small problems.

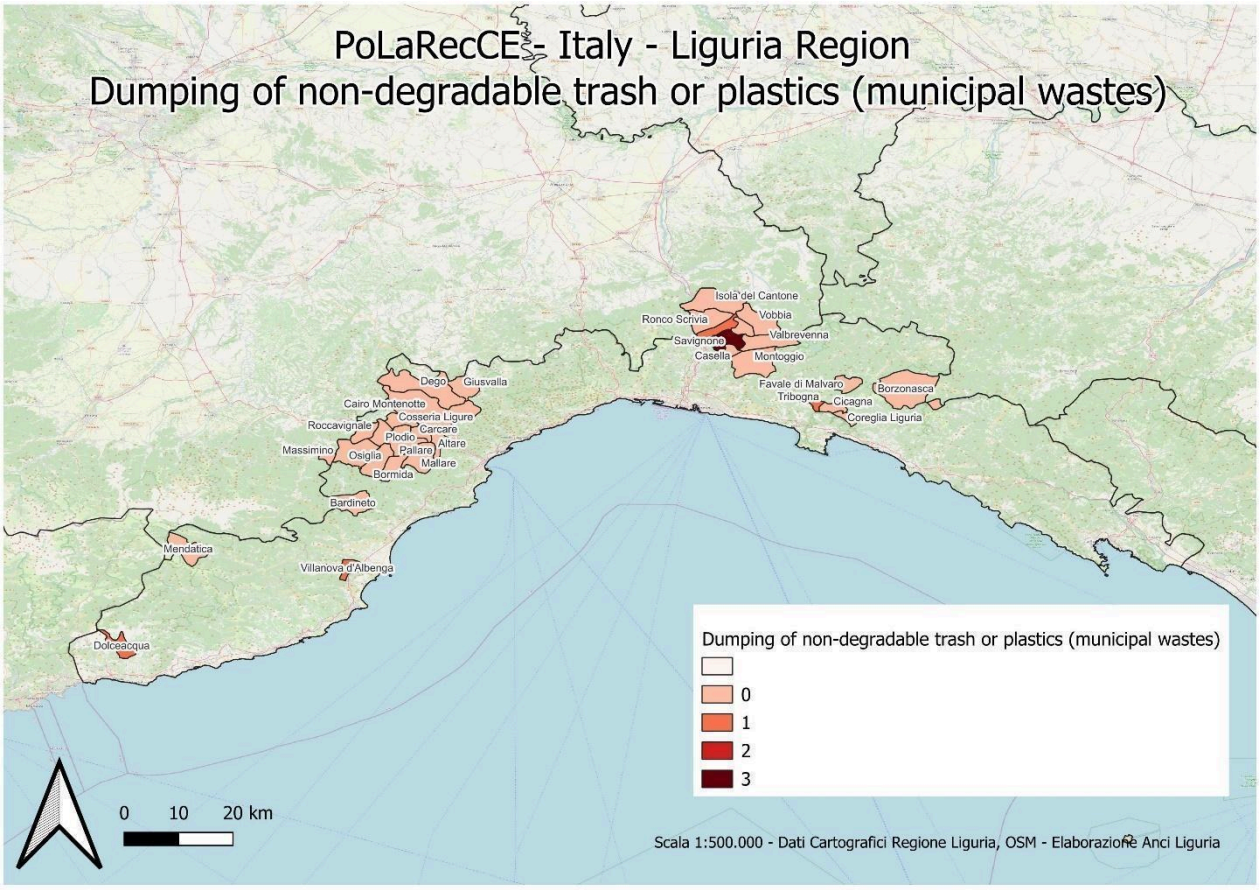


Fig. 12 - Dumping of non-degradable trash or plastics (municipal wastes) - IT - LIG

This kind of degradation has an impact in 2 muicipalities one in the Province of Imperia, Dolceacqua where the level of degradation is level 1 but it includes 80% of the surface, in Valle Scrivia, on the contrary it is higher (level 3) but it is present only in small part of the territory of Savignone.

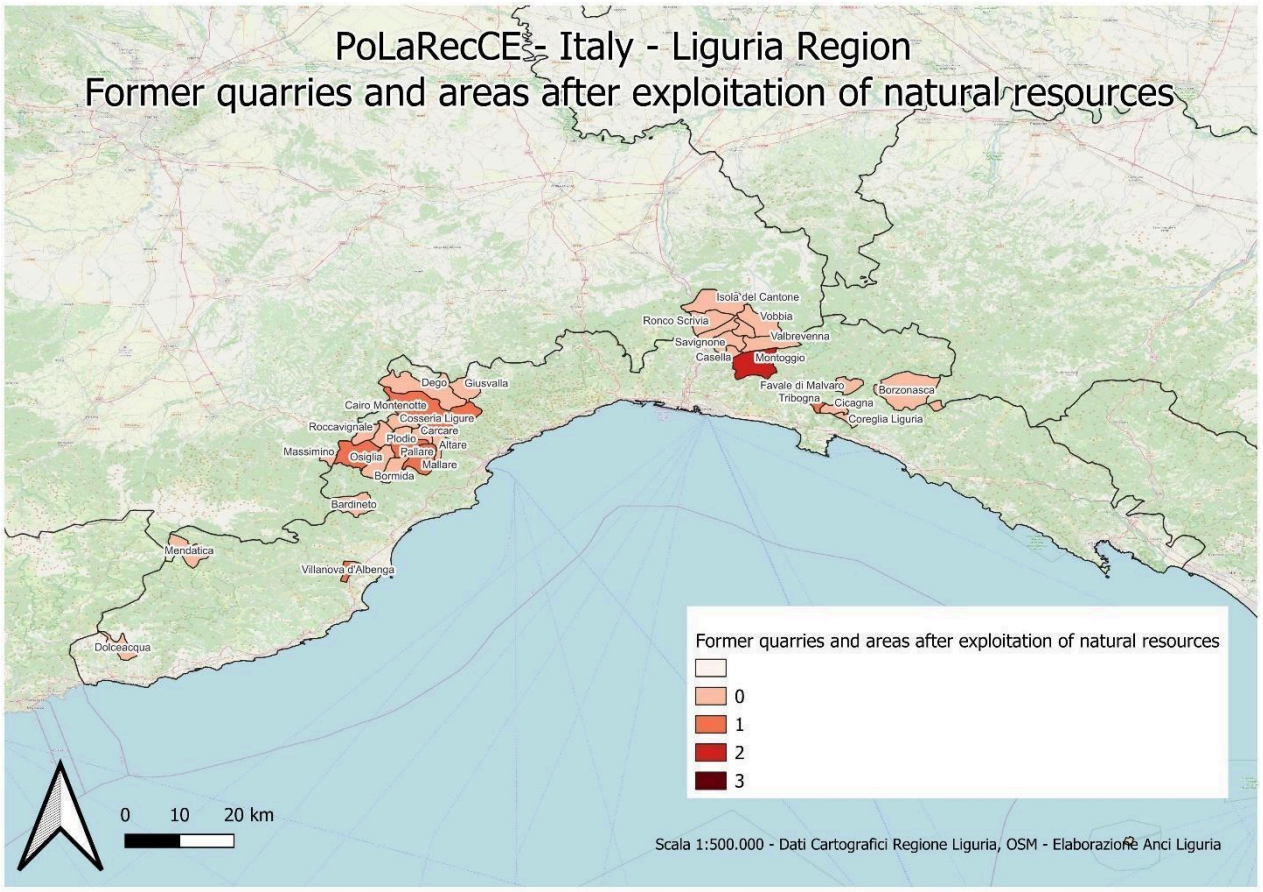


Fig. 13 - Former quarries and areas after exploitation of natural resources - IT - LIG

In general, no big problem emerged, only the Municipality of Montoggio has some problems due to an earthquake that caused some damages.

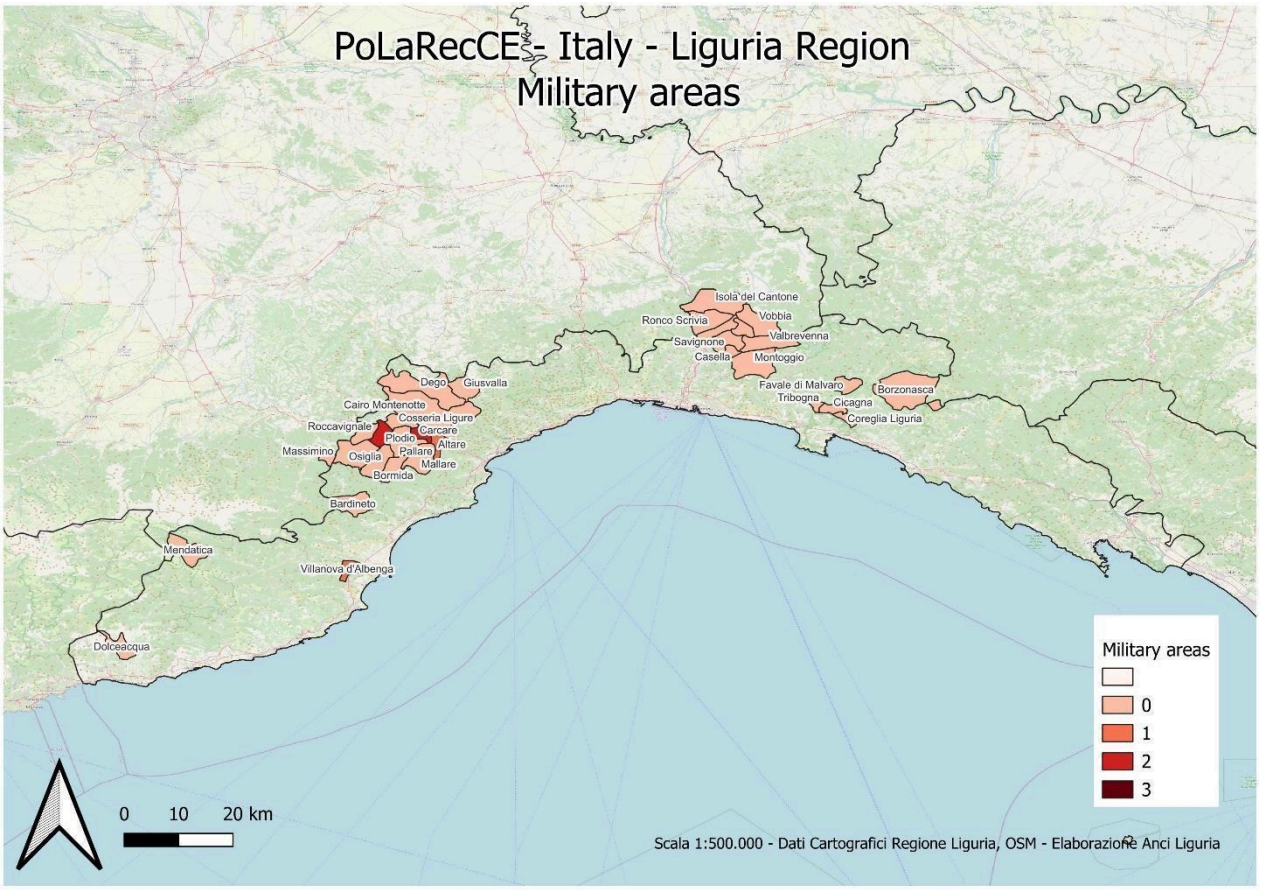


Fig. 14 - Military areas - IT - LIG

There are not so many military areas in the Liguria Region and some degradations are evident in Val Bormida and in Villanova d'Albenga where there is a military airport.

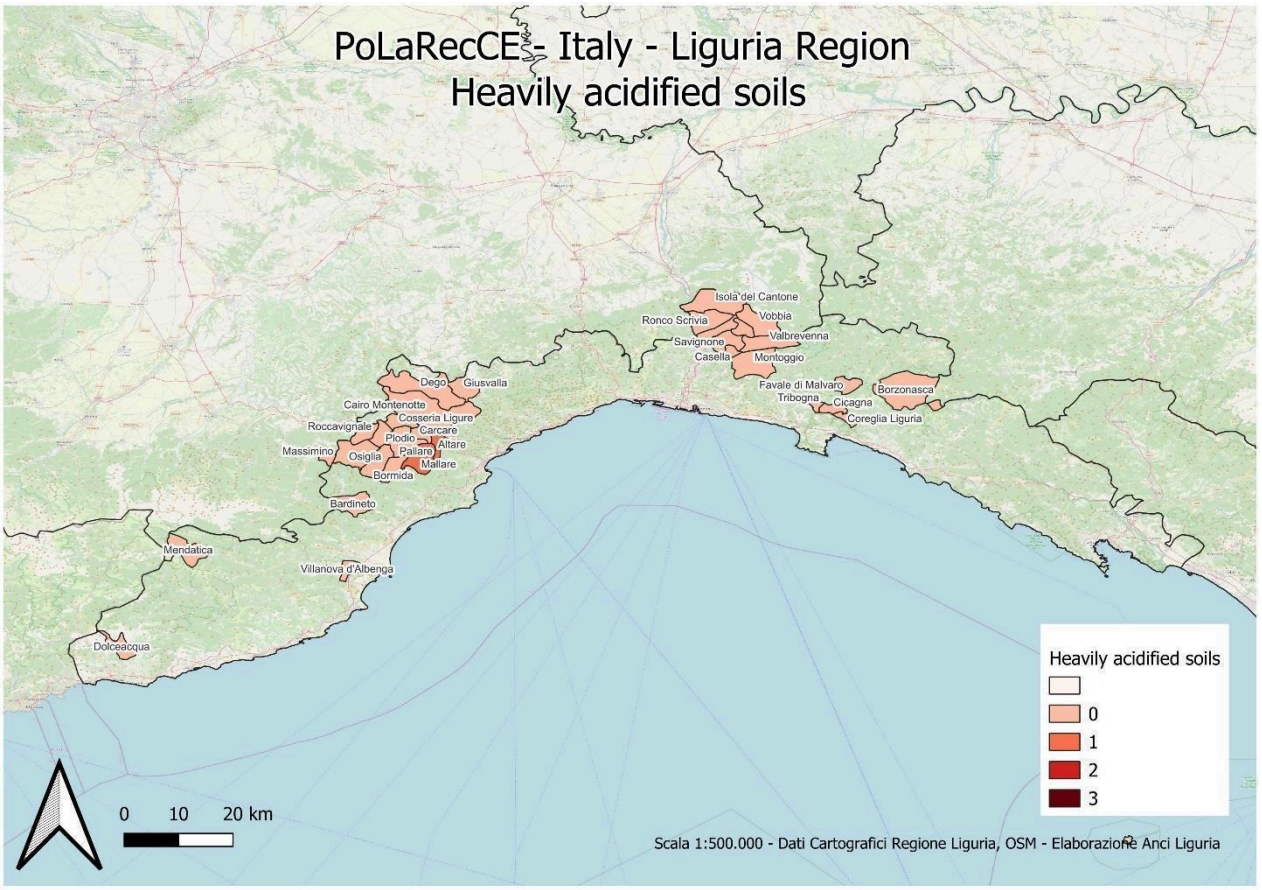


Fig. 15 - Heavily acidified soils - IT - LIG

It has some effect only in Val Bormida in 2 Municipalities Pallare and Mallare, but the problem is of level 1 and only for 1% - 3% of the surface of the municipality.

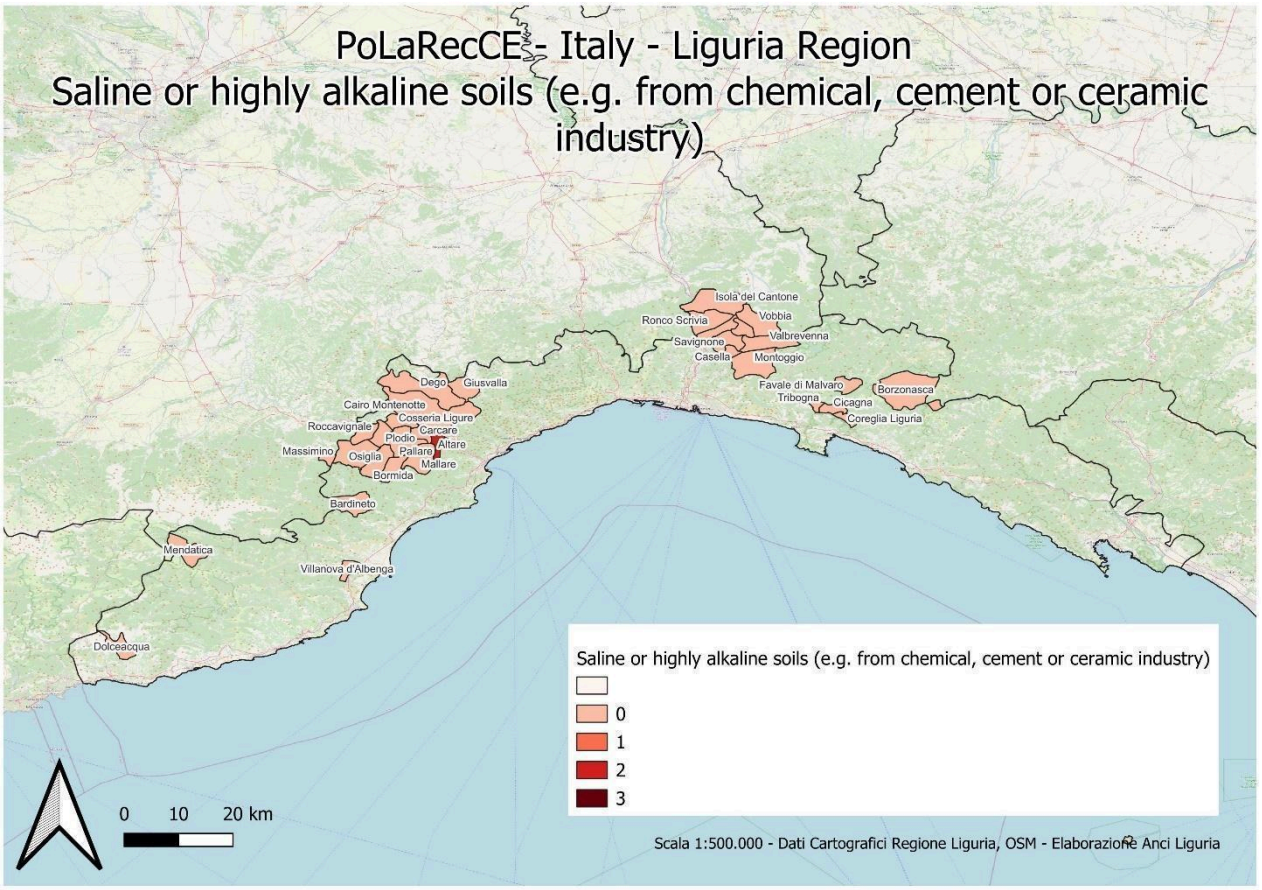


Fig. 16 - Saline of highly alkaline soils (e.g. from chemical, cement or ceramic industry) - IT - LIG

This cause of degradation is not one of the main problems in the area of the survey, but some small effects are visible in Val Bormida.

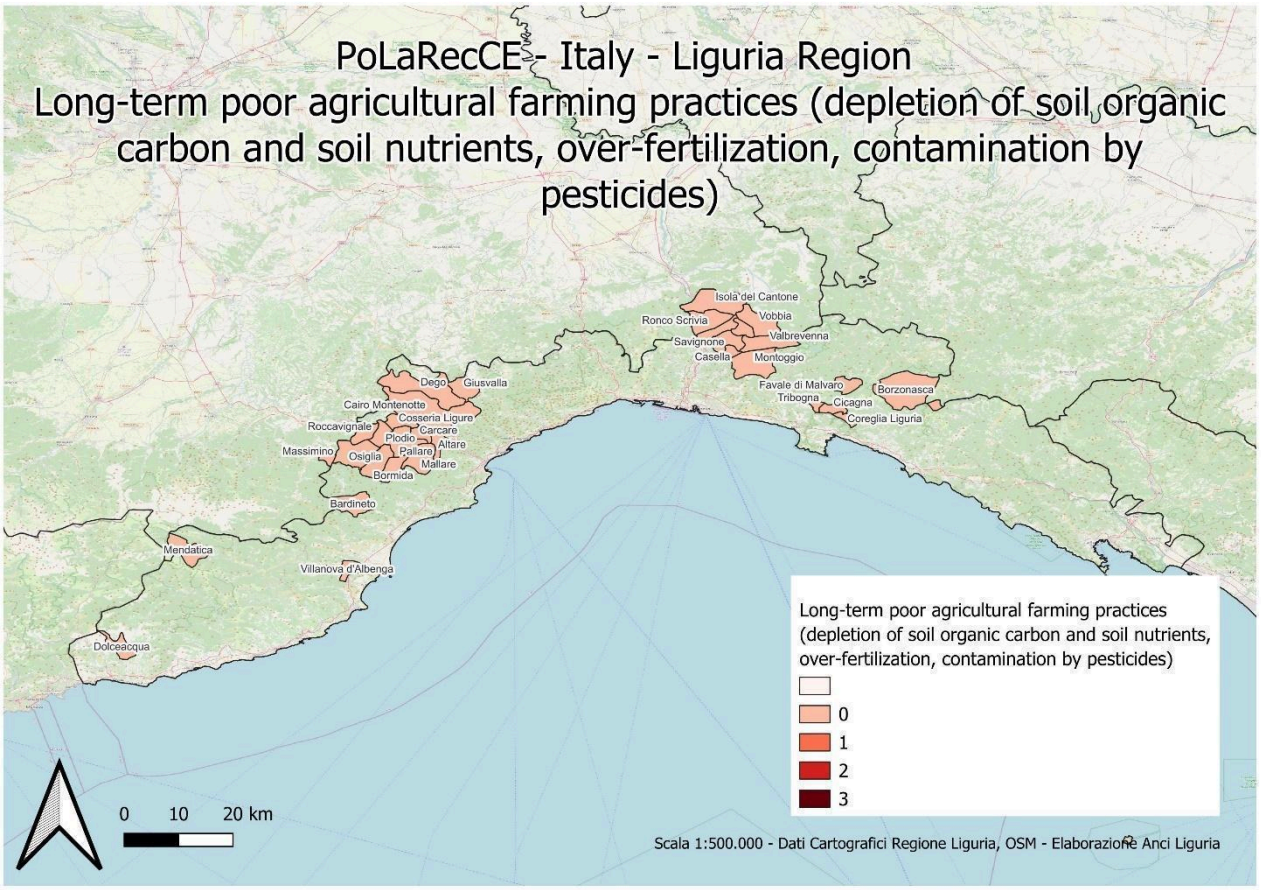


Fig. 17 - Long-term poor agricultural farming practices (depletion of soil organic carbon and soil nutrients, over-fertilization, contamination by pesticides) - IT - LIG

The municipalities that answered the questionnaires don't have this kind of problem, because it is not an intensive agriculture. Some problems can be present in the area of Albenga, but we don't receive the questionnaire.

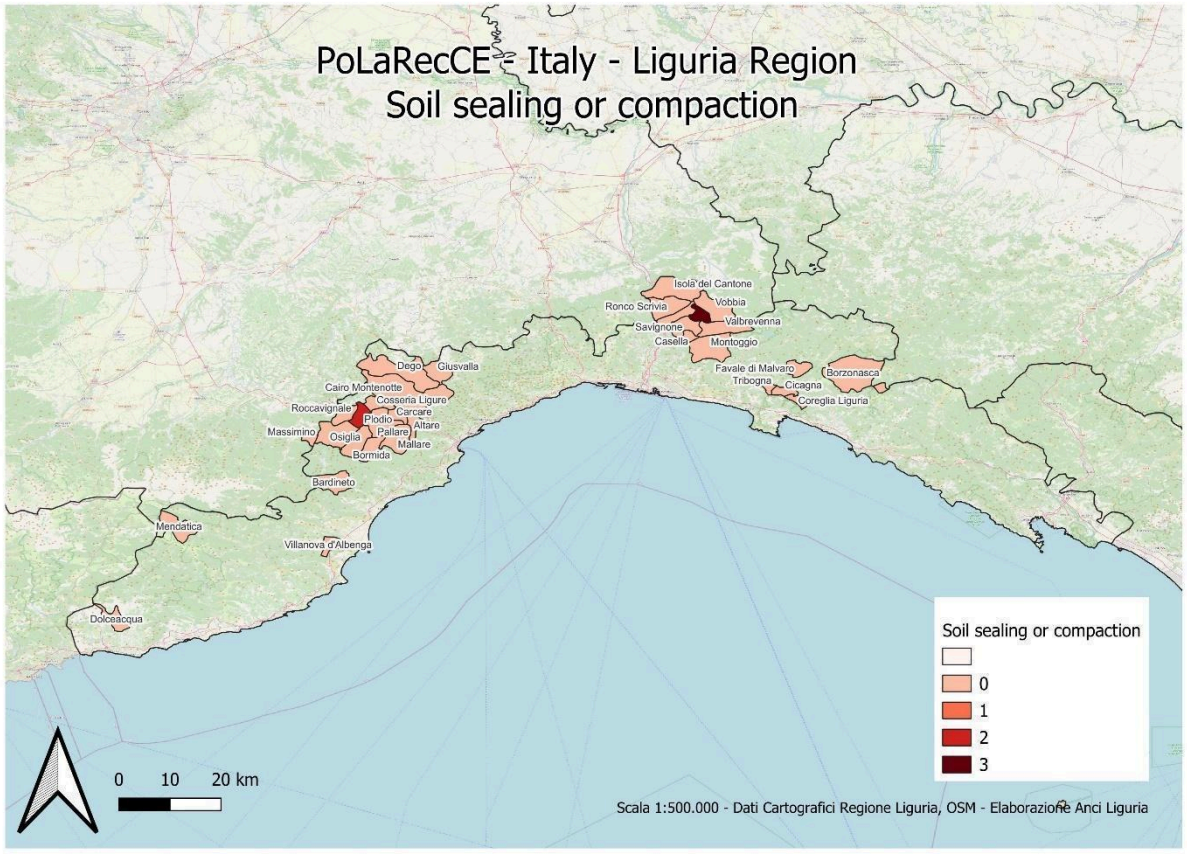


Fig. 18 - Soil sealing or compaction - IT - LIG

Some degradation is visible in the municipality of Millesimo and in the Municipality of Vobbia, the first one in Val Bormida and the other one in Valle Scrivia.

EMILIA ROMAGNA REGION

The Emilia Romagna region has a total surface of 22,453 km2, consisting of 330 municipalities of which 212 have sites inserted 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).

PoLaRecCE questionnaire was distributed to these 212 municipalities. We received responses from 18 municipalities which correspond to 8.5% of the contacted municipalities. The municipalities that responded to the questionnaire represent 4.7% of the total regional surface area and 4.6% of the regional population (Table 1).

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

Province	total surface area (km^2)	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 (km^2)	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

Data collected: summary and main comments

The questionnaire was organized in 18 questions, each referring to a specific soil degradation process with the exception of #18 in which municipalities could indicate soil degradation processes that were not already included in the questionnaire (Table 2). For each soil degradation process, the municipality would indicate its relevance (1: low; 2: medium; 3: high).

All soil degradation processes are present in the territory of the municipalities that responded to the questionnaire (N=18), with the exception of presence of cyanides (e.g. from the cooking industry) (#5), dumping of wastes materials from coal (#6) and ore mining (7). This is because Emilia Romagna region does not have a cooking industrial and coal or ore mining tradition.

Among the soil degradation process present in the region, the most relevant are flooding areas (#11) and soil sealing or compaction (17), for which 72 and 67% of municipalities have indicated a relevance from low to high and from low to medium, respectively (Table 2).

The risk of flooding is well known in the Emilia Romagna region. Recently, the region has been dramatically affected by large-scale floods (in 2023 and 2025), which have hit the plain areas of Romagna and Eastern Emilia, causing extensive damage even in mountain due to hydrogeological instability of these areas (see #18; Table 2; Emilia Romagna Region, 2023).

Another well-known issue in the region is the soil sealing process, leading to losses of soil due to urbanization and impermeabilization of soil. ISPRA's report on Emilia Romagna shows a soil consumption of 8.91% of the regional surface area in 2023, higher than the national average of 7.16% (SNPA-ISPRA, 2024).

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

The second most relevant groups of soil degradation processes involved contamination from urban and industrial dust deposition (#1), dumping of non-degradable trash or plastics (municipal wastes) (#9) and former quarries and areas after exploitation of natural resources (10). These issues are relevant in 44, 44 and 50% of them responded to the questionnaire. In most cases, these issues are present but considered of low importance (≥75%), however issue related to the contamination from urban and industrial dust deposition is considered also having high relevance.

Soil degradation processes that affect from 10 to 30% of municipalities that responded to the questionnaire are: leakage of waste waters or sewage sludge deposition (#3) and wind or water erosion (#16) both for 28%, leakage of oil and petroleum products (#2) and long-term poor agricultural farming practices (#15) both for 22%, volatile organic compounds (#4) and presence of military areas (#12) both for 17%, and saline or highly alkaline soils (#14) for 11%. The relevance of these groups is from low to high (Table 2).

Finally, the less relevant issues are related to degradation processes such as dumping of ashes from power industry (8) and heavily acidified soils (#13). These two issues apparently are not so disturbed among the territories of municipalities that responded to the questionnaire: for both issues one municipality has reported this issue, corresponding to the 6% (Table 2).

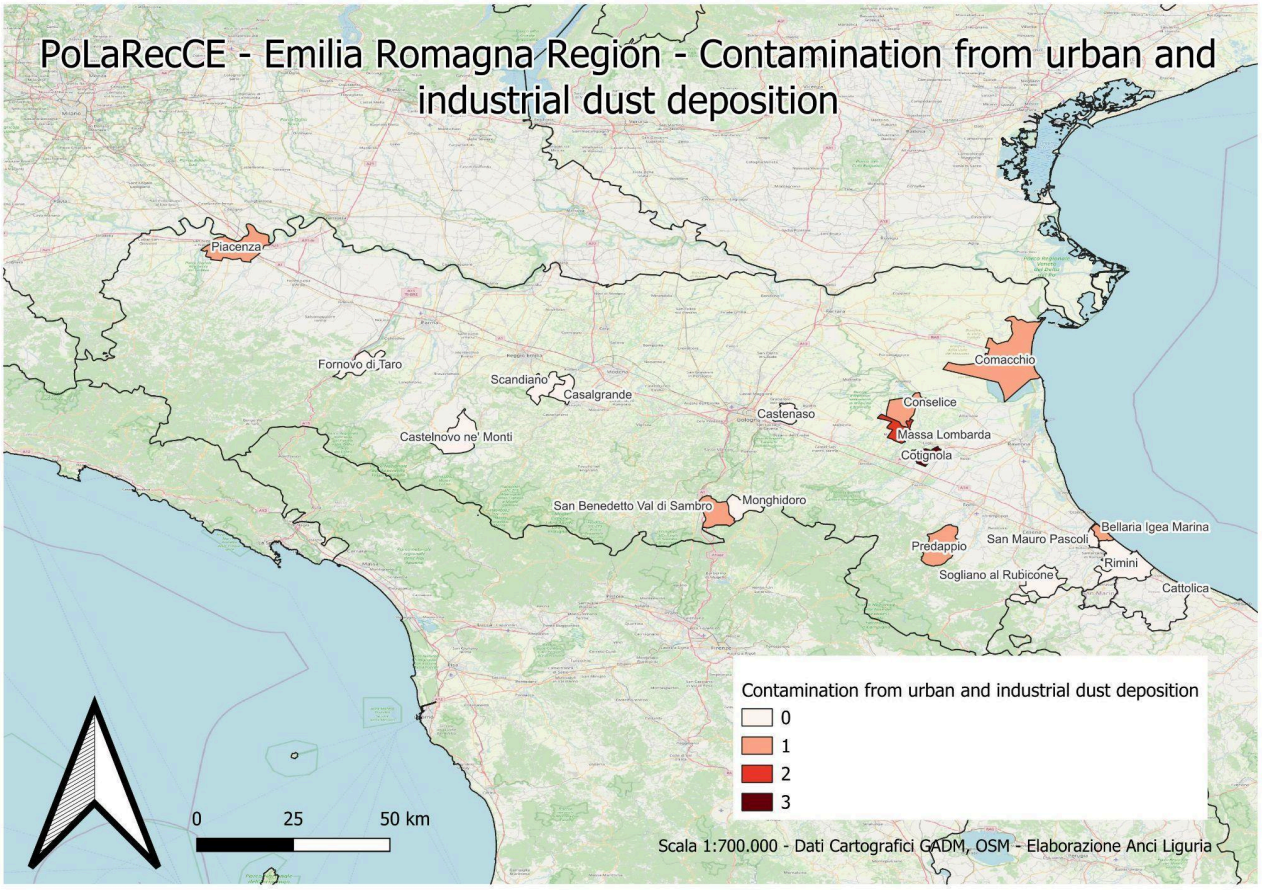


Fig. 19 - Contamination from urban and industrial dust deposition - IT - ER

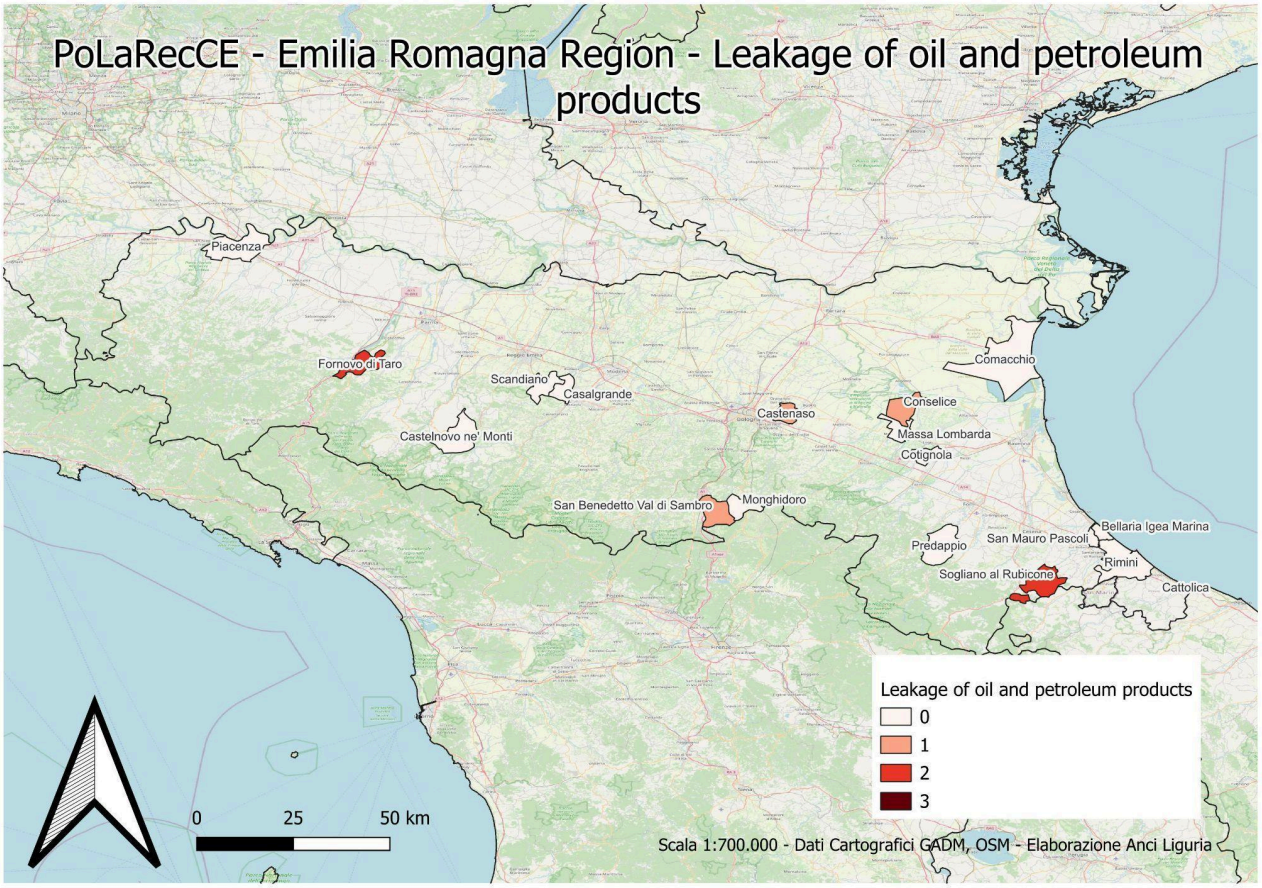


Fig. 20 - Leakage of oil and petroleum products - IT - ER

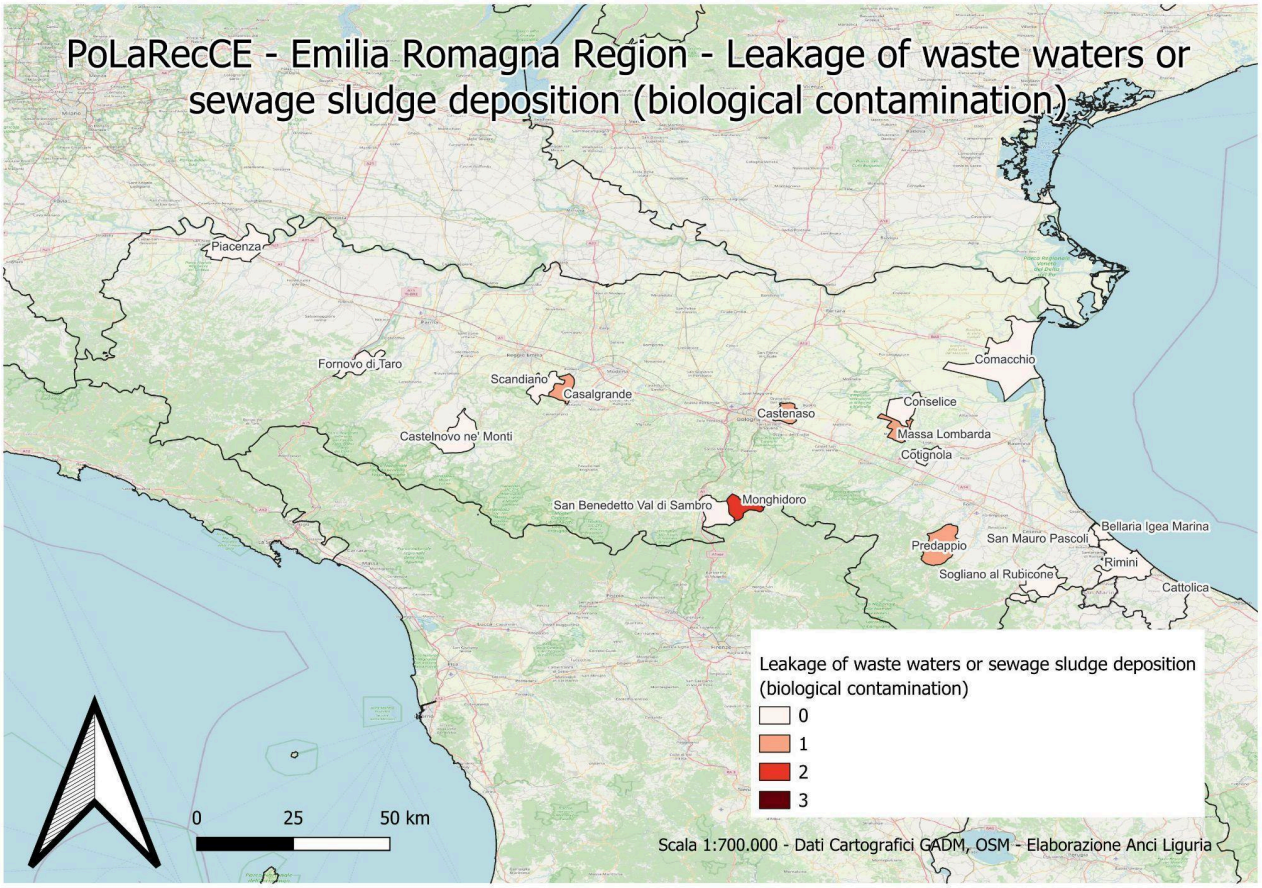


Fig. 21 - Leakage of waste waters or sewage sludge deposition (biological contamination) - IT - ER

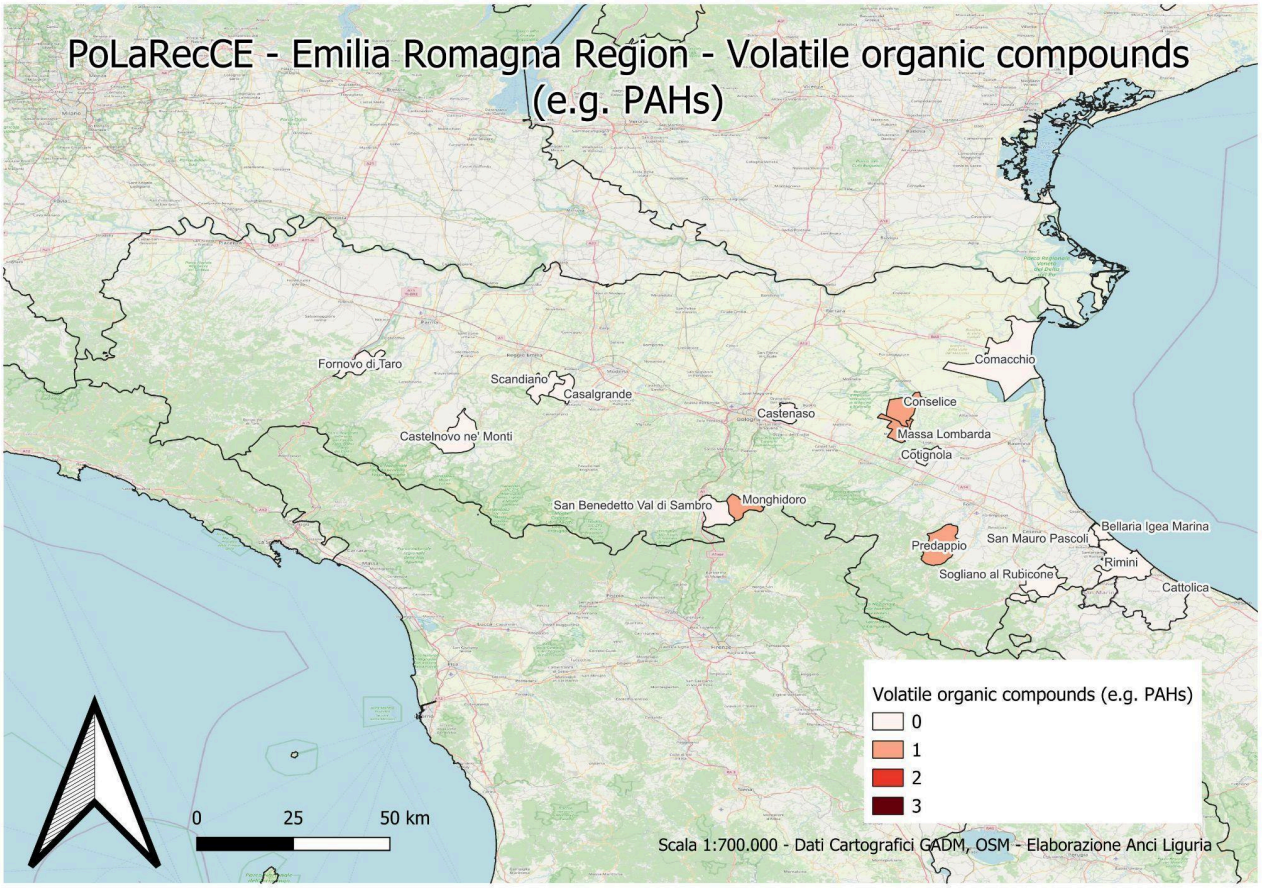


Fig. 22 - Volatile organic compounds (e.g. PAHs) - IT - ER

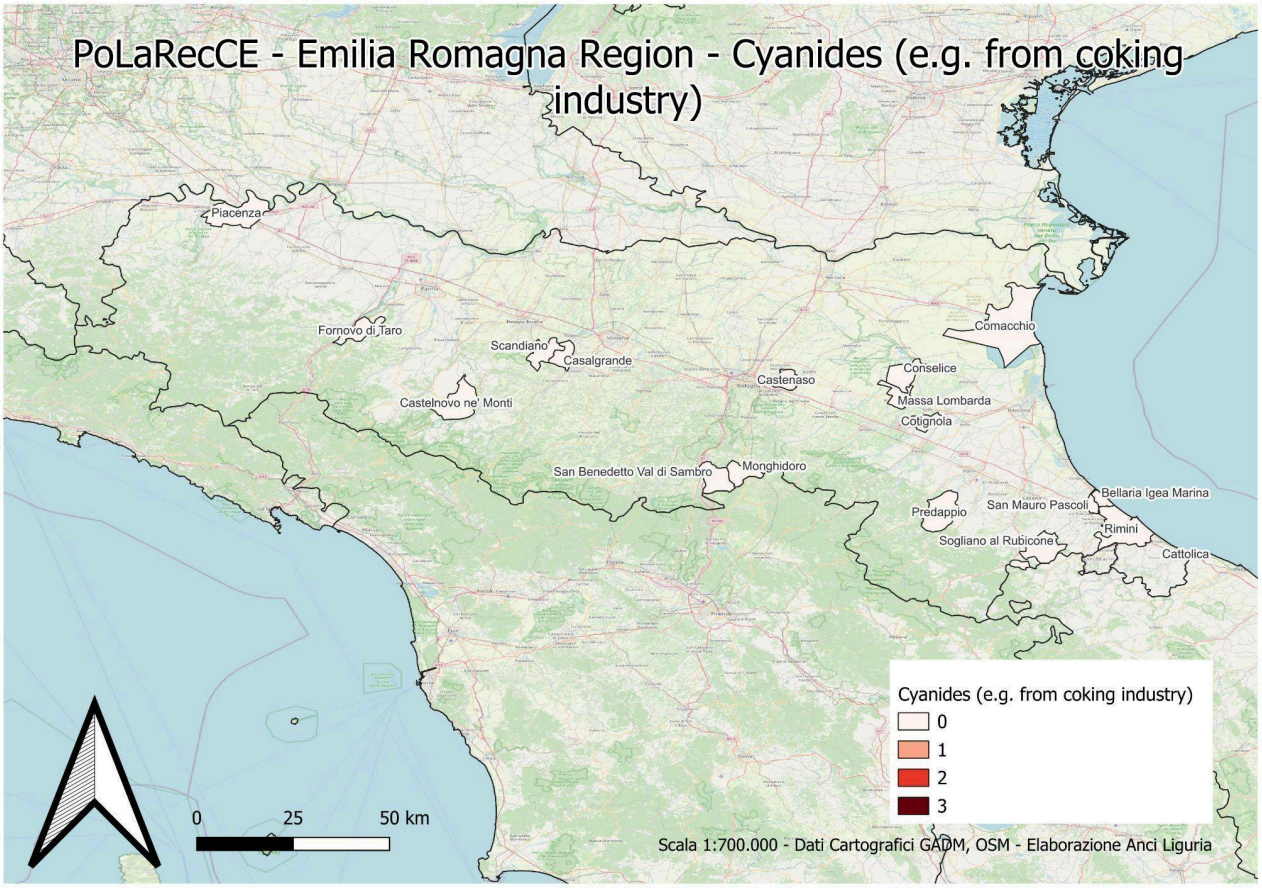


Fig. 23 - Cyanides (e.g. from coking industry) - IT - ER

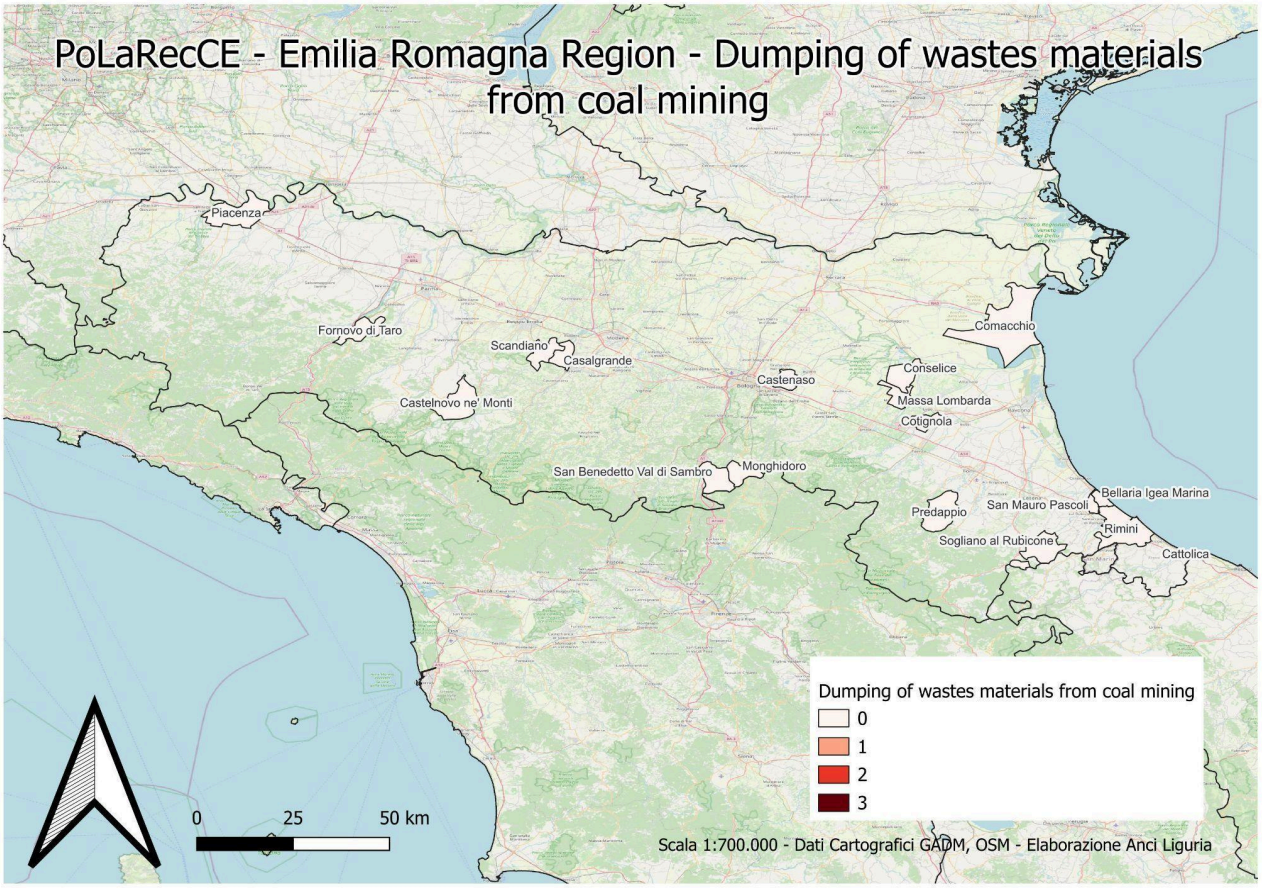


Fig. 24 - Dumping of wastes materials from coal mining - IT - ER

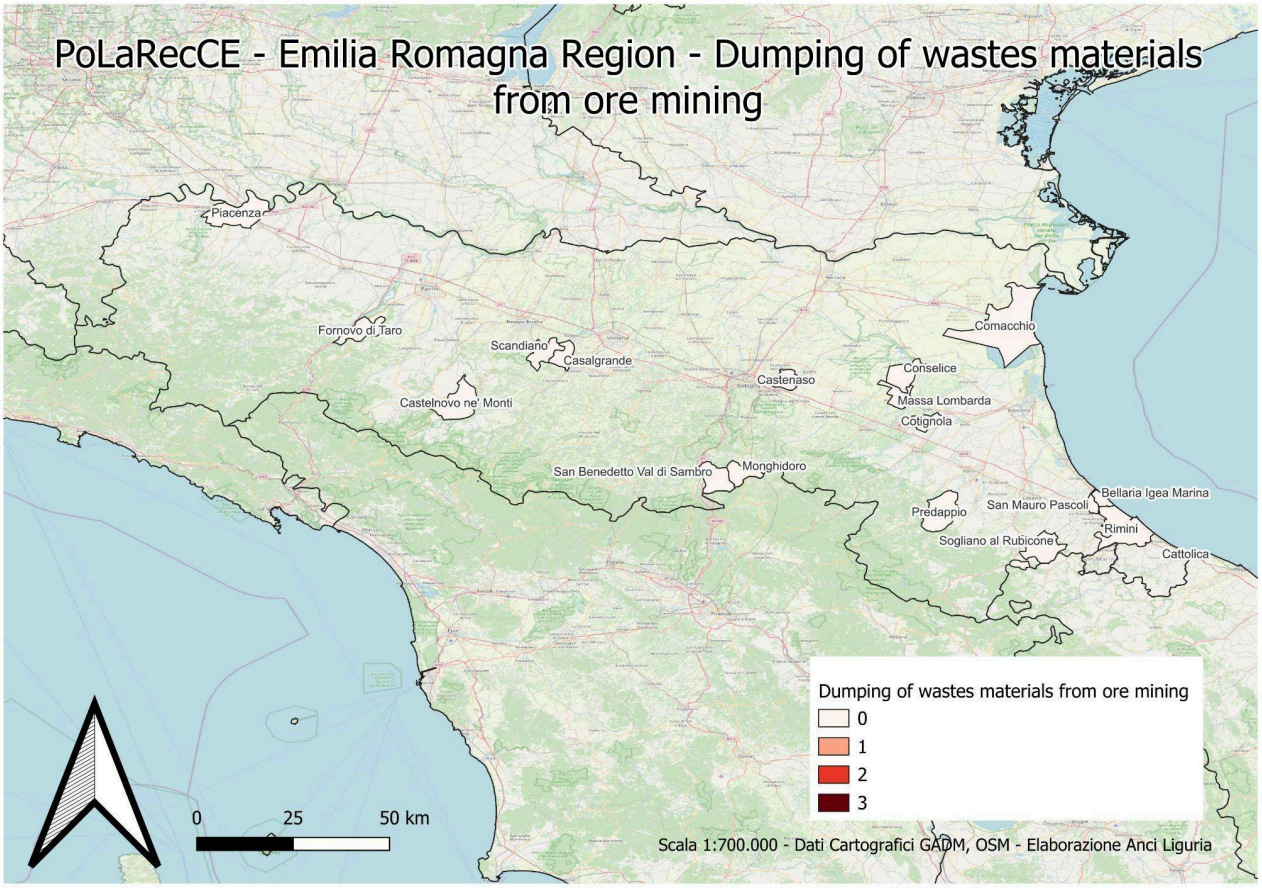


Fig. 25 - Dumping of wastes materials from ore mining - IT - ER

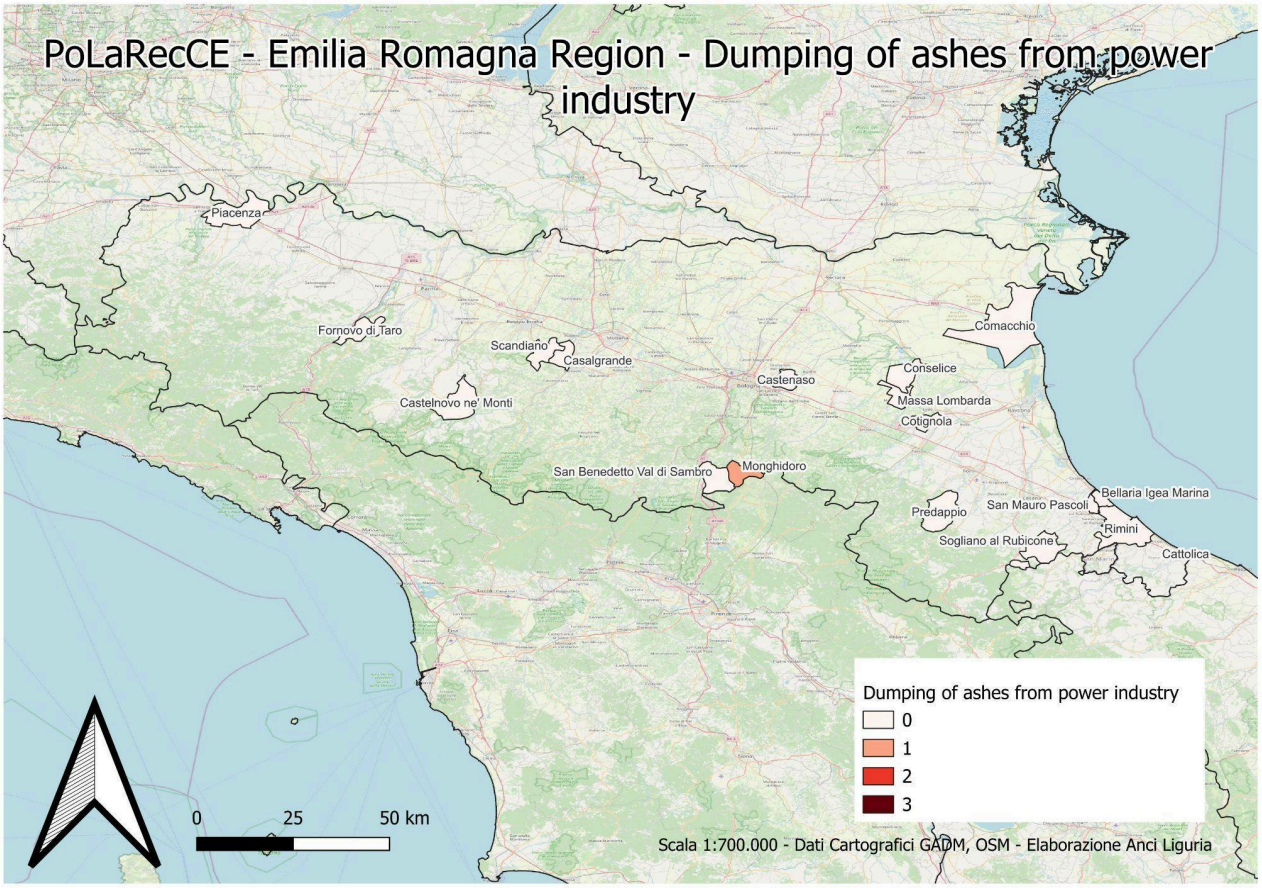


Fig. 26 - Dumping of ashes from power industry - IT - ER

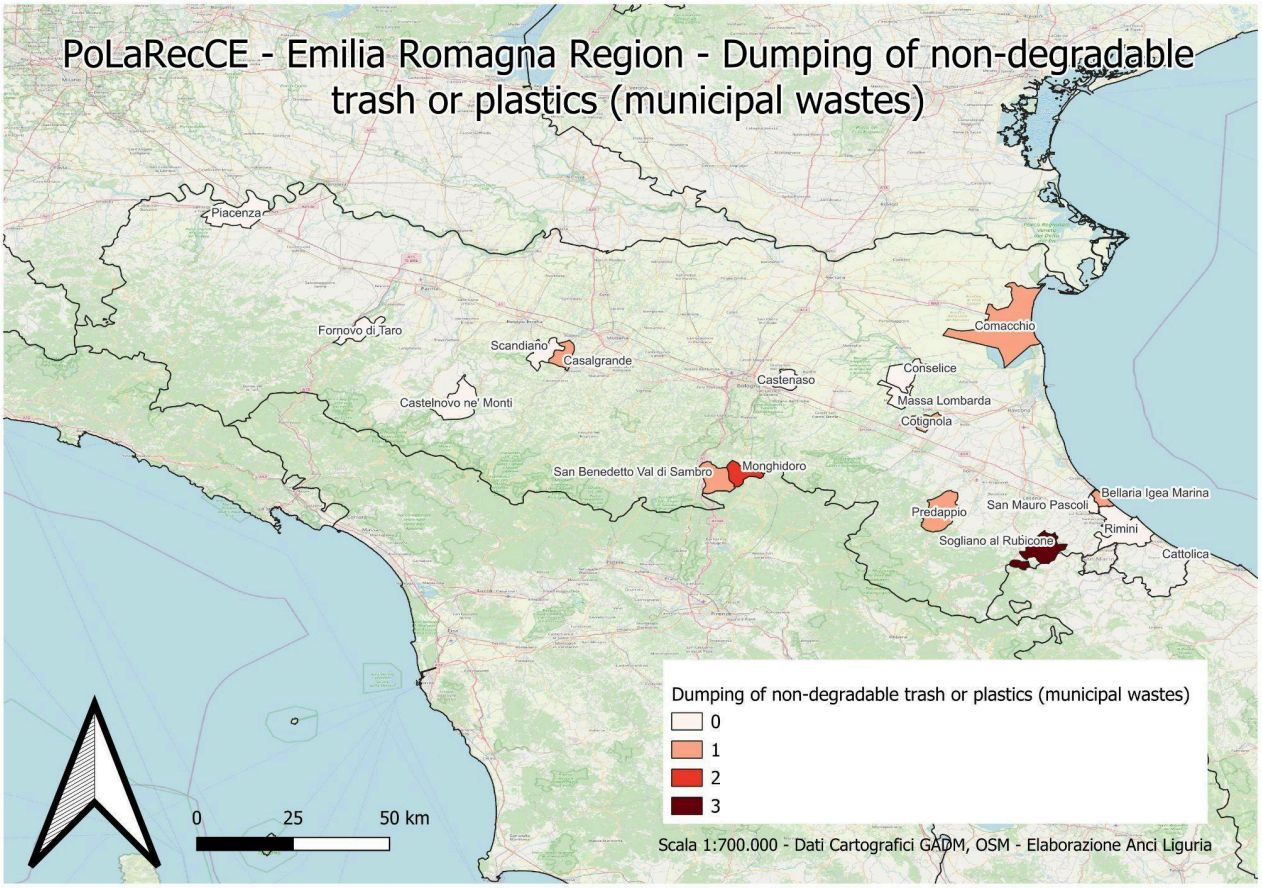


Fig. 27 - Dumping of non-degradable trash or plastics (municipal wastes) - IT - ER

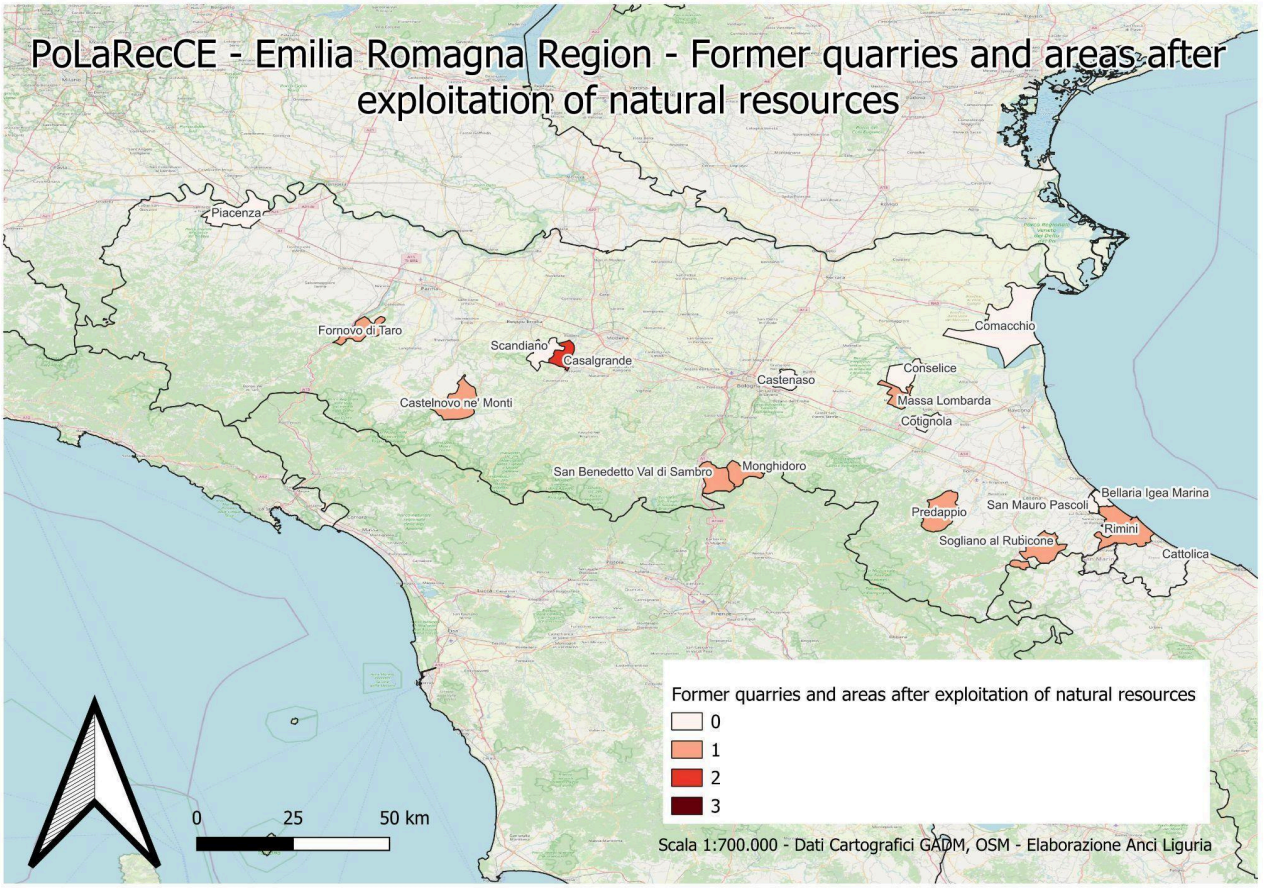


Fig. 28 - Former quarries and areas after exploitation of natural resources - IT - ER

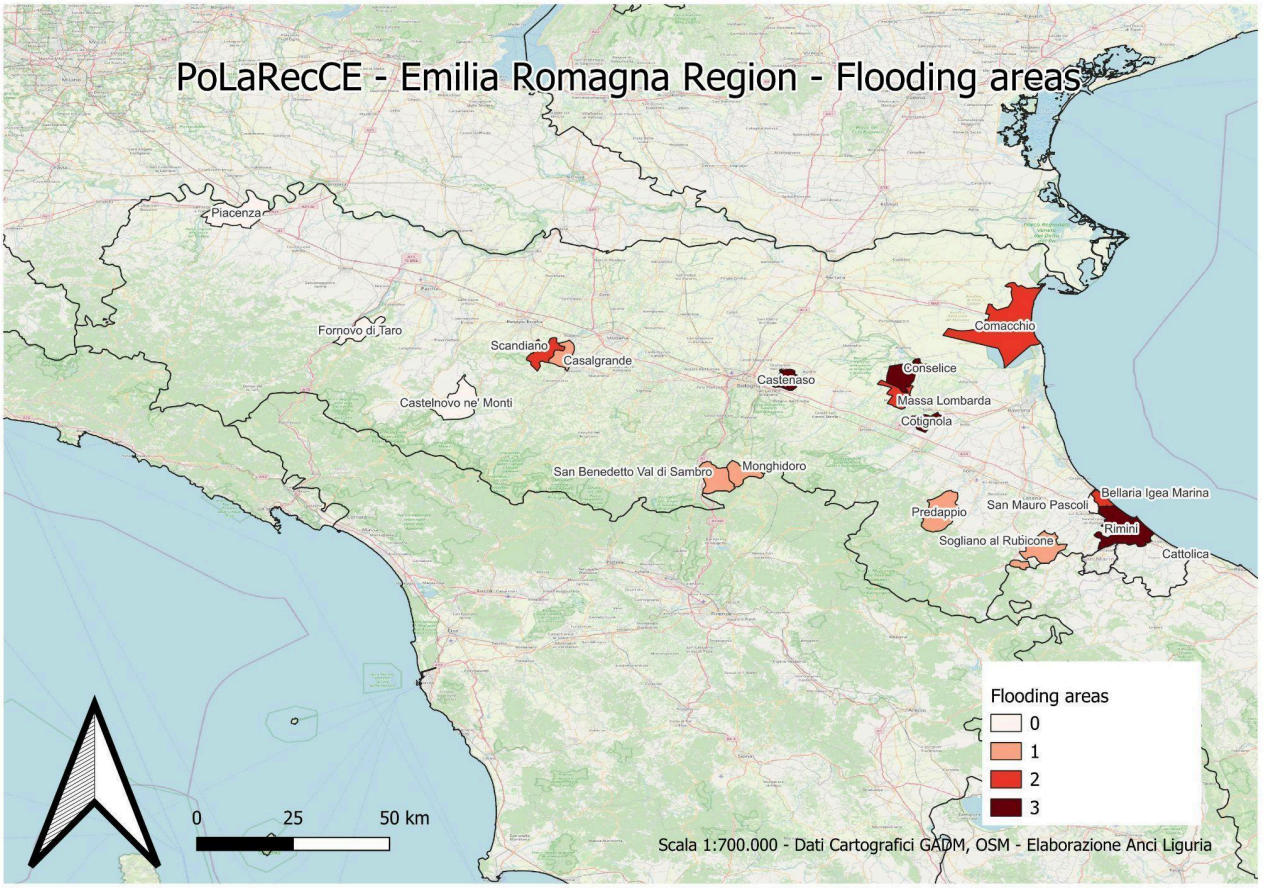


Fig. 29 - Flooding areas- IT - ER

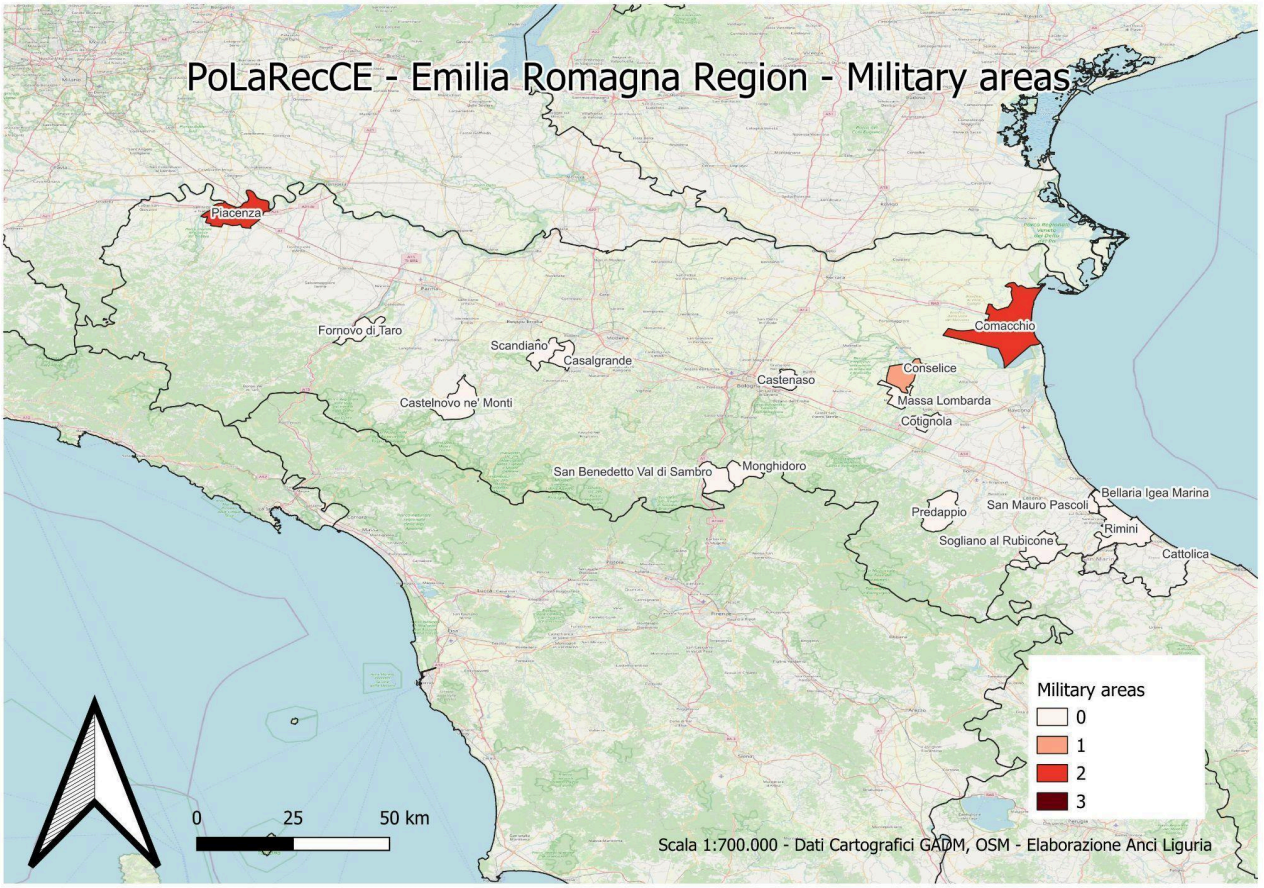


Fig. 30 - Military areas - IT - ER

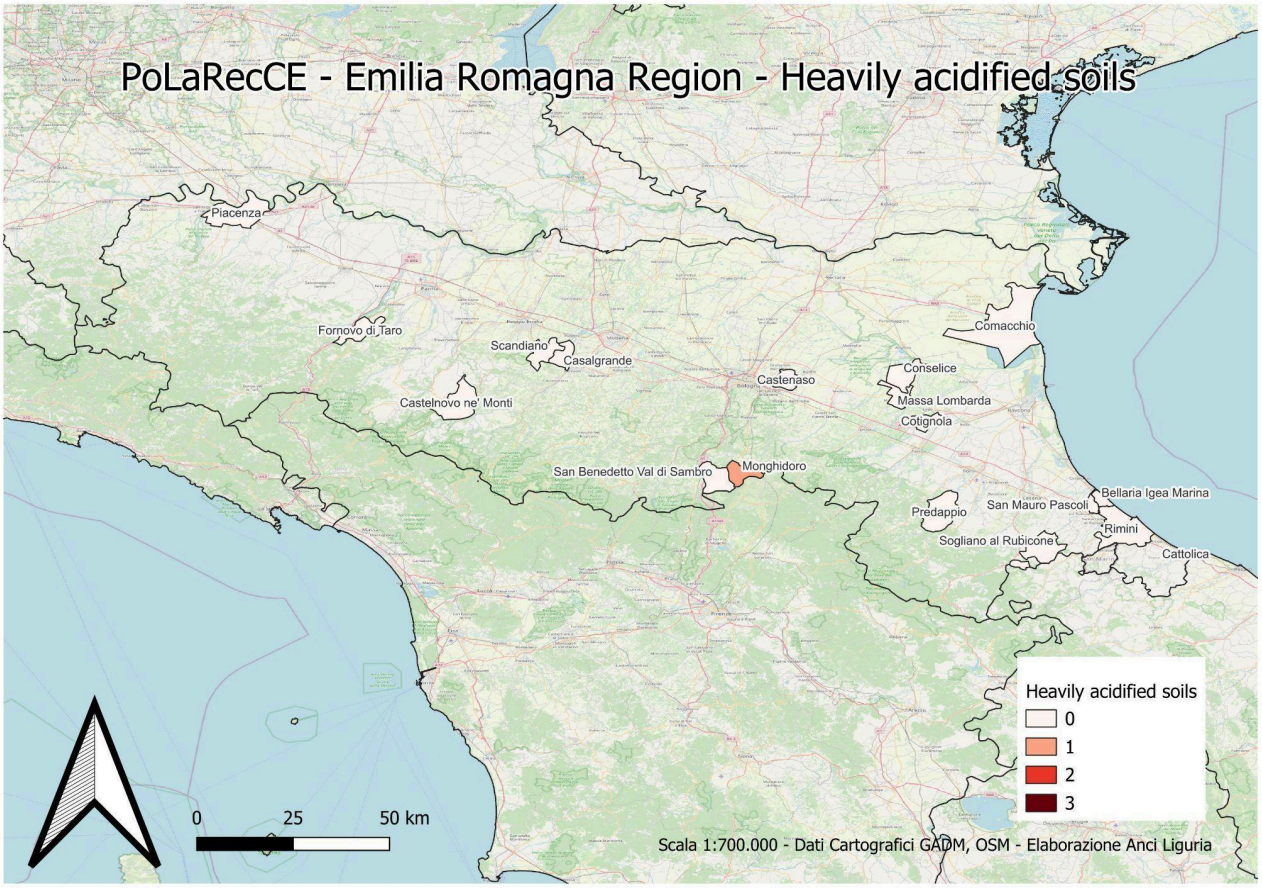


Fig. 31 - Heavily acidified soils - IT - ER

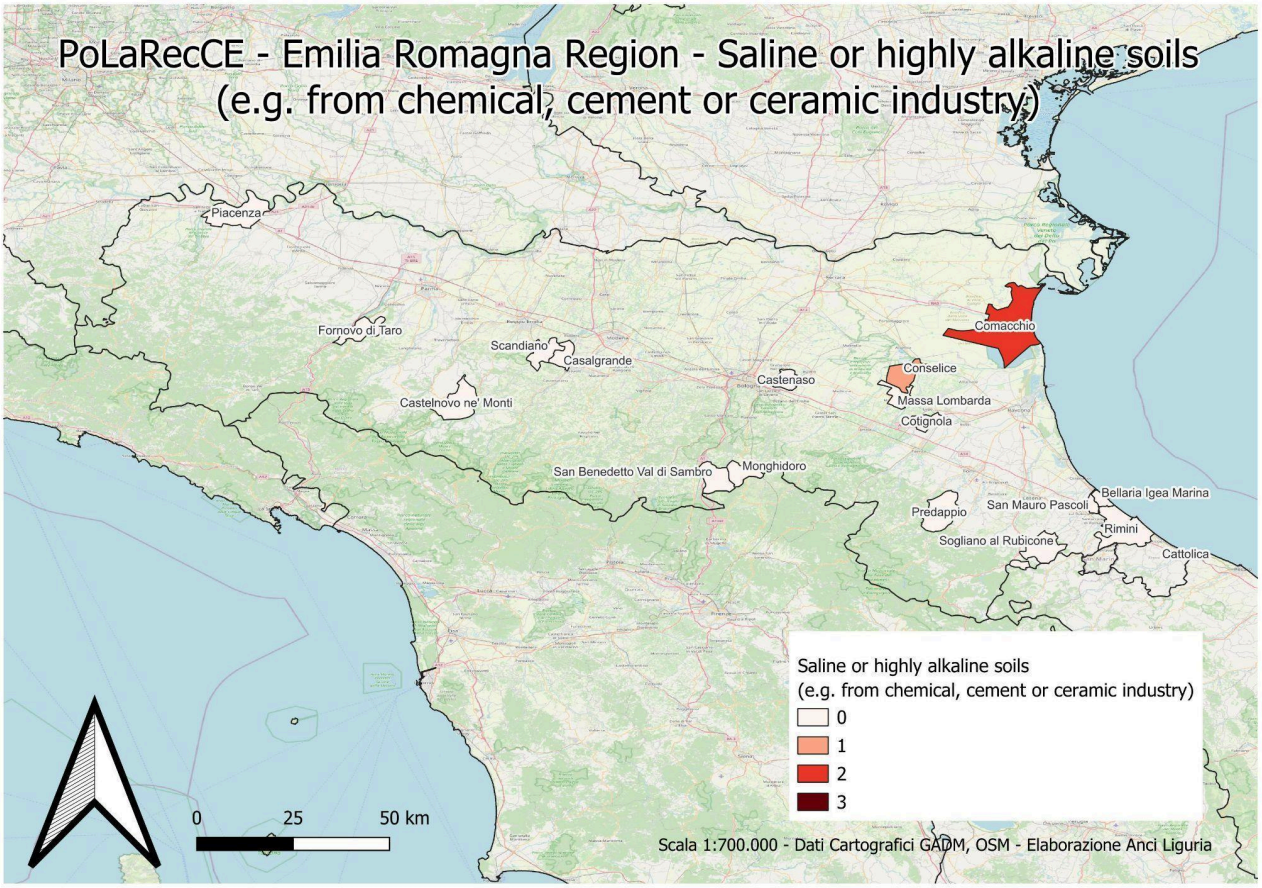


Fig. 32 - Saline or highly alkaline soils (e.g. from chemical, cement or ceramic industry) - IT - ER

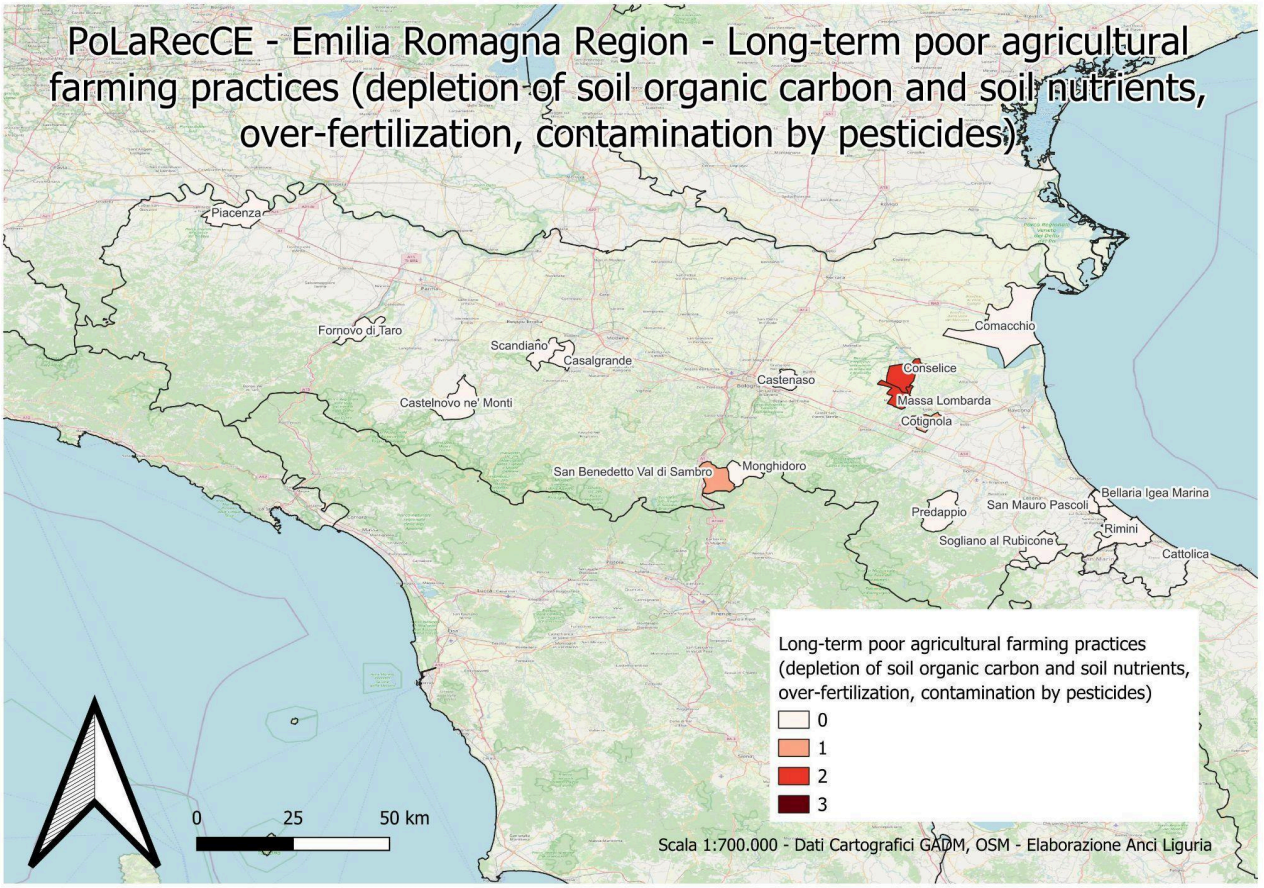


Fig. 33 - Long-term poor agricultural farming practices (depletion of soil organic carbon and soil nutrients, over-fertilization, contamination by pesticides) - IT - ER

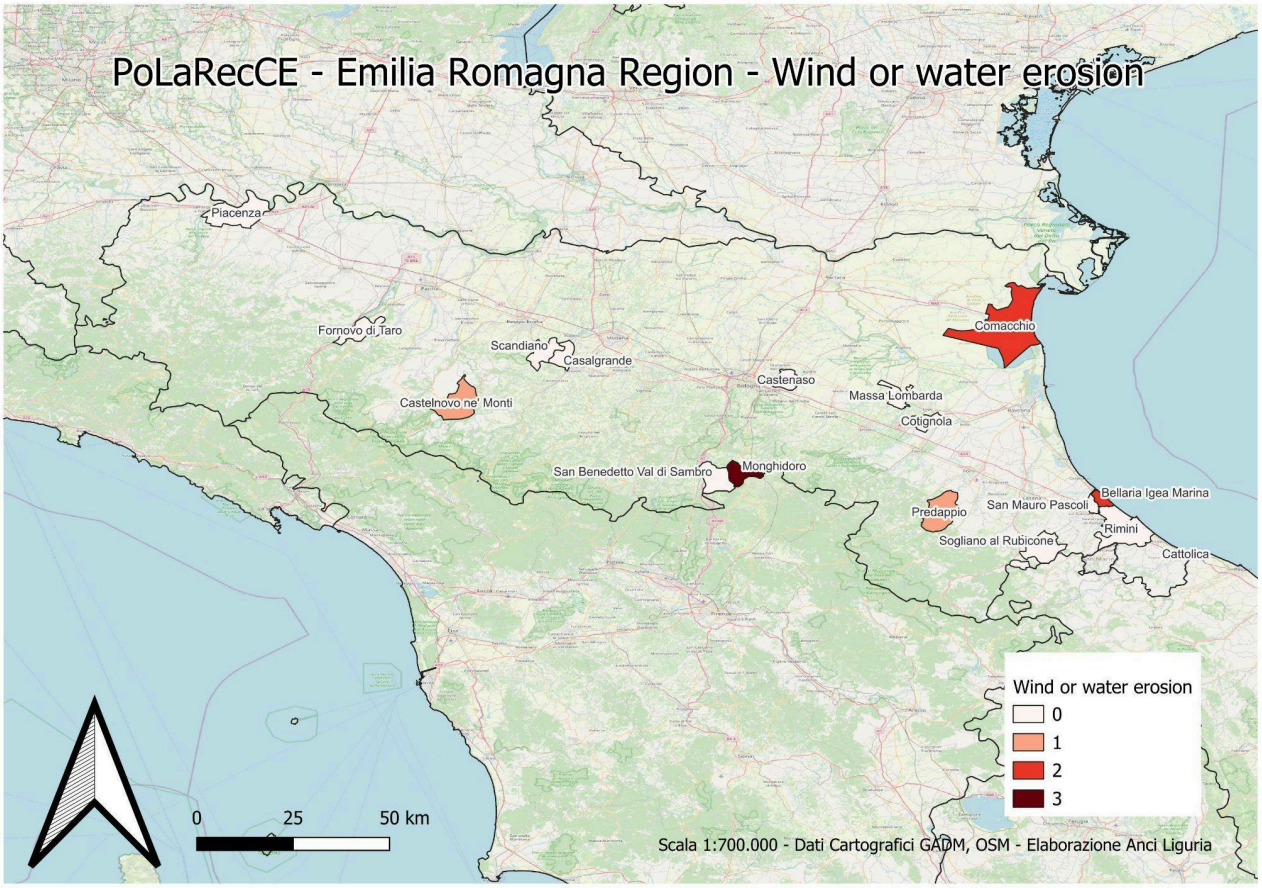


Fig. 34 - Wind or water erosion - IT - ER

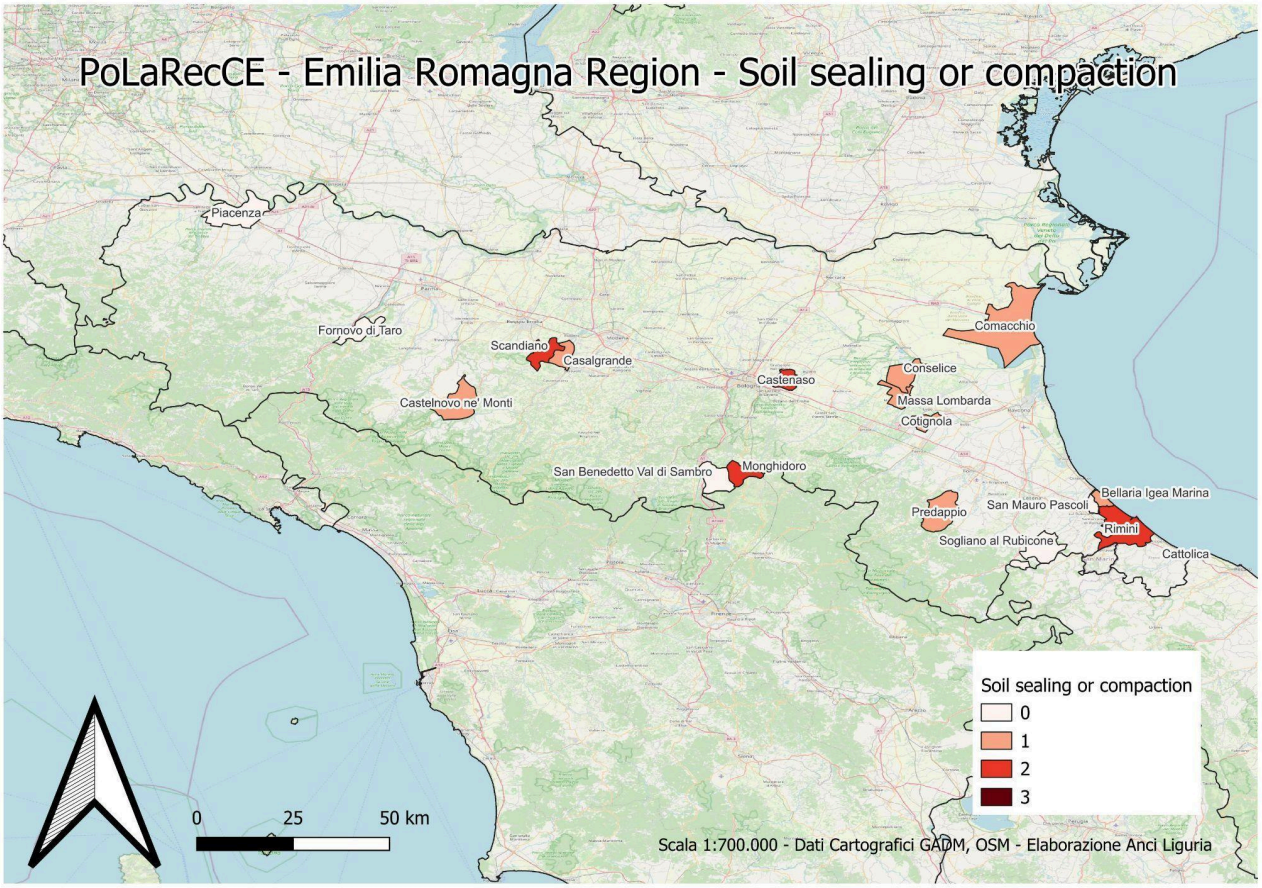


Fig. 35 - Soil sealing or compaction - IT - ER

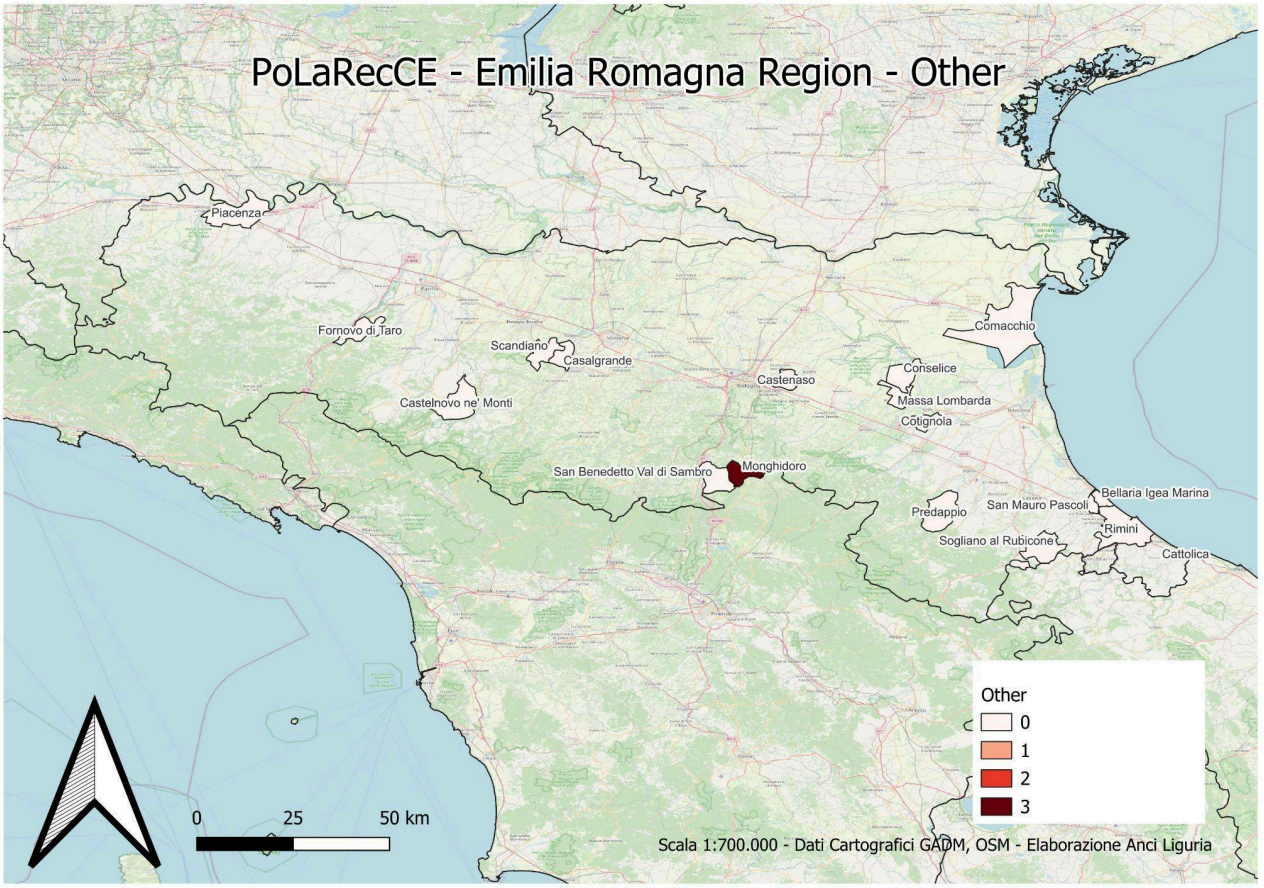


Fig. 36 - Others - IT - ER

3.2. Results in Poland

The European region PL22, which encompasses the Silesian Voivodeship, consists of 167 municipalities (49 urban, 22 urban-rural, and 96 rural), to which the PoLaRecCE questionnaire was distributed. We received responses from 80 municipalities, although not all were satisfactory. Six municipalities refused to complete the questionnaire, claiming they did not possess the relevant data—an assertion we believe is not entirely accurate. Although, according to Polish regulations, the authority responsible for maintaining records of historical land surface contamination (in cases where such contamination occurred in the past and may still pose a risk) is the regional county administration, our questionnaire—addressed to local administrations—did not include detailed questions regarding the state of soil quality. Instead, it clearly focused on whether problems related to specific forms of land degradation exist, and sought the administrative opinion on the extent of these issues. It is difficult to believe that a local administration officer working in a municipal environmental protection department would lack such knowledge. According to the Environmental Protection Law (Article 162 and subsequent articles), public administration bodies, including municipalities, are obliged to maintain local environmental databases—covering, among other things, land—if such information is available to them. Municipalities are required to:

- collect and provide data on the state of the environment, if they possess it or if it has been made available to them;
- participate in proceedings related to remediation or pollution removal, for instance in cases of suspected contamination of the land surface (e.g. resulting from industrial activity);
- issue environmental decisions, in which the condition of the soil may be a relevant factor.

Theoretically, it can be assumed that if a local officer responsible for environmental issues has no information regarding the existence of a given problem, this problem does not exist within the municipality under his or her jurisdiction and should therefore be marked as "0" in our questionnaire. In many cases, this was indeed the case. However, the credibility of questionnaires containing only zero values may be questionable. It is unlikely that none of the soil degradation types listed in the questionnaire occur at all. Nevertheless, considering that the "total zero" responses came mostly from small municipalities—primarily located in the southern mountainous areas and the north-eastern part of the region, where no major industrial centers are present—it can be assumed that, even if such forms of degradation do occur, they do not constitute a significant concern for local authorities. Our survey clearly indicates that, at the local level (i.e., municipalities), the awareness and knowledge of local administrations regarding soil conditions is strikingly low—even in large cities of the region. This applies as well to cities located in the central part of the region that are part of the Upper Silesian Metropolitan Union (GZM), where soil degradation caused by historical coal and metal extraction, as well as heavy industrial development dating back to the late 18th century, is a well-documented issue and where urbanization levels are very high In light of this, it should be acknowledged that the questionnaire results may contain certain inaccuracies.

Chemical contamination related to urban and industrial dust deposition.

The problem of soil contamination with heavy metals resulting from long-term atmospheric deposition from industrial and urban sources was reported by 32% of the municipalities. However, only four of them (Chorzów, Piekary Śląskie, Siemianowice Śląskie, and Rydułtowy) assessed the issue as high problem. The cities of Chorzów, Piekary Śląskie, and Siemianowice Śląskie are located in the central part of the GZM, where heavy industry—particularly coal mining, metallurgy, and power generation—was active for more than 200 years. Given the specific nature of the GZM area, it can be assumed that this form of chemical soil contamination extends beyond these cities and also affects neighboring municipalities that did not respond to our survey. The most critical soil pollutants in this region are cadmium, lead and zinc. Additionally, 6% of small towns—including Rydułtowy—located in other parts of the Silesian Voivodeship also reported this type of soil degradation as a high or medium concern. However, in most of these cases, the sources of pollution are not located within the towns themselves. This same type of soil degradation, though reported as a low problem, was also identified in 20% of the surveyed municipalities.

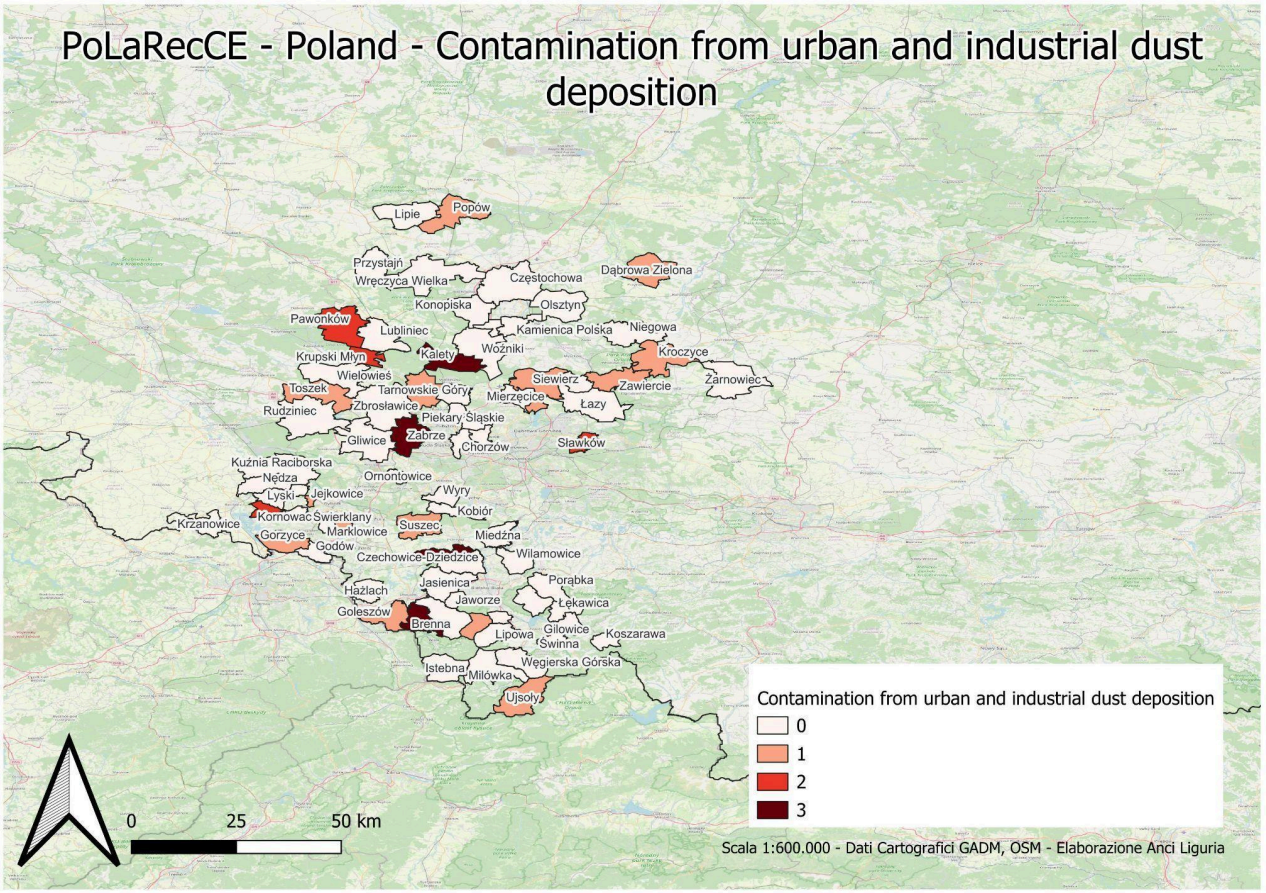


Fig. 37 - Chemical contamination related to urban and industrial dust deposition - POL

Degradation caused by leakage of oil and petroleum products.

Degradation caused by oil and petroleum product spills was reported by 17% of the surveyed municipalities; however, in only one case was this issue assessed as highly significant. In the remaining cases, the problem involved only localized point-source pollution, typically occurring in small areas around current or former fuel and oil storage tanks. The only municipality to classify this issue as high in significance was Czechowice-Dziedzice, home to the largest oil refinery in the region. The refinery has operated there since the late 19th century, producing oils and lubricants that were exported globally. After 2006, the facility was transformed into a storage and distribution center and ceased oil production. The areas where waste materials—such as tar and petroleum derivatives—are stored have been entered into the historical pollution register by the Regional Director for Environmental Protection in Katowice.

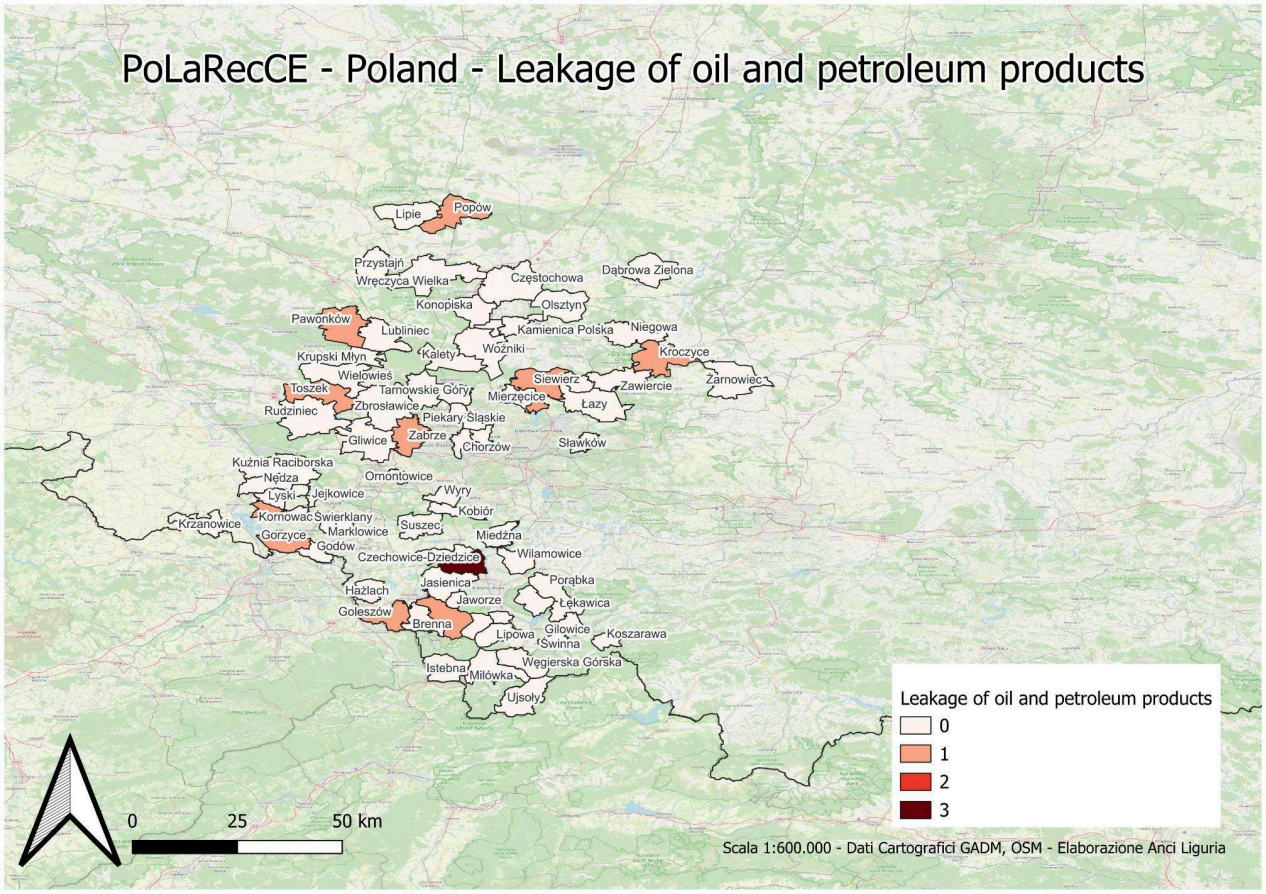


Fig. 38 - Degradation caused by leakage of oil and petroleum products - POL

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

The problem of soil degradation caused by wastewater leakage or sewage sludge deposition (biological contamination) was reported in 23% of the municipalities; however, it was assessed as a high or medium-level issue in only two cases. Both of these were rural municipalities—Suszec and Wielowieś—though the sources of the problem differed. In Suszec, significant contamination of groundwater and surface water was identified, primarily due to poor management of sewage and waste generated by coal mining activities (a hard coal mine operates within the municipality). In contrast, the Wielowieś municipality reported issues related to the uncontrolled use of sewage sludge by local farmers, which may directly impact the quality of groundwater and sources of drinking water.

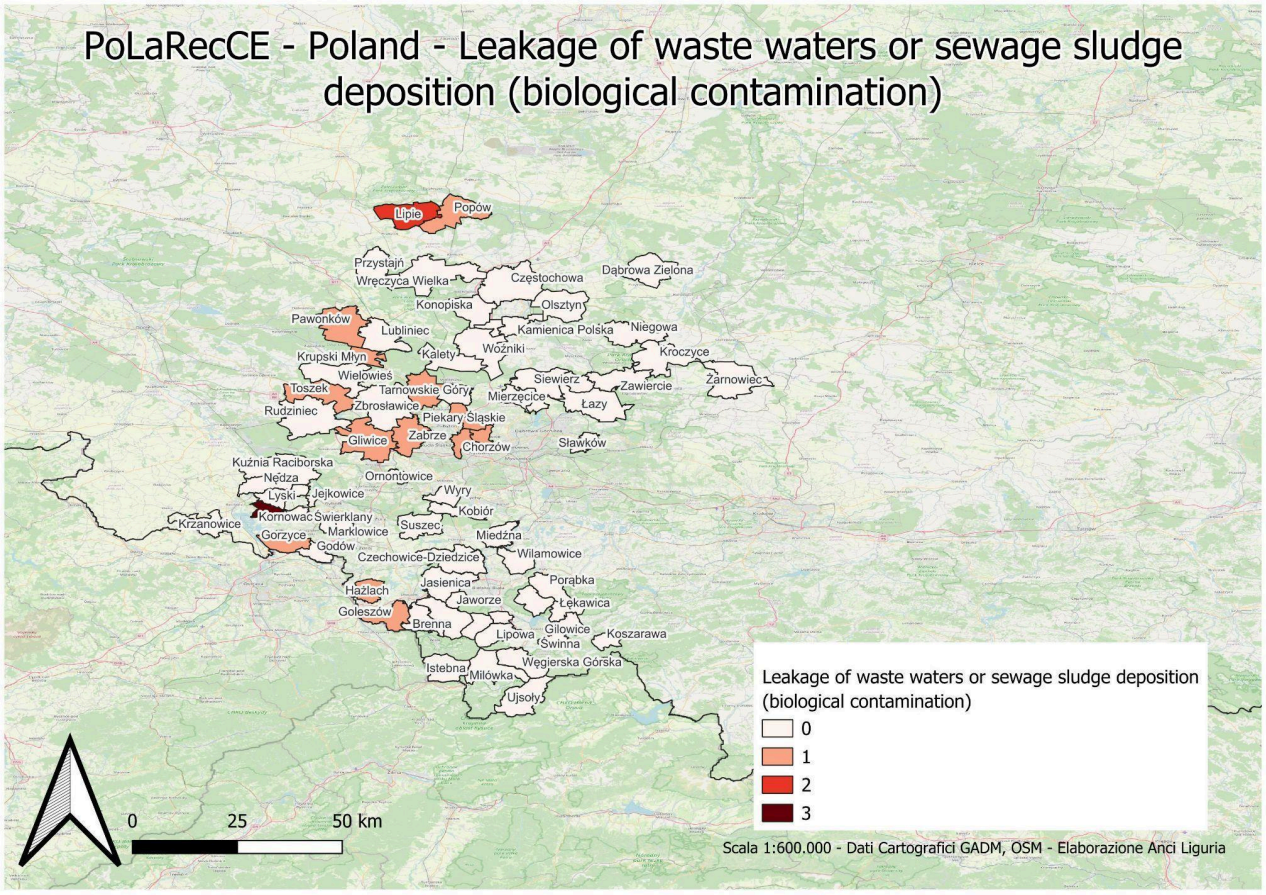


Fig. 39 - Degradation caused by leakage of waste waters or sewage sludge deposition (biological contamination) - POL

Degradation caused by volatile organic compounds (e.g. VOCs, PAHs).

Degradation caused by volatile organic compounds (VOCs) or polycyclic aromatic hydrocarbons (PAHs was reported by 17% of the surveyed municipalities, but it was considered a medium or high-level problem only in Zabrze and Siemianowice Śląskie. However, based on our experience, this issue appears to be underestimated in the Upper Silesia region, and knowledge regarding the distribution of organic contaminants in the soil remains incomplete. Related studies have been conducted only locally, primarily in areas surrounding previously identified sources of pollution—mostly former coking plants.

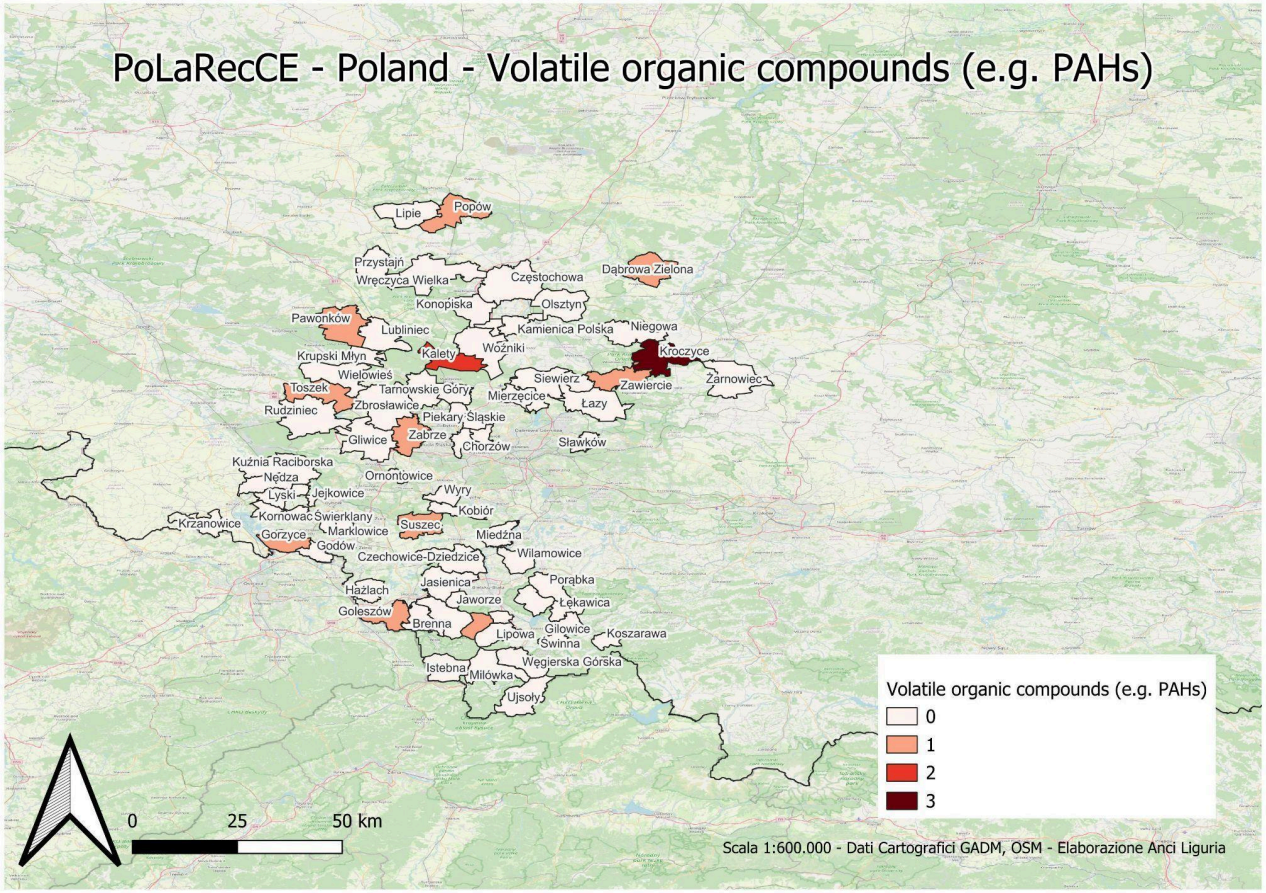


Fig. 40 - Degradation caused by volatile organic compounds (e.g. VOCs, PAHs) - POL

Degradation caused by cyanides (e.g. from coking industry).

Soil degradation caused by cyanides is primarily associated with coking activities. Only four municipalities reported the existence of this problem, and in only one case—Zabrze—was it classified as a high-level issue. This is likely due to the historical presence of five coking plants located in or near Zabrze.

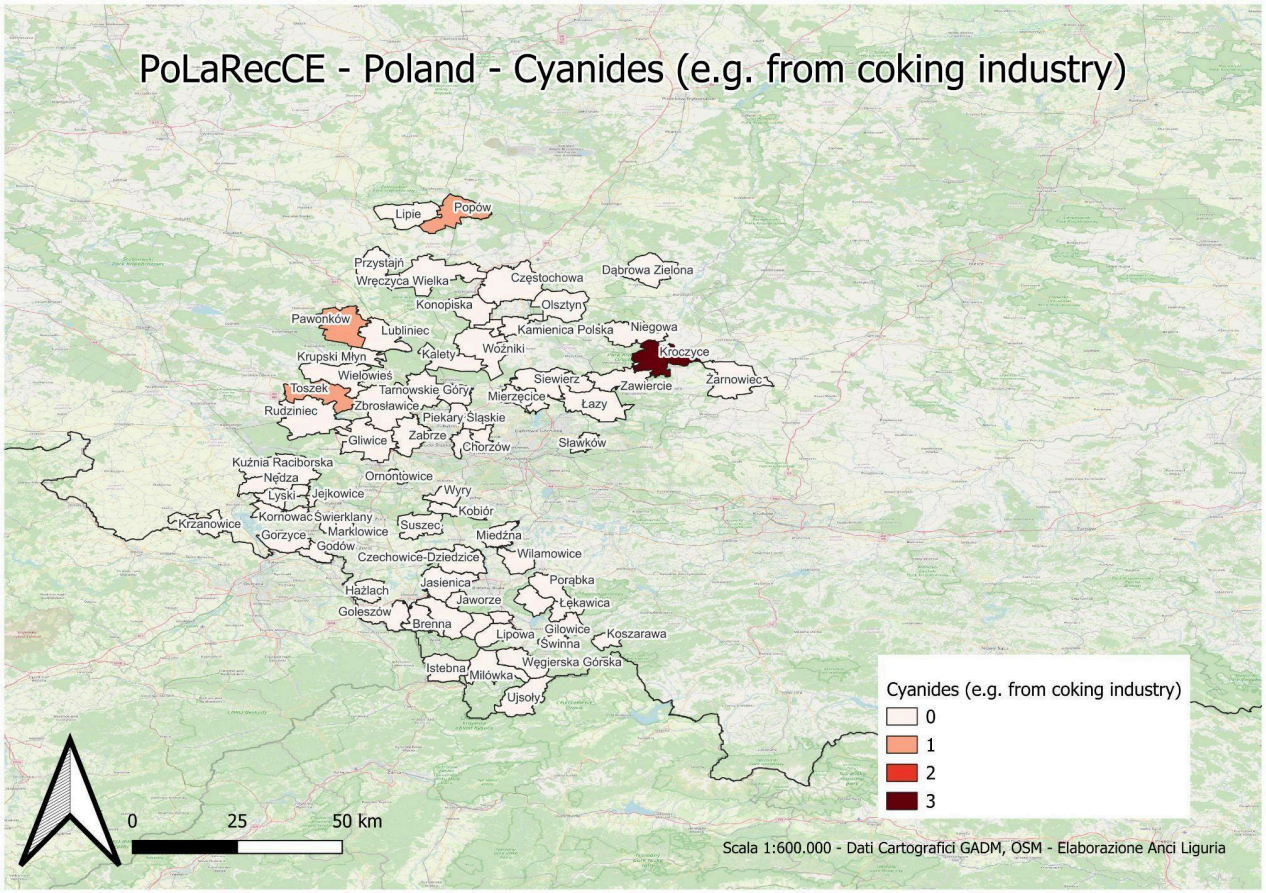


Fig. 41 - Degradation caused by cyanides (e.g. from coking industry) – POL

Degradation caused by dumping of wastes materials from coal mining.

Soil degradation caused by the storage of coal mining waste was reported by 20% of the surveyed municipalities, with six municipalities considering it a high problem: Suszec, Świerklany, Siemianowice Śląskie, Zbrosławice, Rydułtowy, and Zabrze. The coal mining waste in these municipalities is found in various forms, including spoil heaps, flotation sludge settling tanks, and waste rock dumps. Soil degradation associated with these sites includes, among other issues: the generation of acidic wastewater, dust dispersion affecting a wider area around the sources, uncontrolled spontaneous combustion emitting gaseous substances and dust particles. These features are also characteristic elements of the local and regional landscape. This problem undoubtedly affects a larger area than what has been reported by the respondents.

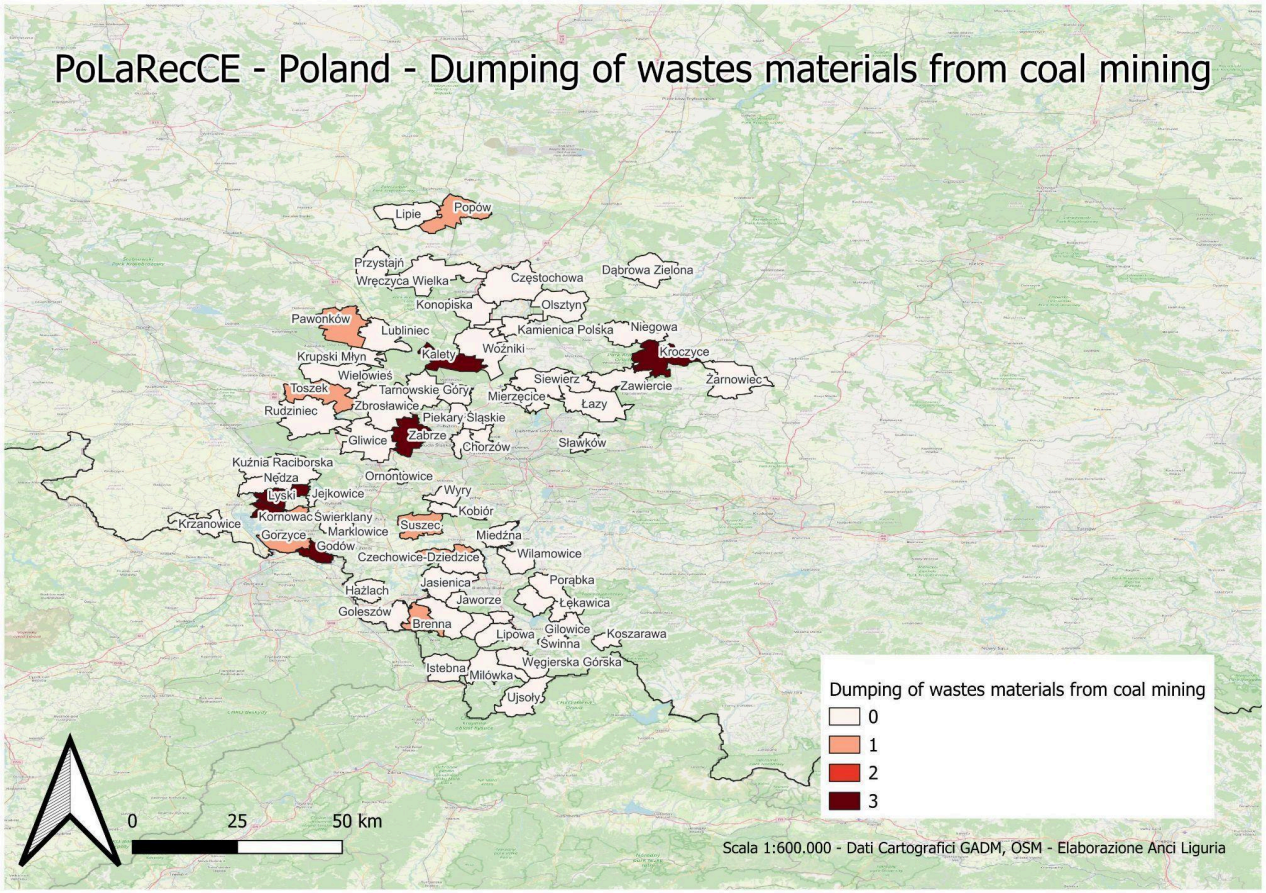


Fig. 42 – Dumping of wastes materials from coal mining - POL

Degradation caused by dumping of wastes materials from ore mining.

The dumping of waste materials from ore mining was reported by only five municipalities, but it was considered a serious problem in only two of them: Siemianowice Śląskie and Piekary Śląskie. Both are located in the central part of the GZM, an area with a history of zinc and lead ore extraction and processing, as well as iron metallurgy. This problem undoubtedly exists in other municipalities in the region that did not submit questionnaires, but it is primarily related to historical ore mining activities.

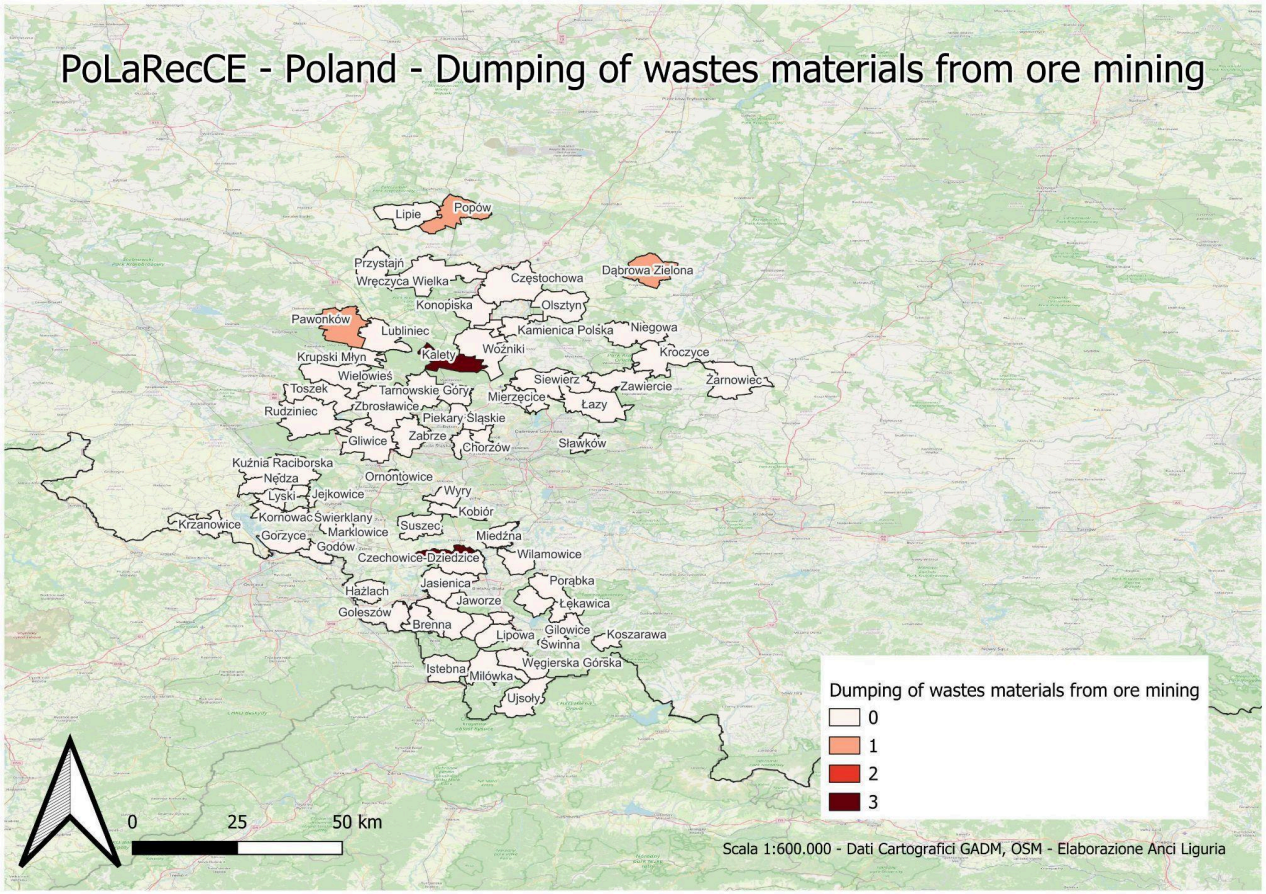


Fig. 43 - Degradation caused by dumping of wastes materials from ore mining - POL

Degradation caused by dumping of ashes from power industry.

Six municipalities reported soil degradation caused by the dumping of ashes from the power industry. In two cases (Siemianowice Śląskie and Zbrosławice), it was reported as a high or medium-level problem. In Siemianowice Śląskie, there is currently no active dumping of power plant waste; however, in the past, there were waste dumps from local heating plants. The by-products of these activities included fly ash and furnace slag. Today, some of the old power ash dumps are being re-exploited, with ashes being used for the reclamation of degraded areas, surface hardening, and the construction of embankments for railways and roads. In Zbrosławice, a rural municipality, one of the largest dumping sites in the region is located, containing 65% coal mine waste from mines in the western part of GZM and 35% power plant ashes from the large Rybnik power plant. The total volume of waste stored at this facility is estimated at approximately 25 million m^3.

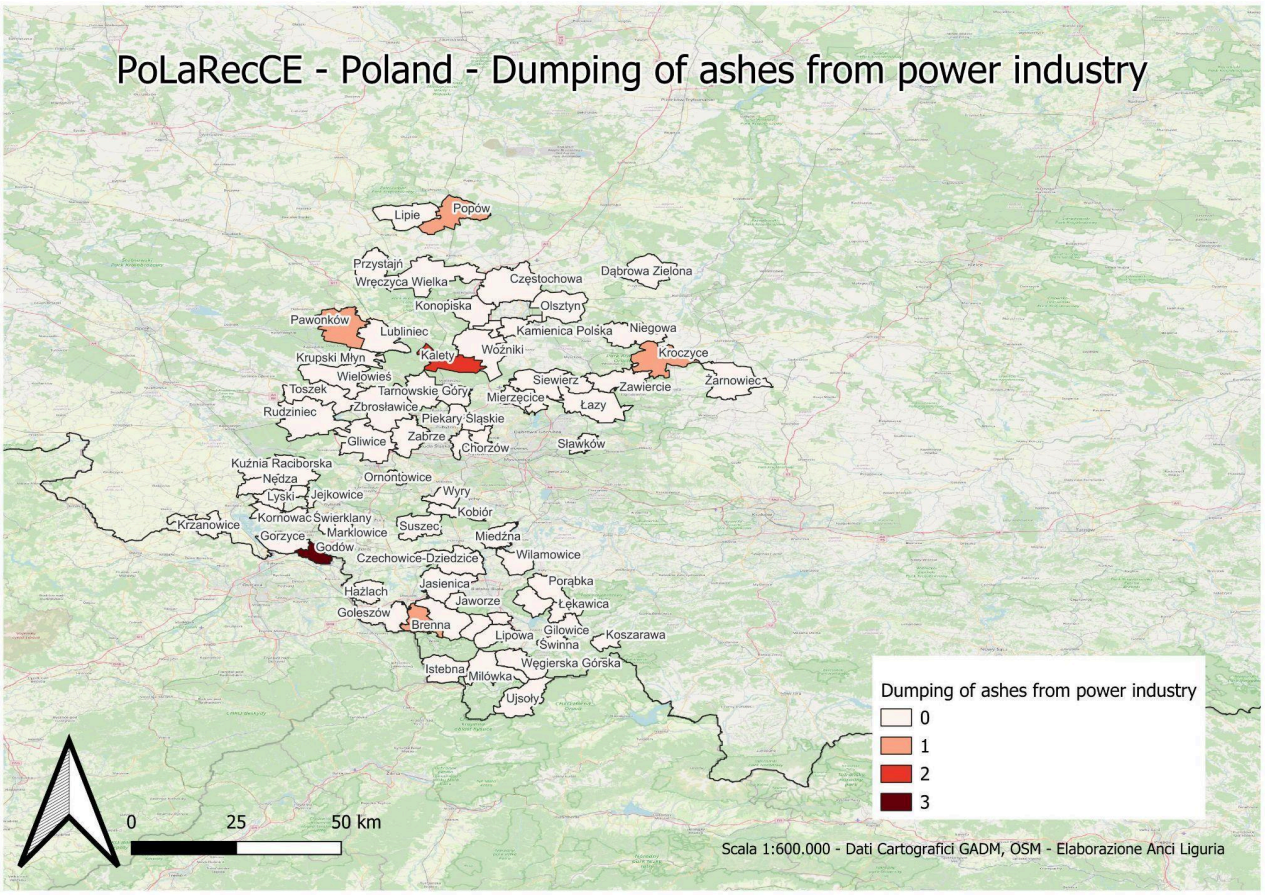


Fig. 44 - Degradation caused by dumping of ashes from power industry - POL

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

Soil degradation caused by the storage of non-biodegradable waste or plastics (mainly municipal waste) was reported by 32% of the municipalities, including six that assessed it as a medium-level problem and two as a high-level problem. The highest importance of soil degradation related to the storage of non-degradable waste was recorded in the small rural municipality of Kamienica Polska and in Sławków, a small town located in the eastern part of the region. These issues are most likely the result of many years of neglect in municipal waste management, insufficient infrastructure for waste management, and the activities of entities operating in violation of the law. Small illegal landfills were also reported as a problem in Sławków and some other municipalities. A low scale of the problem was also reported in six other municipalities: Siewierz, Gliwice, Kuźnia Raciborska, Rydułtowy, Zabrze, and Zawiercie.

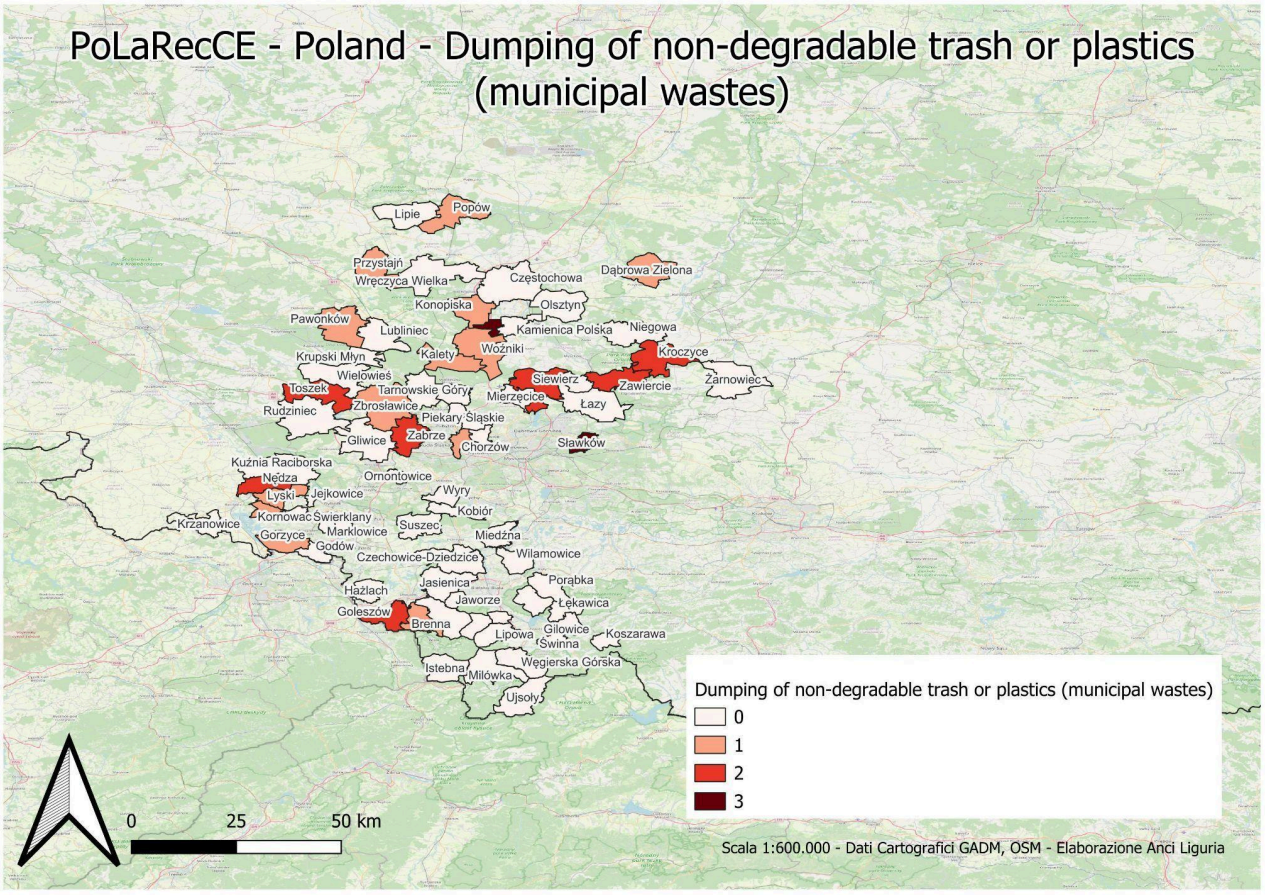


Fig. 45 - Degradation caused by dumping of non-degradable trash or plastics (municipal wastes) - POL

Soil degraded in former quarries and areas after exploitation of natural resources.

Soil degradation in the vicinity of former quarries and areas impacted by the extraction of natural resources (mostly dolomite, limestone, clays, sand, or gravel) was reported by 31% of municipalities, but only in five of them was it noted as a medium-level problem. With the exception of Milówka (a small municipality located in the Beskidy Mountains), the others are located in the north-eastern part of the region, where dolomite and limestone quarries, as well as areas of local clay and gravel extraction, are found. Large areas affected by sand extraction, which were used for filling underground workings after hard coal extraction, have already been reclaimed and transformed into forested areas or water reservoirs, which are now primarily used for recreation.

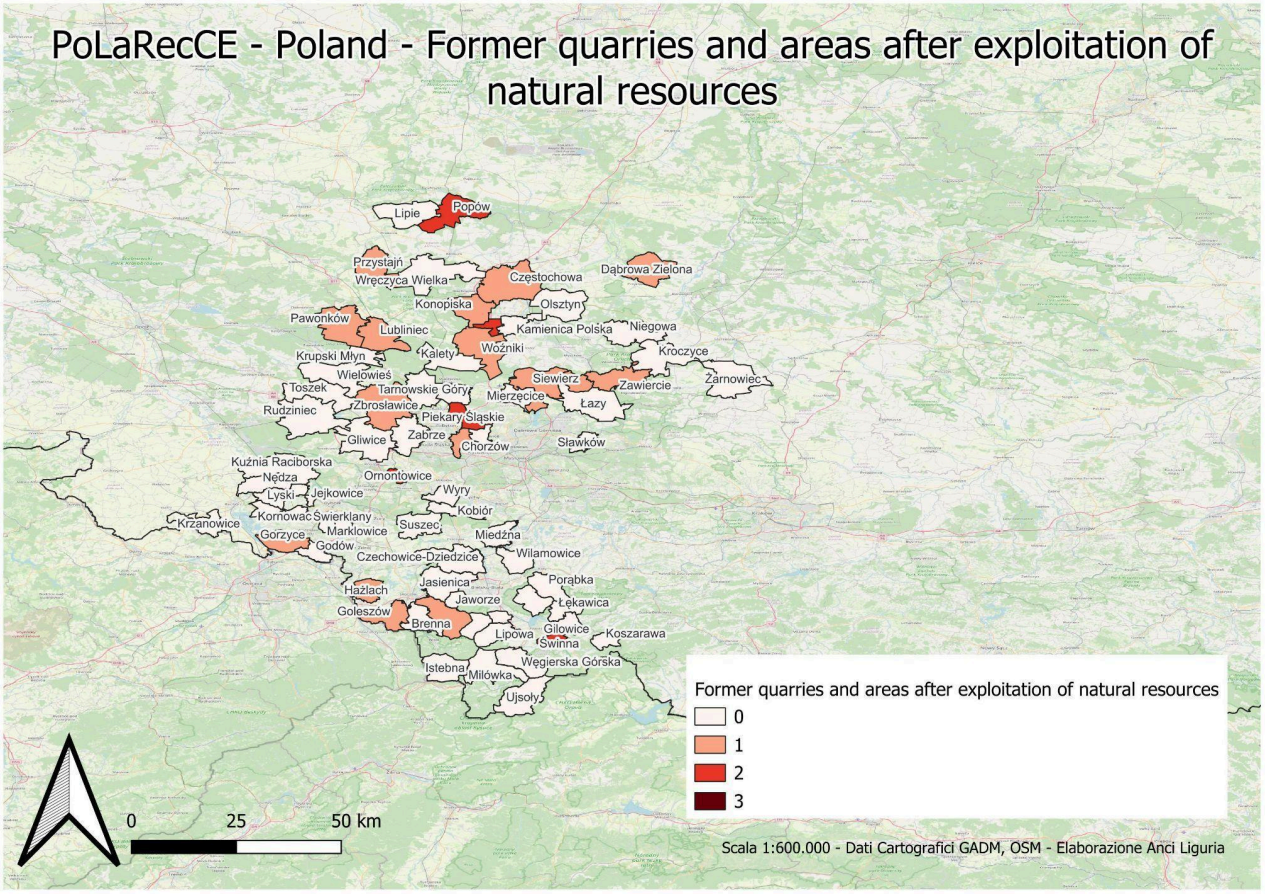
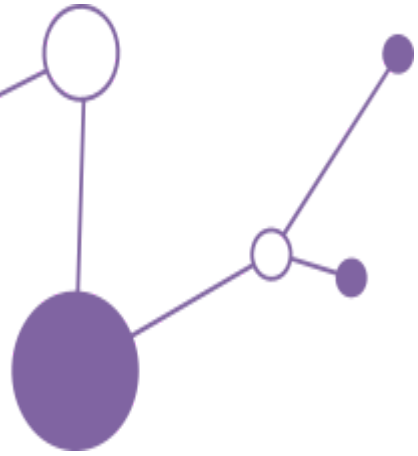


Fig. 46 - Soil degraded in former quarries and areas after exploitation of natural resources - POL



Degradation caused by floods.

This problem was reported by over 50% of municipalities, but in half of the cases, it concerned local areas located on natural terraces and floodplains of rivers. The municipalities that reported this problem as high or medium are located directly on the largest Polish rivers (the Oder and the Vistula) or in the riverbeds of mountain rivers. Along with climate change, which has led to increasingly frequent floods in the Silesian region (1980, 1987, 1997, 2010, 2014, 2024), this problem is becoming more significant and is likely the best recognized by local administration. Therefore, compared to other analyzed forms of land degradation, it is most likely overestimated. Some municipalities indicated all areas marked on local maps as potentially flooded areas as being degraded by floods. To minimize this risk, it is necessary to modernize existing flood embankments and build new retention reservoirs, which also contribute to soil degradation in large areas. In many municipalities where underground hard coal mining occurs, local subsidence basins and anthropogenic water reservoirs have developed, disrupting the local hydrological network. This, in turn, creates local flooding, especially with the increasing frequency of heavy rainfall. This problem was highlighted in the comments of the questionnaires from Rydułtowy and Zabrze.

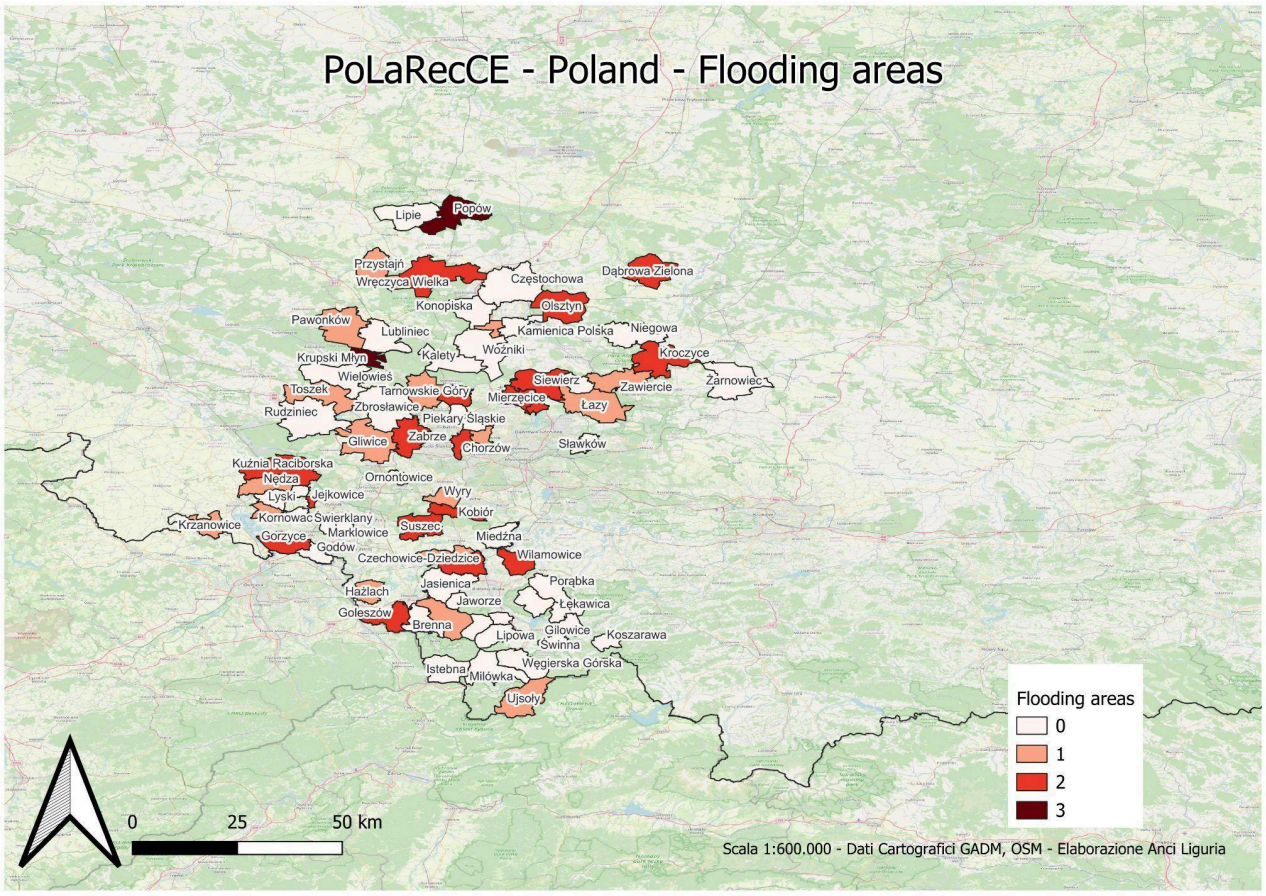


Fig. 47 - Degradation caused by floods - POL

Degraded soil in former military areas.

Military areas as sources of soil degradation were reported as a low-level problem by six municipalities.

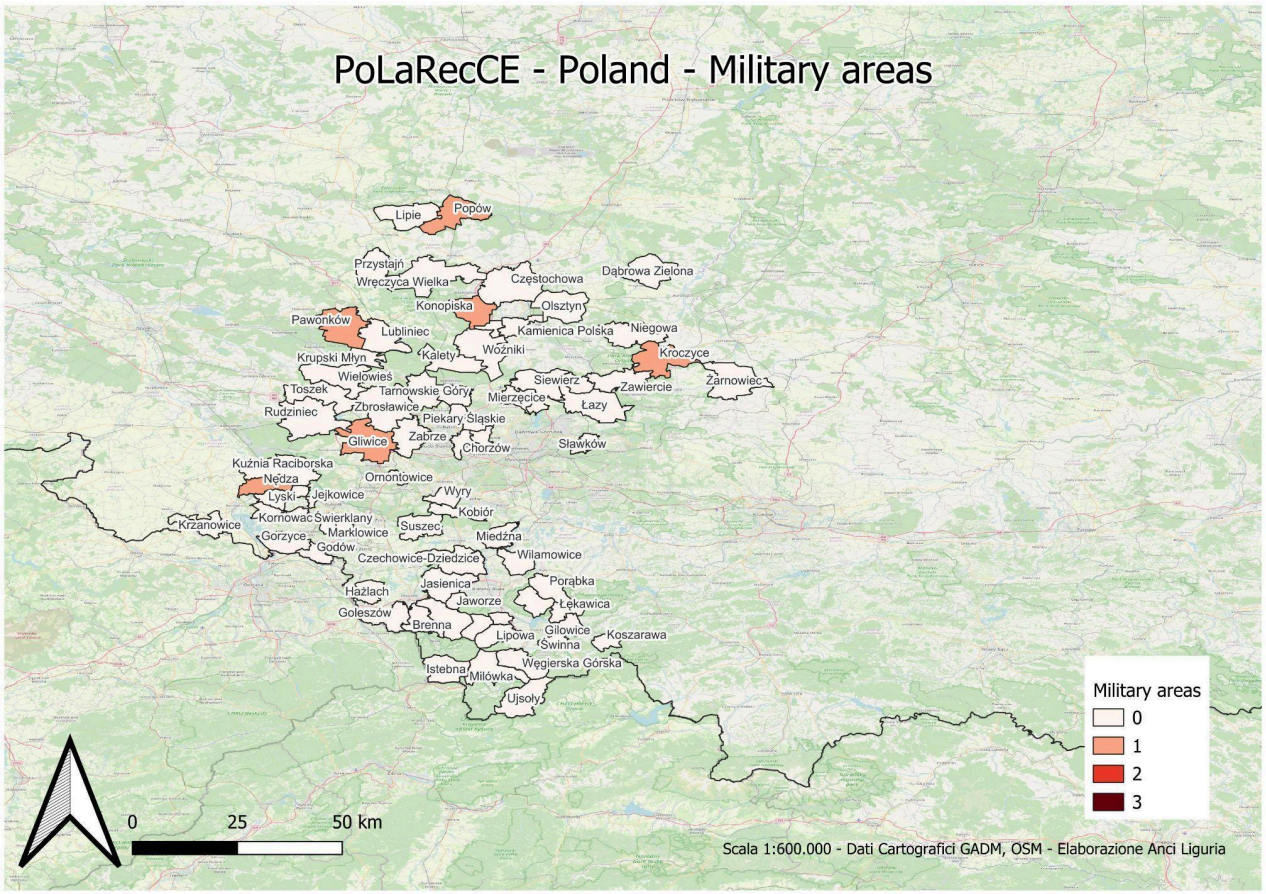


Fig. 48 - Degraded soil in former military areas - POL

Problem with heavily acidified soils.

The problem of soil acidification was reported in 22% of the questionnaires; however, no municipality reported it as a high-level soil degradation problem. In five cases, it was reported as a medium-level problem. In the industrial part of the Silesian Voivodeship (municipalities of Zabrze and Rydułtowy), the source of acidification is the emission of sulfur dioxide and other acid-forming compounds produced in industrial processes, especially in coal and heavy industry. These pollutants, combined with rainfall, caused so-called acid rains in the 1970s and 1980s, contributing to a decrease in soil pH. This problem, related to the long-range transport of air pollution from the industrial Ostrava region (Czech Republic), was also reported in the mountain Beskidy region (e.g., the Istebna municipality, located near the Czech border). In small rural municipalities (Dąbrowa Zielona, Kornowac), soil acidification is caused by intensive agricultural activity, including excessive fertilization. Mineral fertilizers, especially those containing nitrates and sulfates, introduce acids into the soil, which leads to a decrease in its pH and negatively affects its physical and chemical properties.

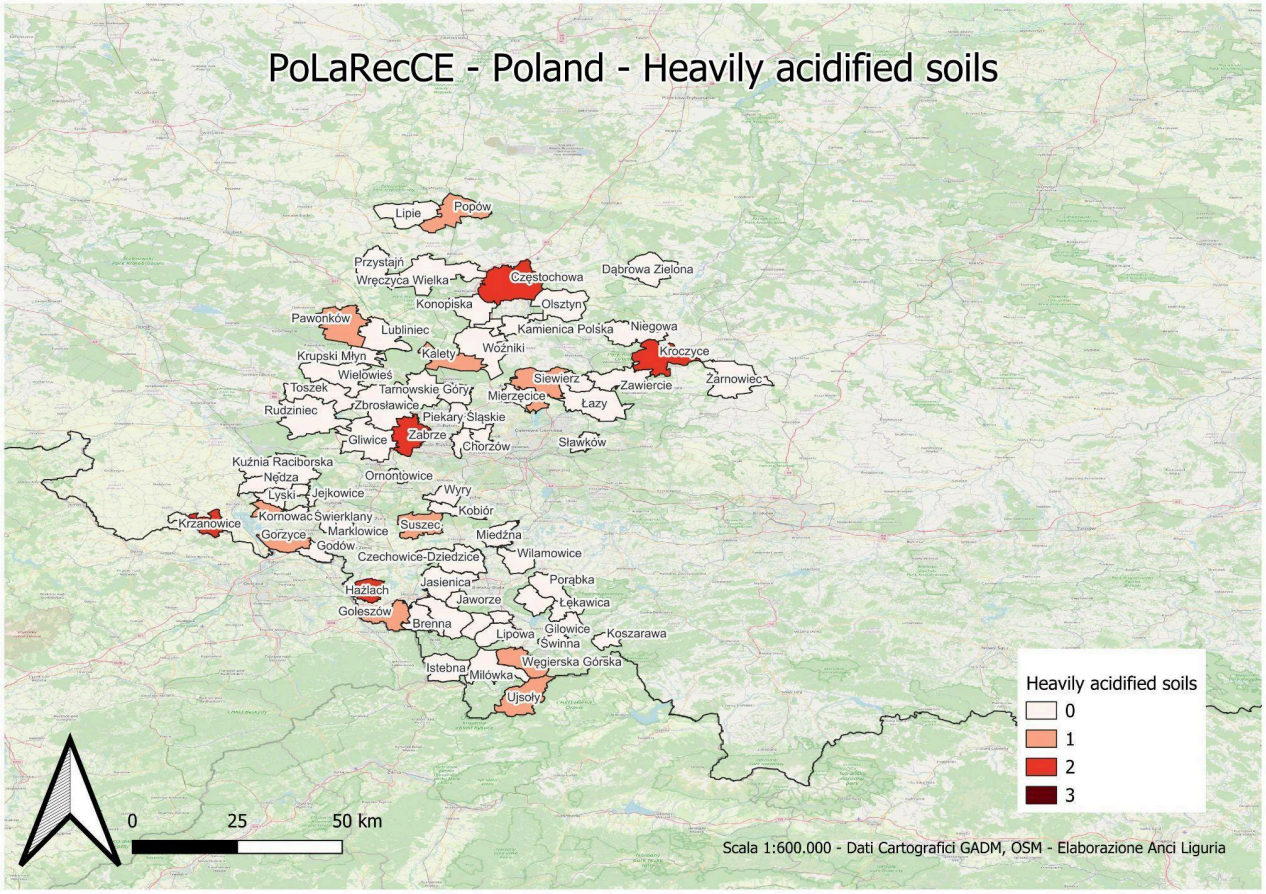


Fig. 49 - Problem with heavily acidified soils - POL

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

Saline or highly alkaline soils were reported as a high or medium problem of land degradation by three municipalities. In each case, the source differs. In Tarnowskie Góry, it is a historical chemical waste dump, the disposal of which has been one of the region's biggest challenges for years. In Zbrosławice, it is the aforementioned power plant waste dump, while in Zawiercie, the source is local industrial emissions. Furthermore, in nine other municipalities, the problem of soil alkalization was assessed as low

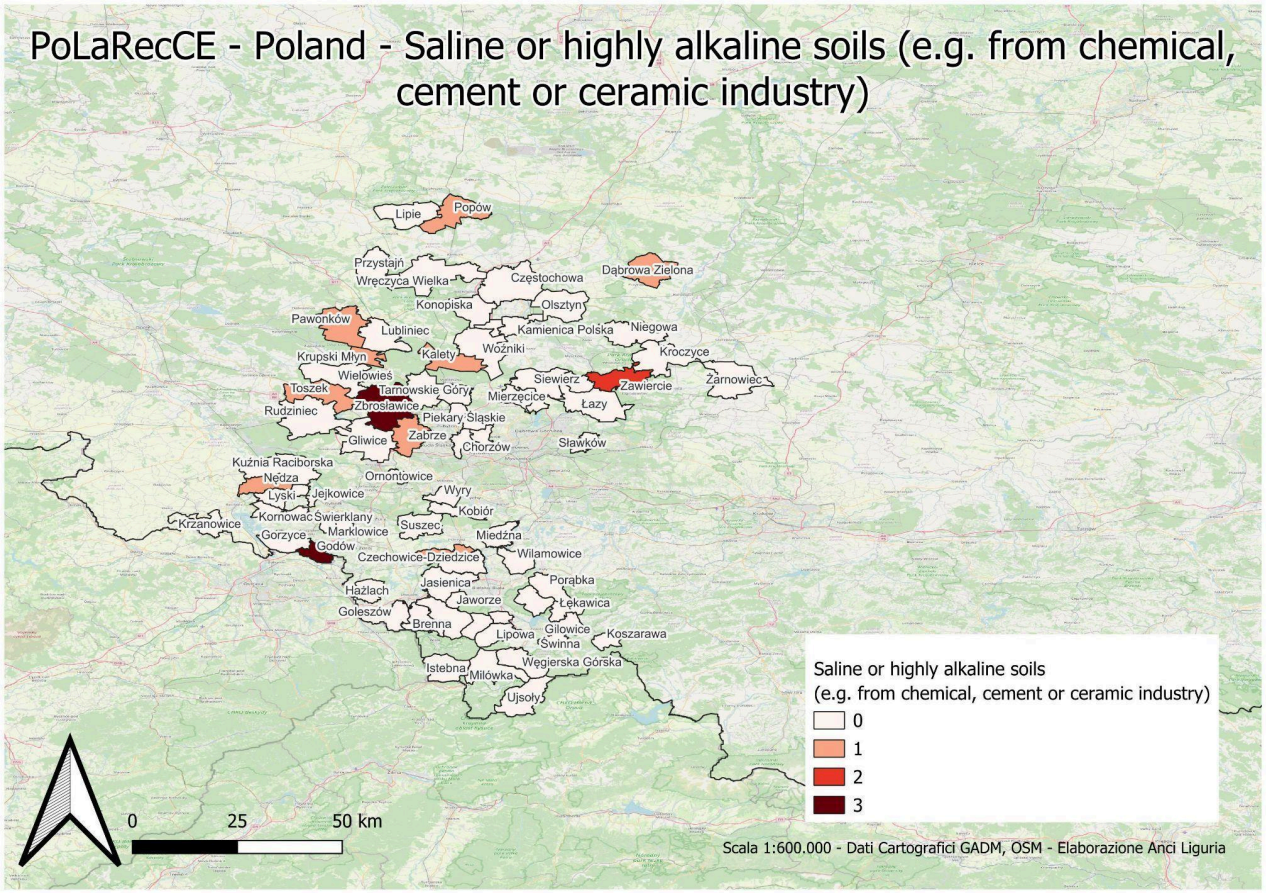


Fig. 50 - Problem with saline or highly alkaline soils (e.g. from chemical, cement or ceramic industry) - POL

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

The problem of soil degradation due to long-term poor agricultural practices was reported in 25% of the investigated municipalities, but only in one case (Ustroń, located in the Beskidy Mountains) was it assessed as a high-level problem of land degradation. Five other municipalities reported the problem as medium (Nędza, Toszek, Wielowieś, Wilamowice, Sławków). The first three rural municipalities are located in the western part of the Silesian Voivodeship, in agricultural areas that were part of Germany before World War II, where large-scale intensive agricultural activities were carried out. Soil degradation is the result of excessive exploitation of agricultural land, accompanied by a lack of appropriate organic fertilization, which leads to a decrease in the content of organic matter in the soil and a reduction in its fertility.

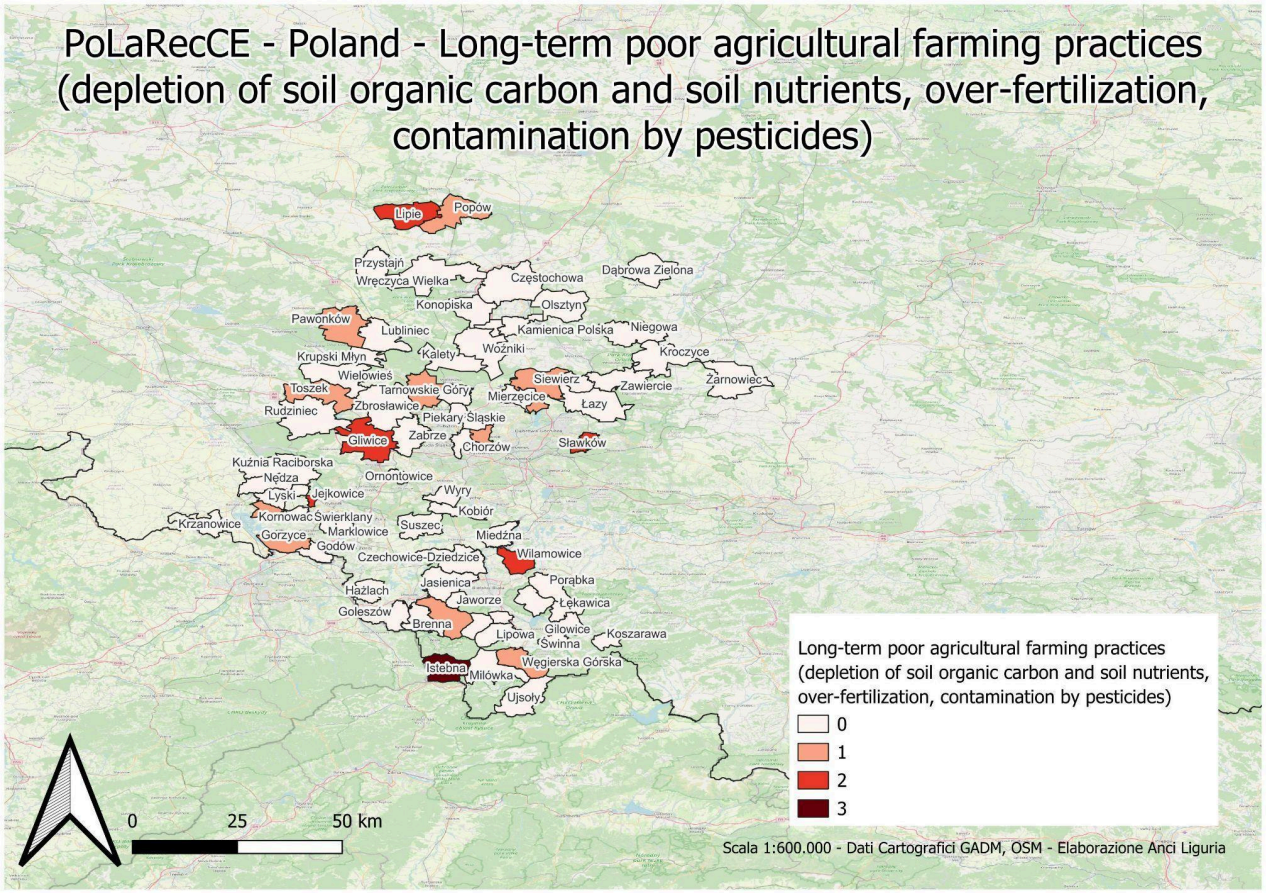


Fig. 51 - Degradation caused by long-term poor agricultural farming practices (depletion of soil organic carbon and soil nutrients, over-fertilization, contamination by pesticides) - POL

Degradation caused by wind or water erosion

Wind or water erosion was reported as a low-level soil degradation problem in 16% of the questionnaires. Only in two small rural municipalities was it reported as a medium-level problem. In the Istebna municipality, the occurrence of water erosion, and to a lesser extent wind erosion, is associated with the mountainous terrain—primarily with steep slopes and heavy precipitation. In the Nędza municipality, surface water erosion is observed, leading to the washing away of the topsoil, along with important nutrients and organic matter.

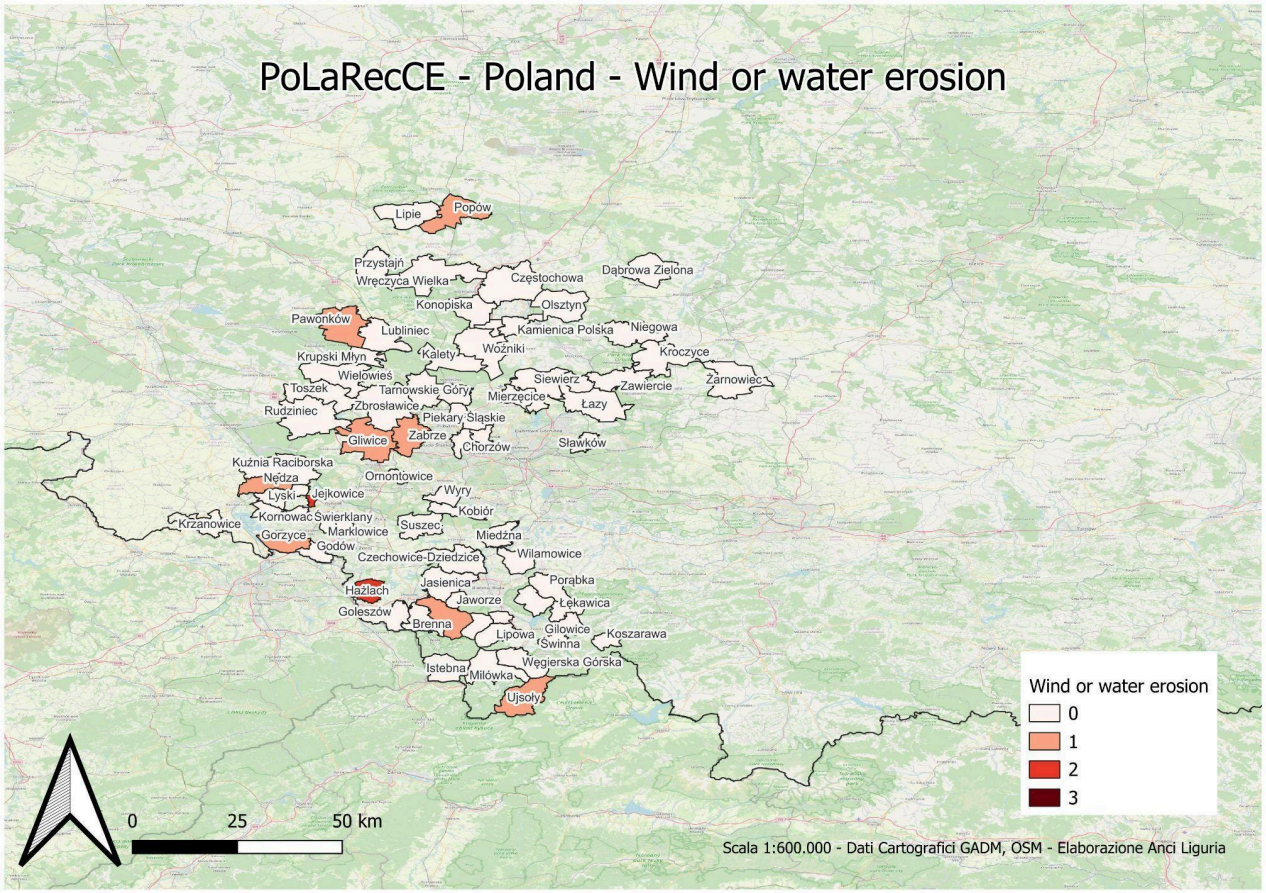


Fig. 52 - Degradation caused by wind or water erosion - POL

Degradation caused by intensive soil sealing or soil compaction.

Soil sealing or compaction was mentioned as a low-level problem of land degradation in only eight municipalities, with one (Kuźnia Raciborska) reporting it as a medium-level problem. It is important to note that Kuźnia Raciborska is a small rural area with a relatively large proportion of forested land. Typically, soil sealing and compaction are issues in urban and industrial areas. Among the larger cities of the GZM, only Gliwice reported it as a low-level problem, while the rest were small rural areas or tourist towns.

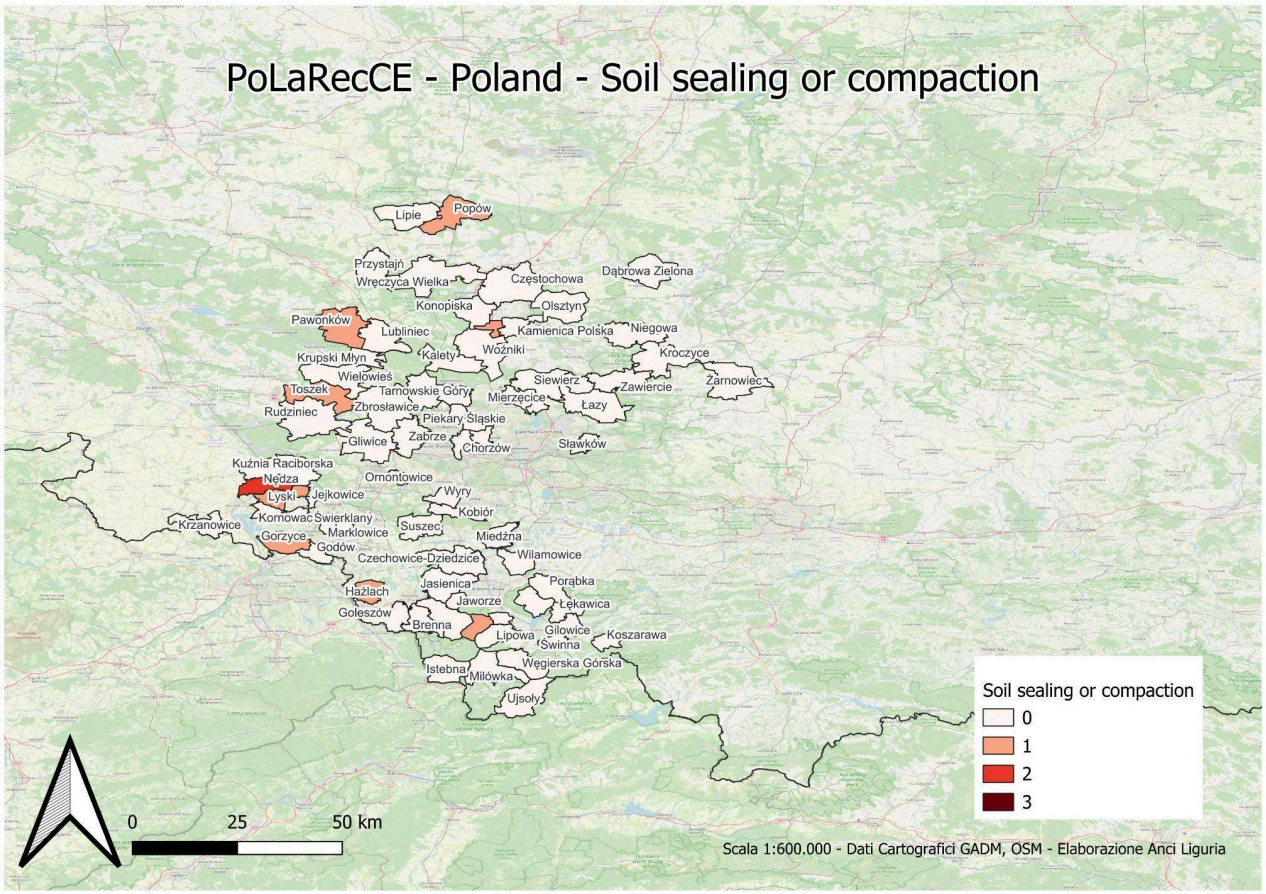


Fig. 53 - Degradation caused by intensive soil sealing or soil compaction - POL

Other forms of soil degradation.

Among the other land degradation problems reported by the municipalities participating in this survey, located in areas of current or historical underground hard coal mining (Goczałkowice-Zdrój, Świerklany, Siemianowice Śląskie, and Zabrze), surface deformations in the form of subsidence basins, as well as local depressions and sinkholes, were noted. These phenomena are a characteristic effect of underground mining operations. They are particularly widespread in the Silesian Voivodeship, where many years of hard coal mining have led to significant structural transformations within geological layers. These deformations are caused by the collapse of the overburden into post-mining voids, which results in the lowering of the ground surface and, in extreme cases, the formation of sinkholes.

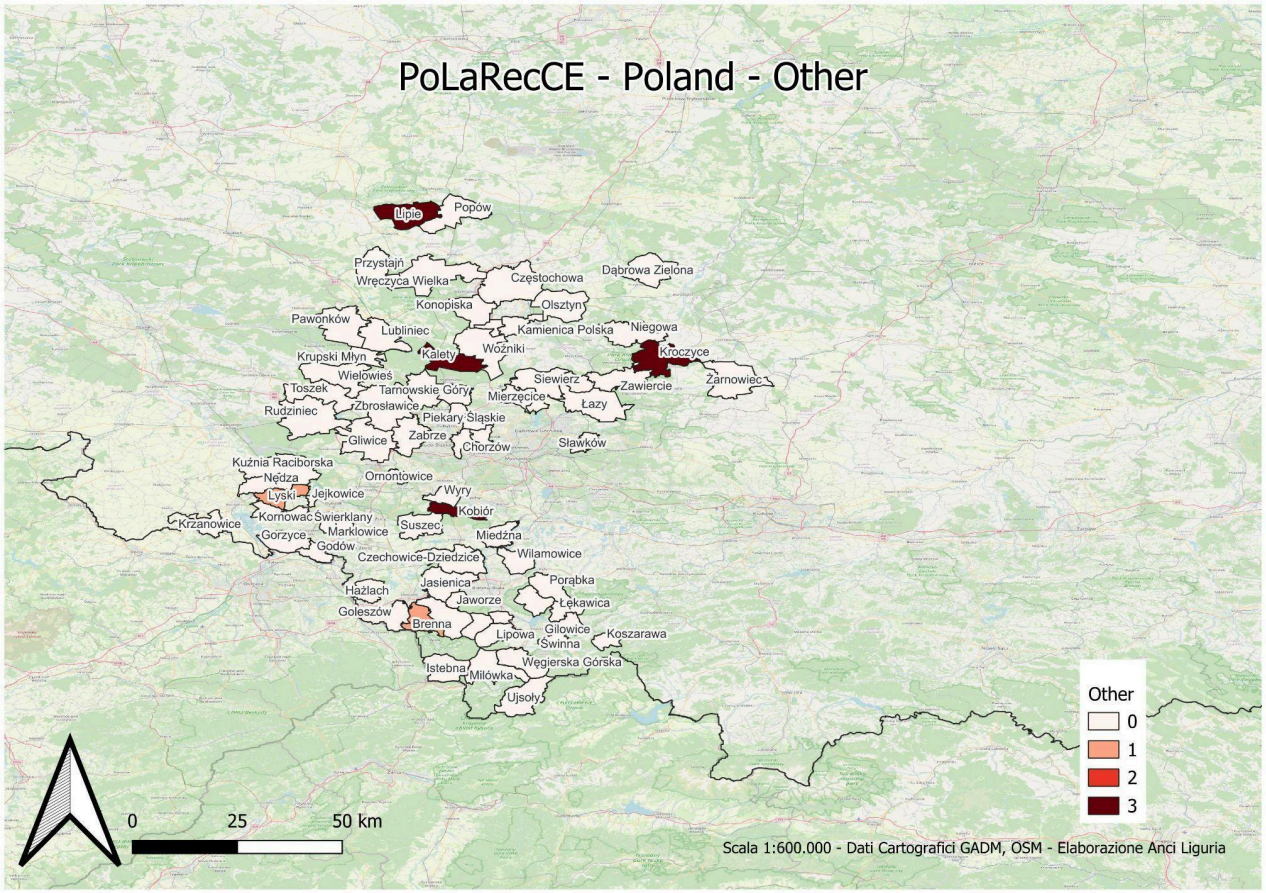


Fig. 54 – Other - POL

3.3. Results in Slovenia

Municipalities themselves do not collect data on parameters in degraded areas. There are some studies at the national level regarding the identification of degraded areas. Despite all this, the municipalities themselves determine which areas they will define as degraded areas. Sometimes this is also related to obtaining European funds, because then only degraded areas receive funds.

The 18 collecting answers show that no big problems are present in Slovenia. One of the Municipality, Ptuj, indicated different situations of degradation and risk, as dust deposition of industrial and urban activities that generated effects on 50% of the surface and 30% has problems of volatic organic compounds.

Three Municipalities, Markovci, Ormoz and Podlehnik, indicated that some degradation at level 3 is present in their territories due to leakage of waste waters or sewage sludge deposition (biological contamination). Furthermore, in Ormoz, Gravel' cave is still active, and this creates problems of former quarries and areas after exploitation of natural resources. Gravel's cave is still active. The clay mine is active, the old used parts are overgrown or will be used for other activities (industry).

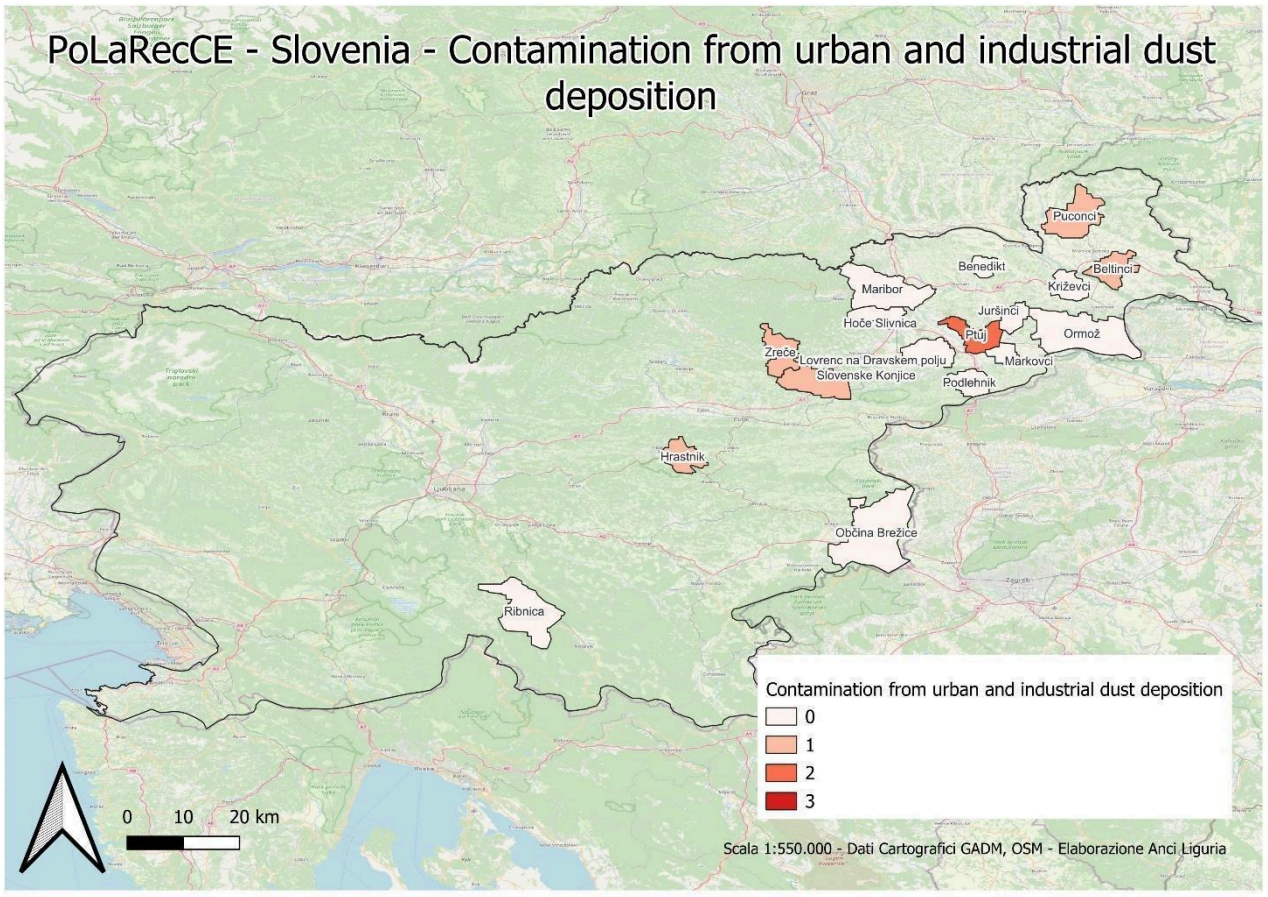


Fig. 55 - Contamination from urban and industrial dust deposition - SLO

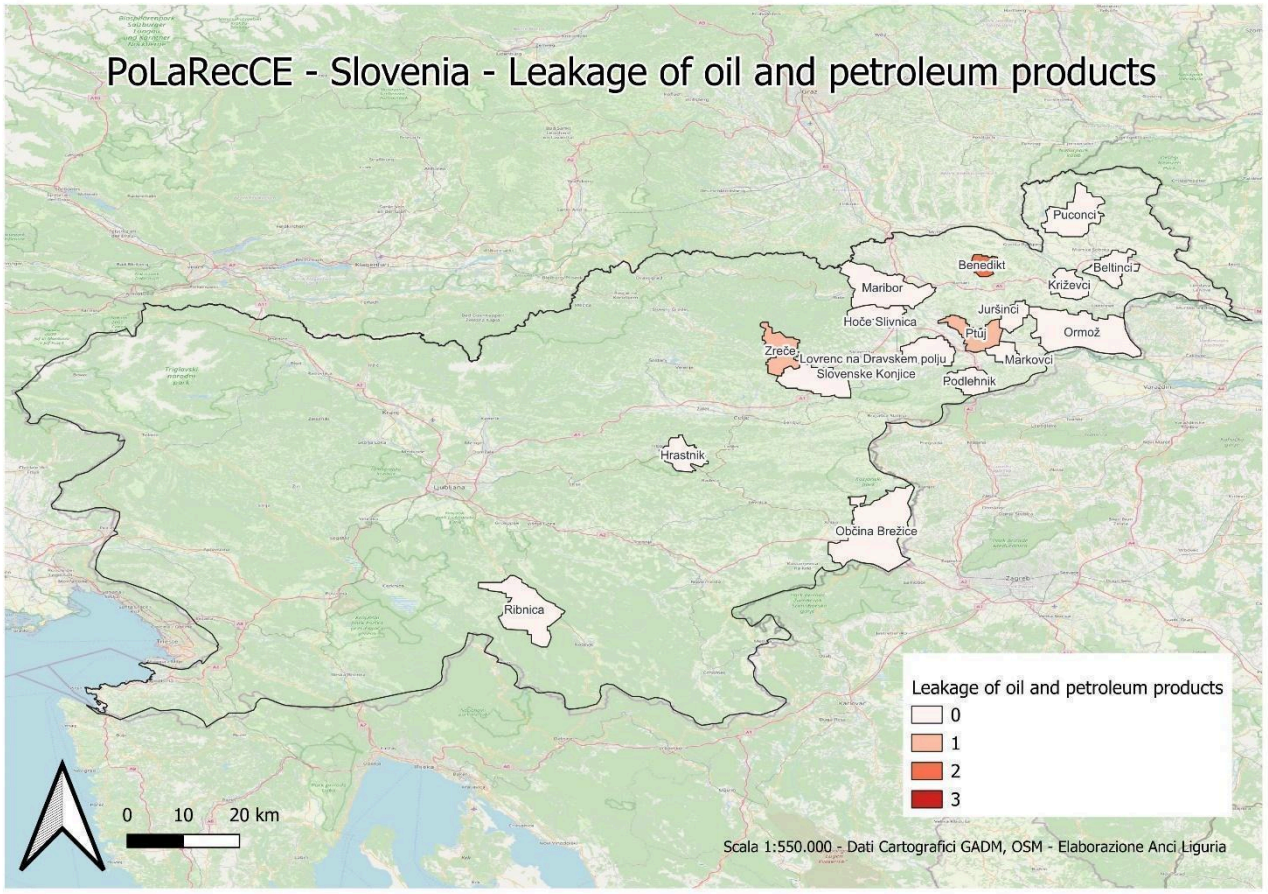


Fig. 56 - Leakage of oil and petroleum products - SLO

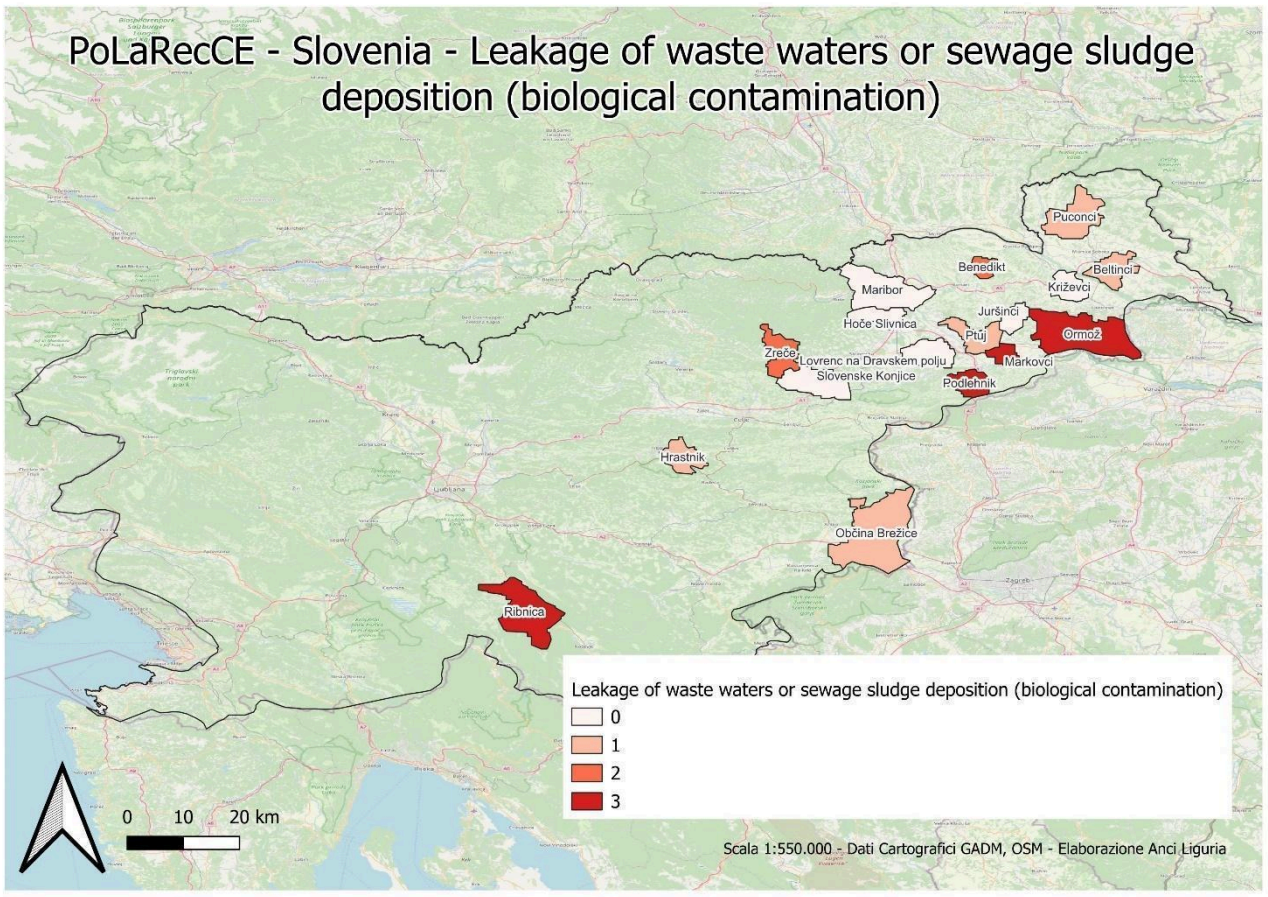


Fig. 57 - Leakage of waste waters or sewage sludge deposition (biological contamination) - SLO

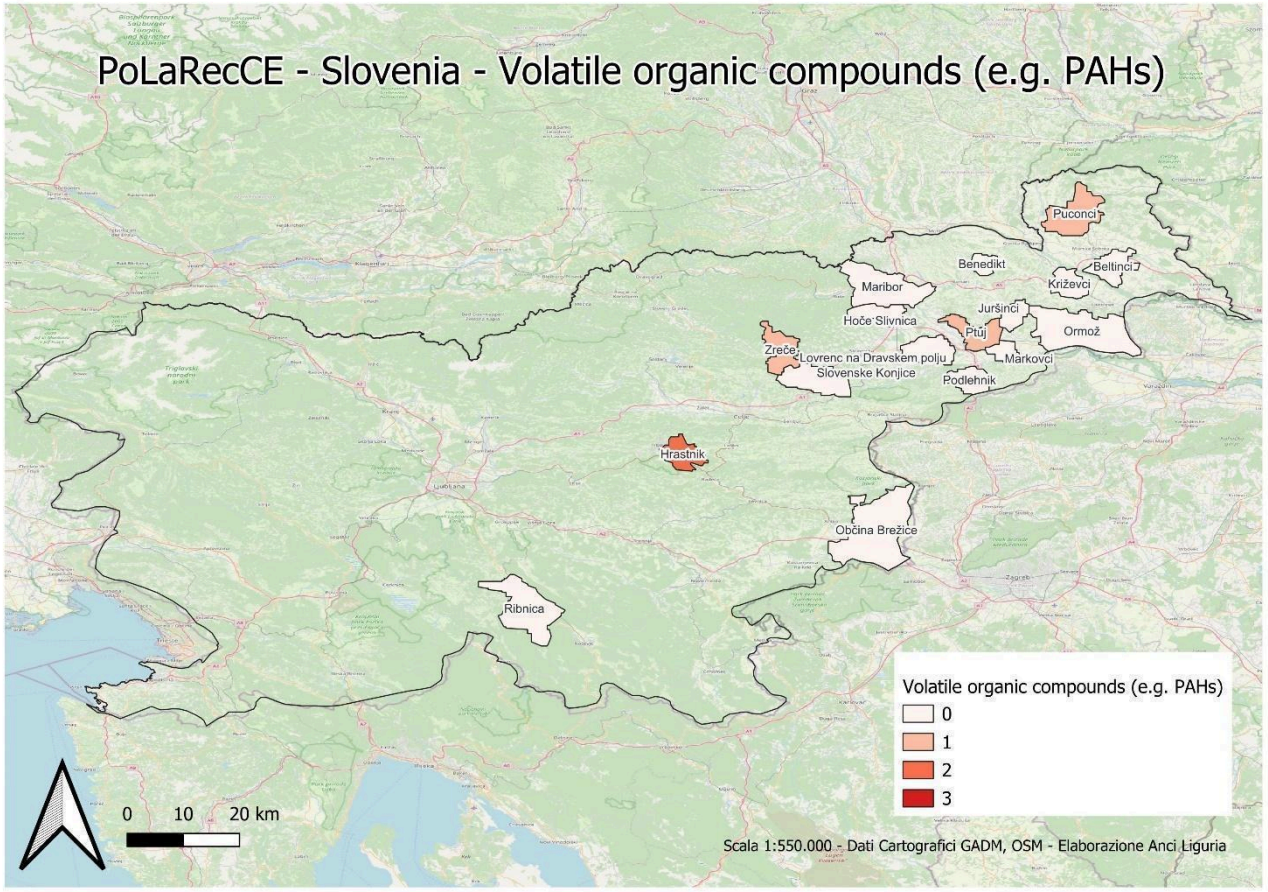


Fig. 58 - Volatile organic compounds (e.g. PAHs) - SLO

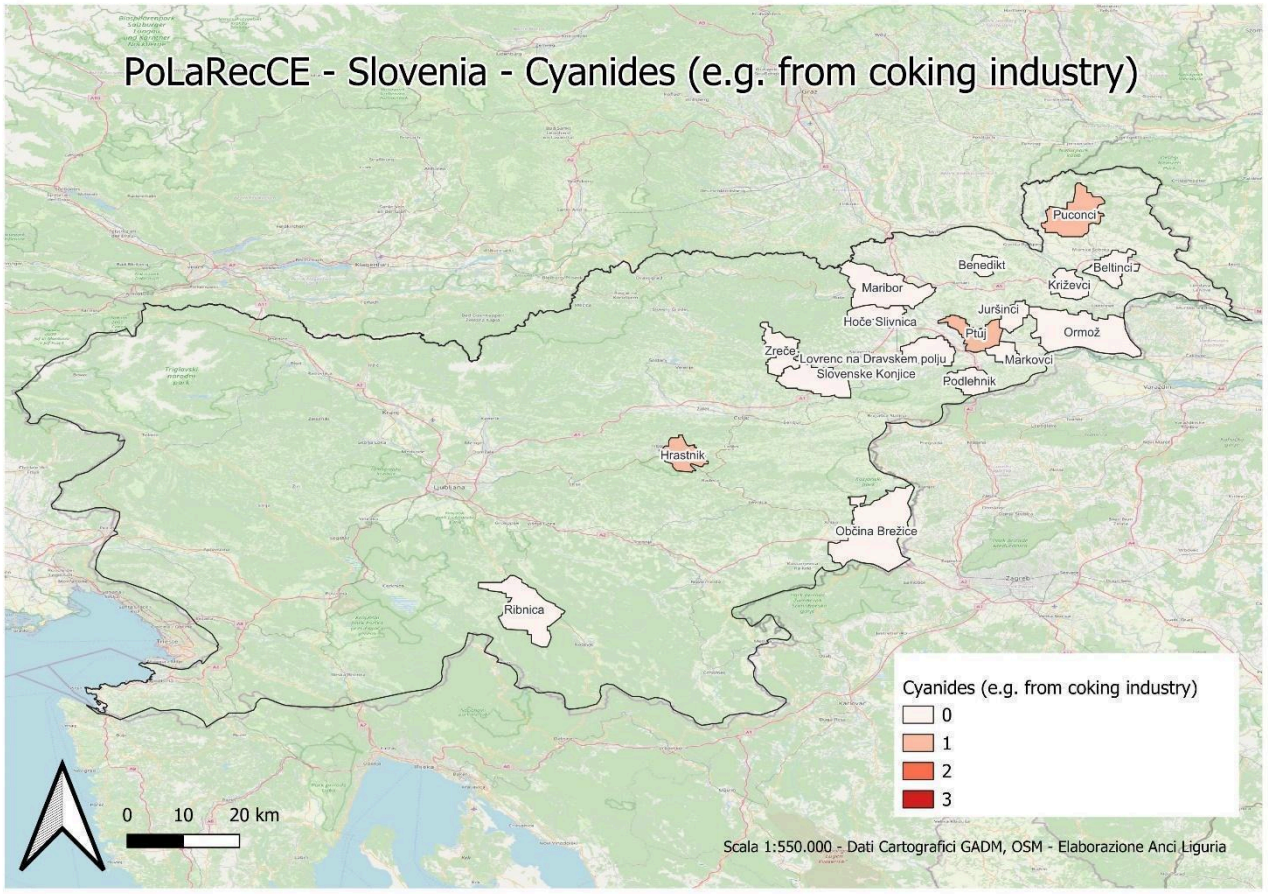


Fig. 59 - Cyanides (e.g. from coking industry) - SLO

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

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

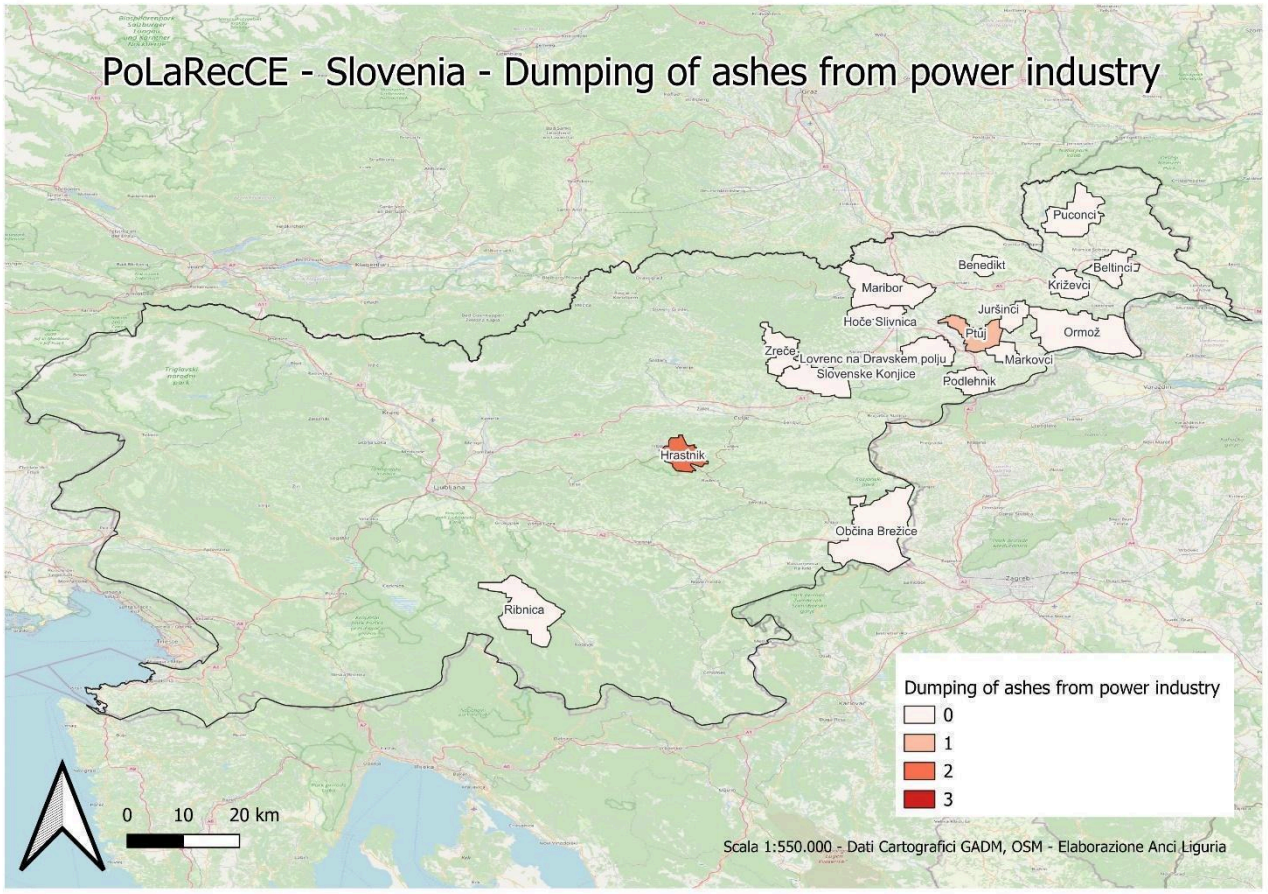


Fig. 62 - Dumping of ashes from power industry - SLO

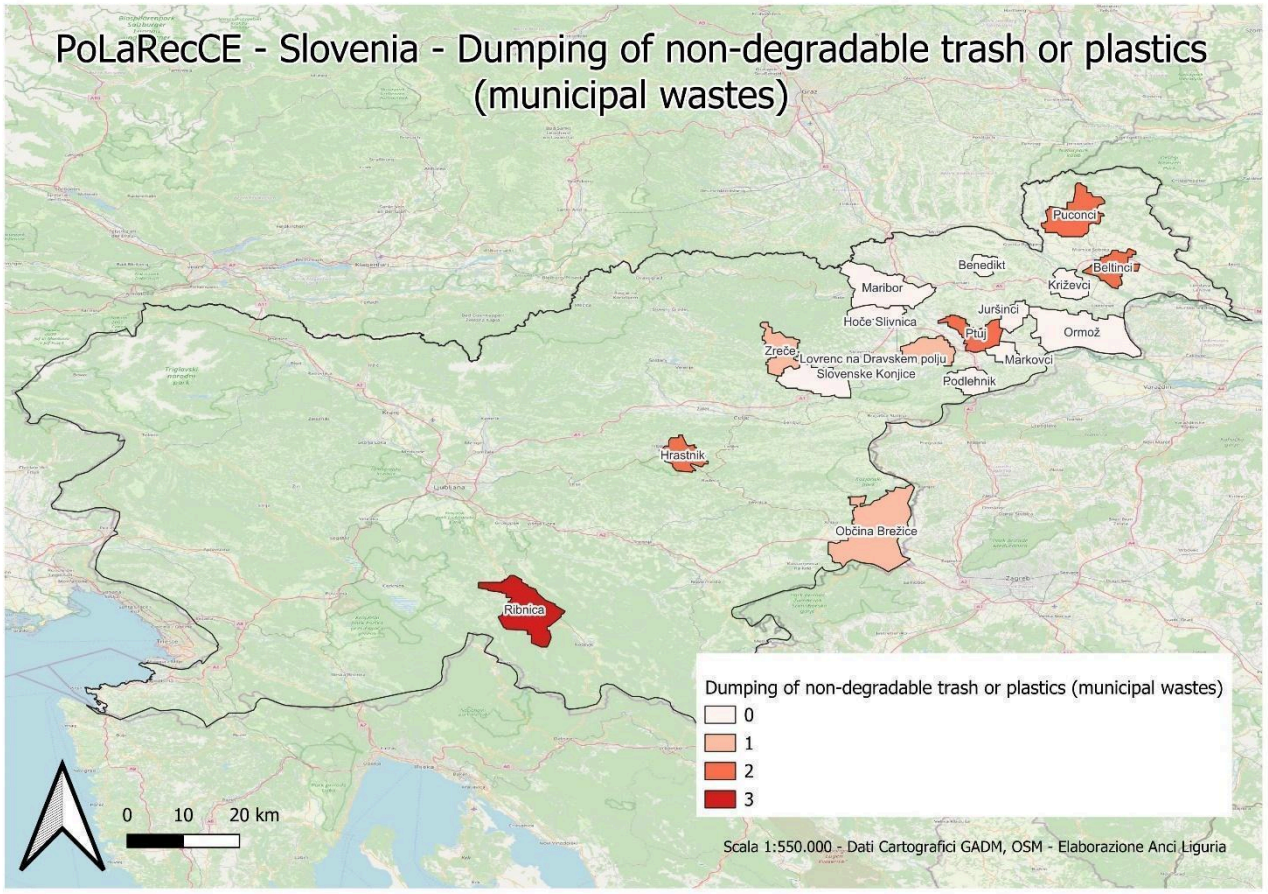


Fig. 63 - Dumping of non-degradeted trash or plastic (municipal wastes) - SLO

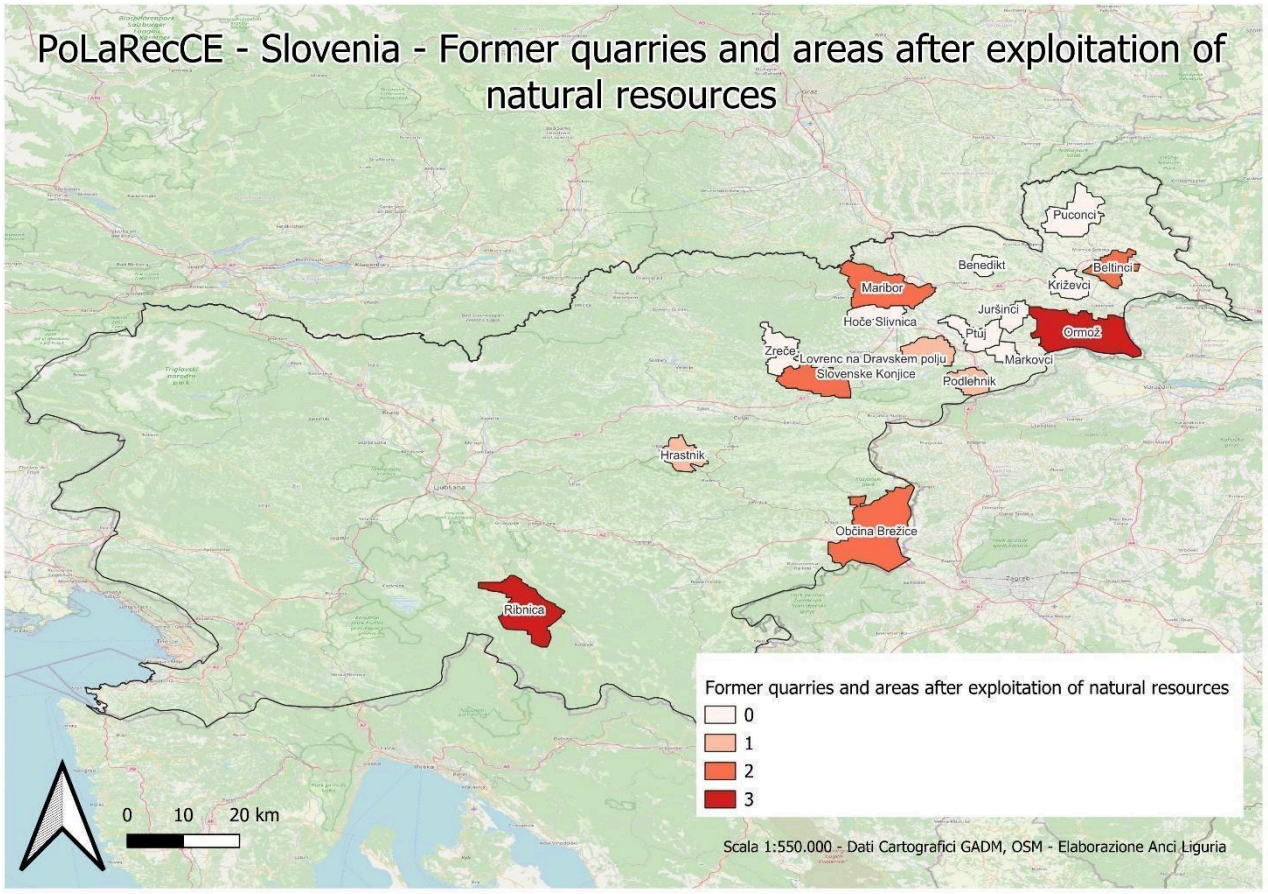


Fig. 64 - Former quarries and areas after exploitation of natural resources - SLO

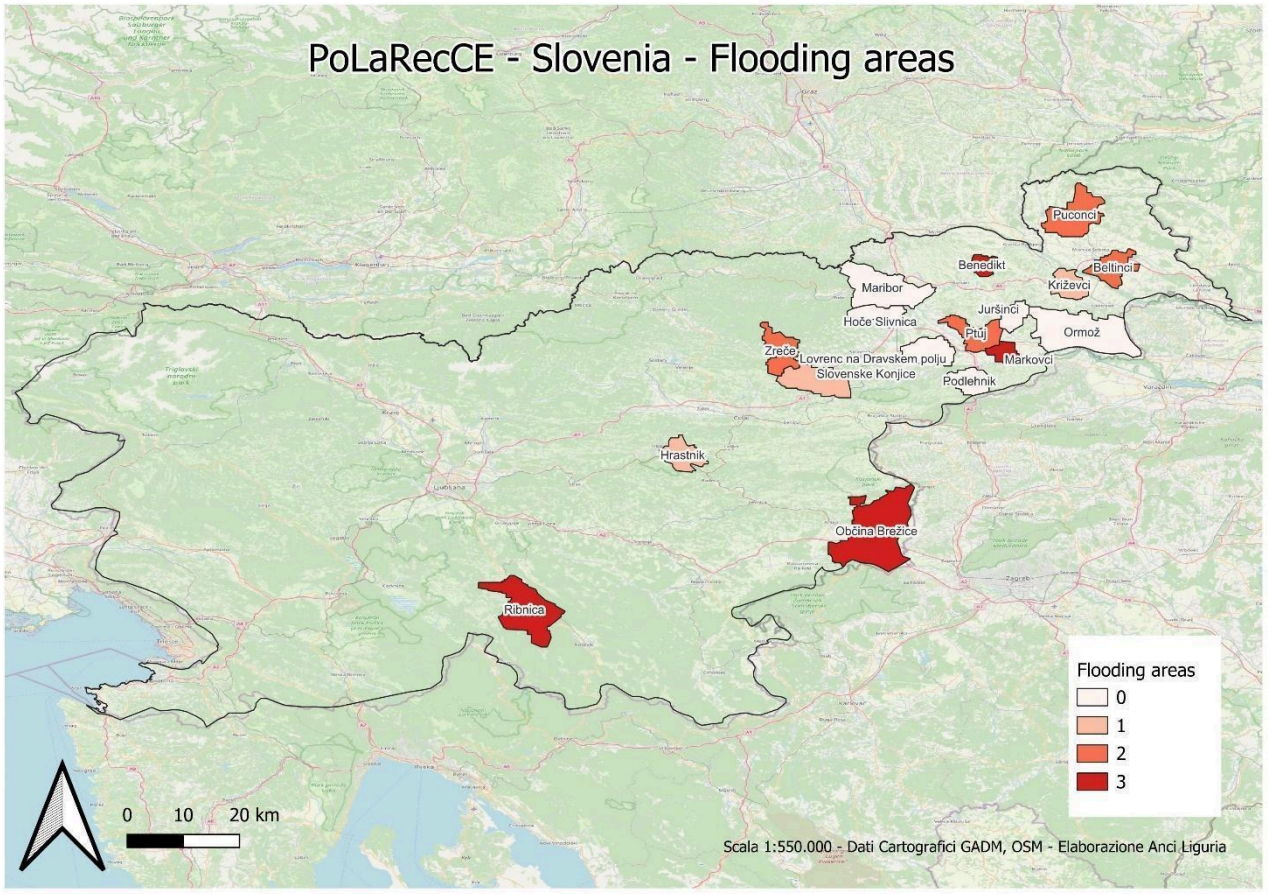


Fig. 65 - Flooding areas - SLO

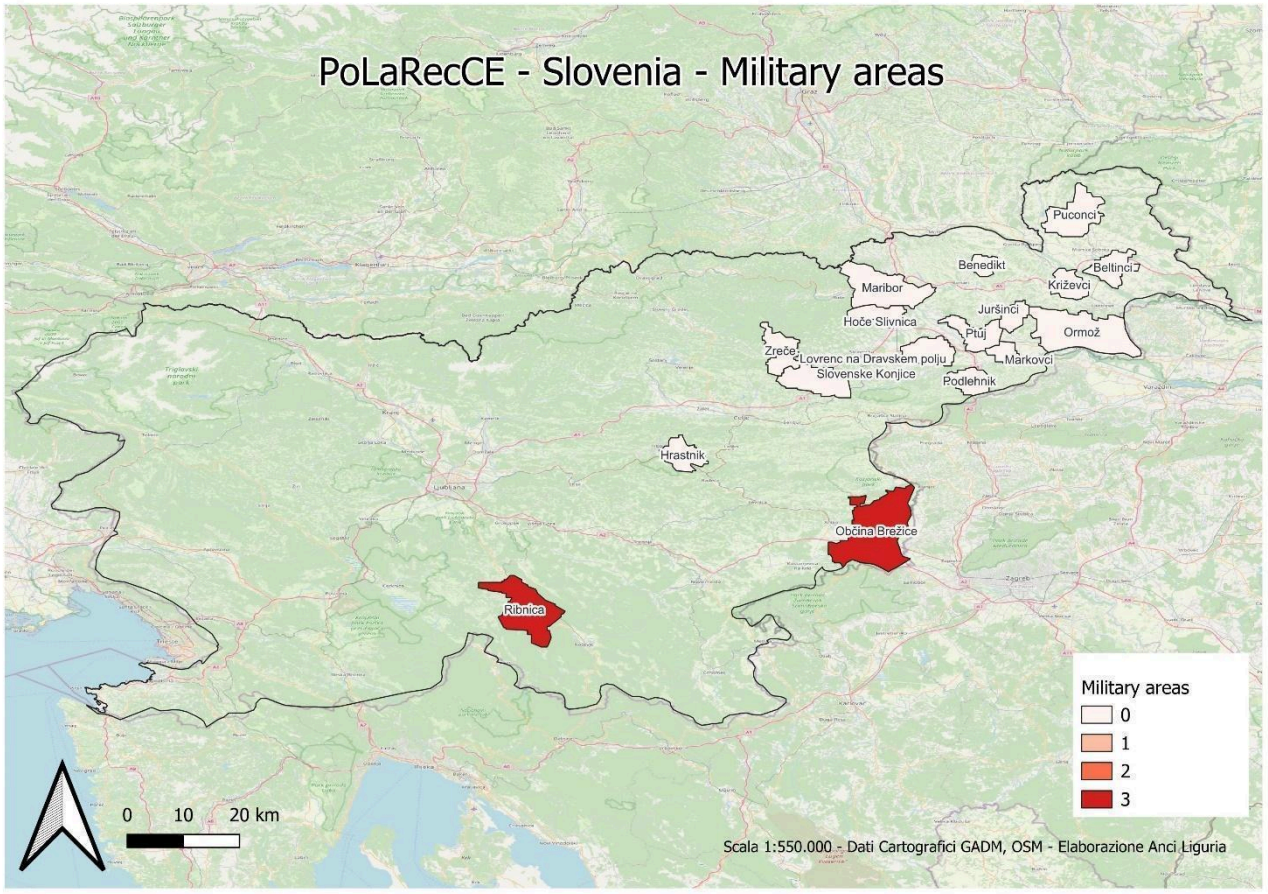


Fig. 66 - Military areas - SLO

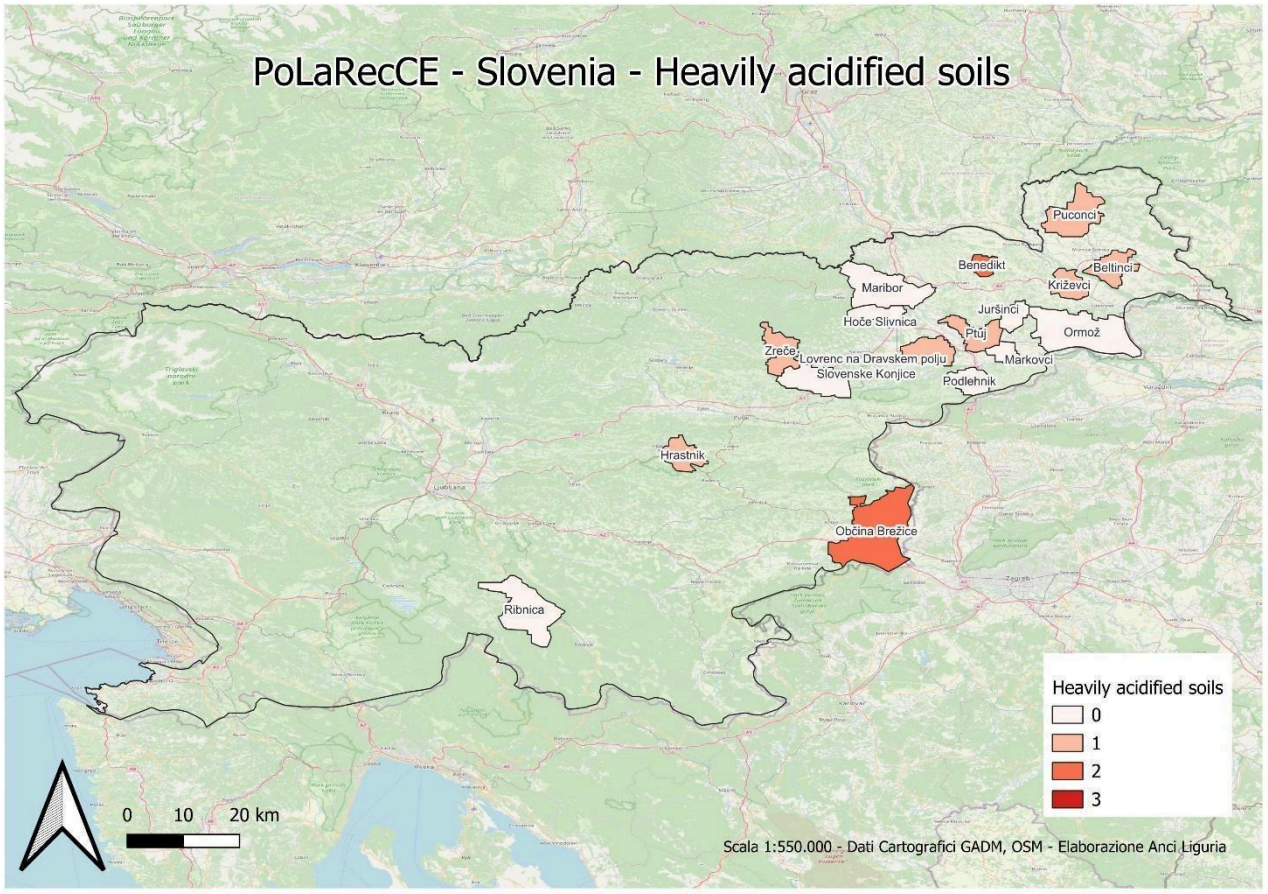


Fig. 67 - Heavily acidified soils - SLO

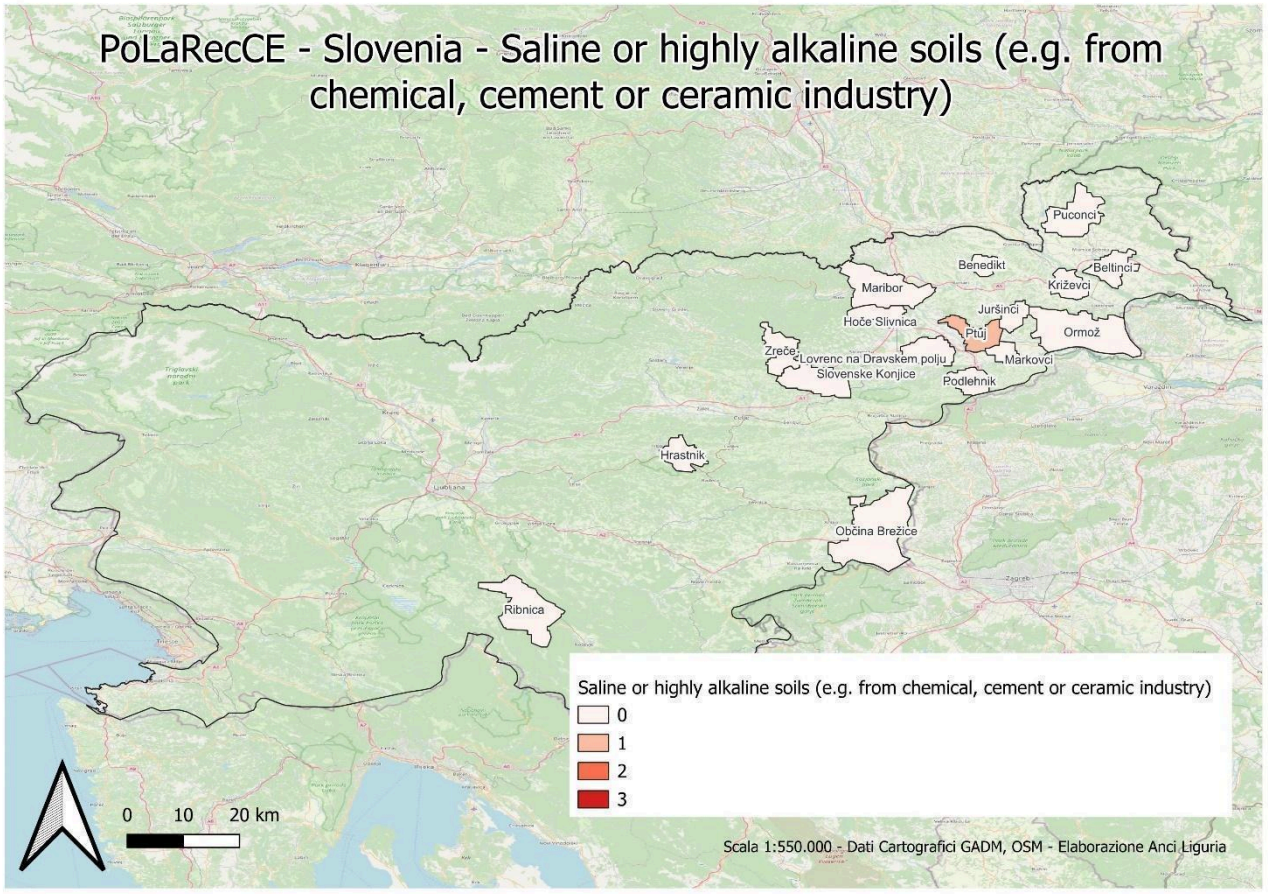


Fig. 68 - Saline or highly alkaline soils (e.g. from chemical, cement or ceramic industry) - SLO

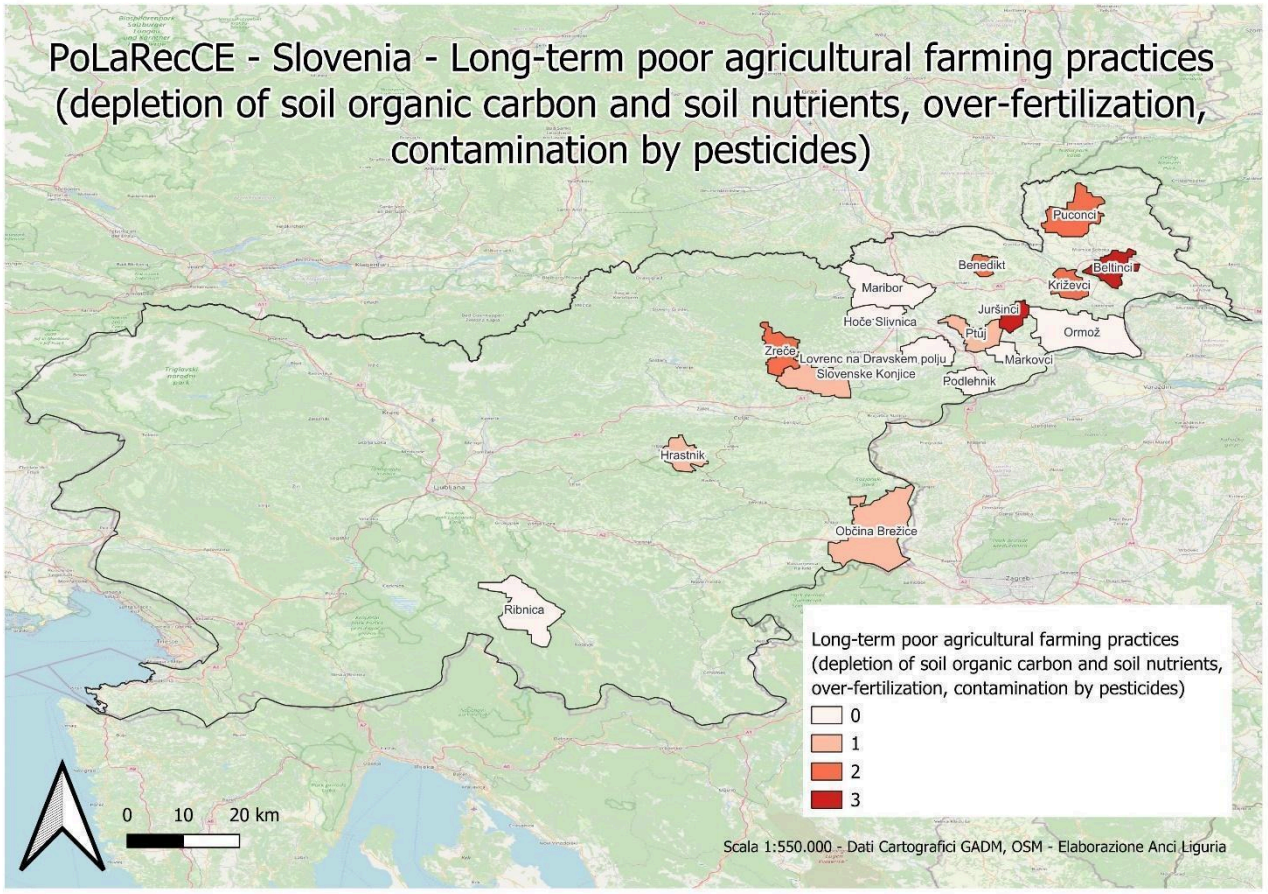


Fig. 69 - Long-term poor agricultural farming practices - SLO

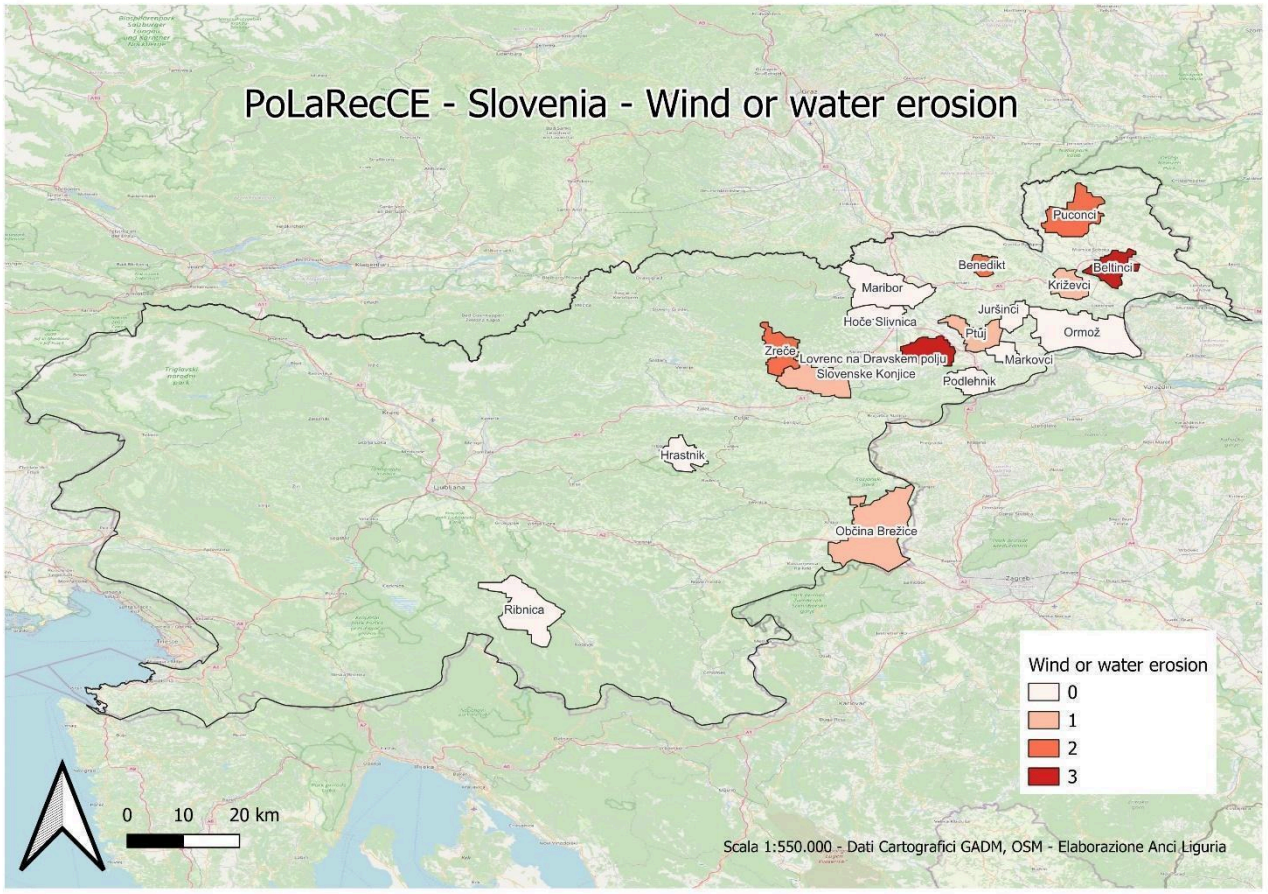


Fig. 70 - Wind or water erosion - SLO

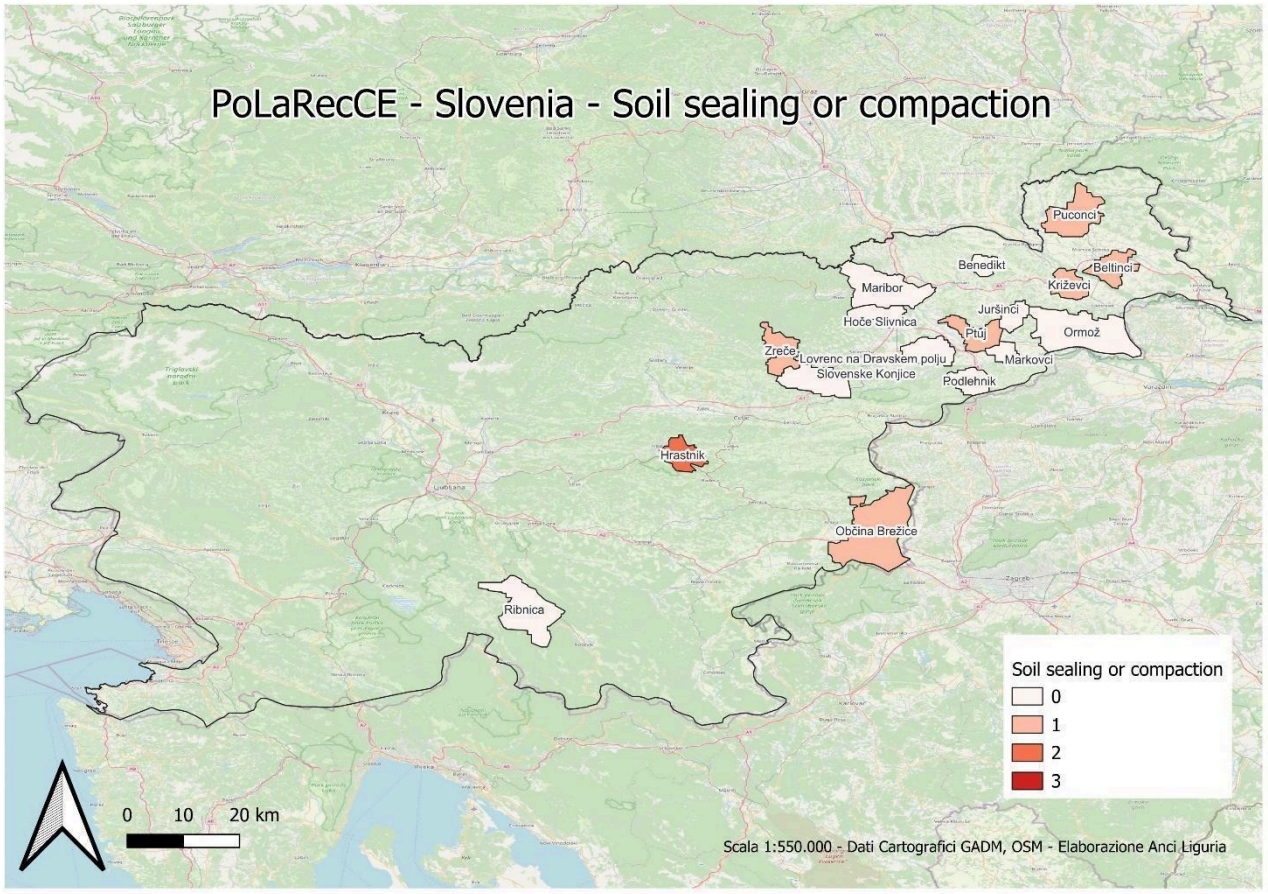


Fig. 71 - Soil sealing or compaction - SLO

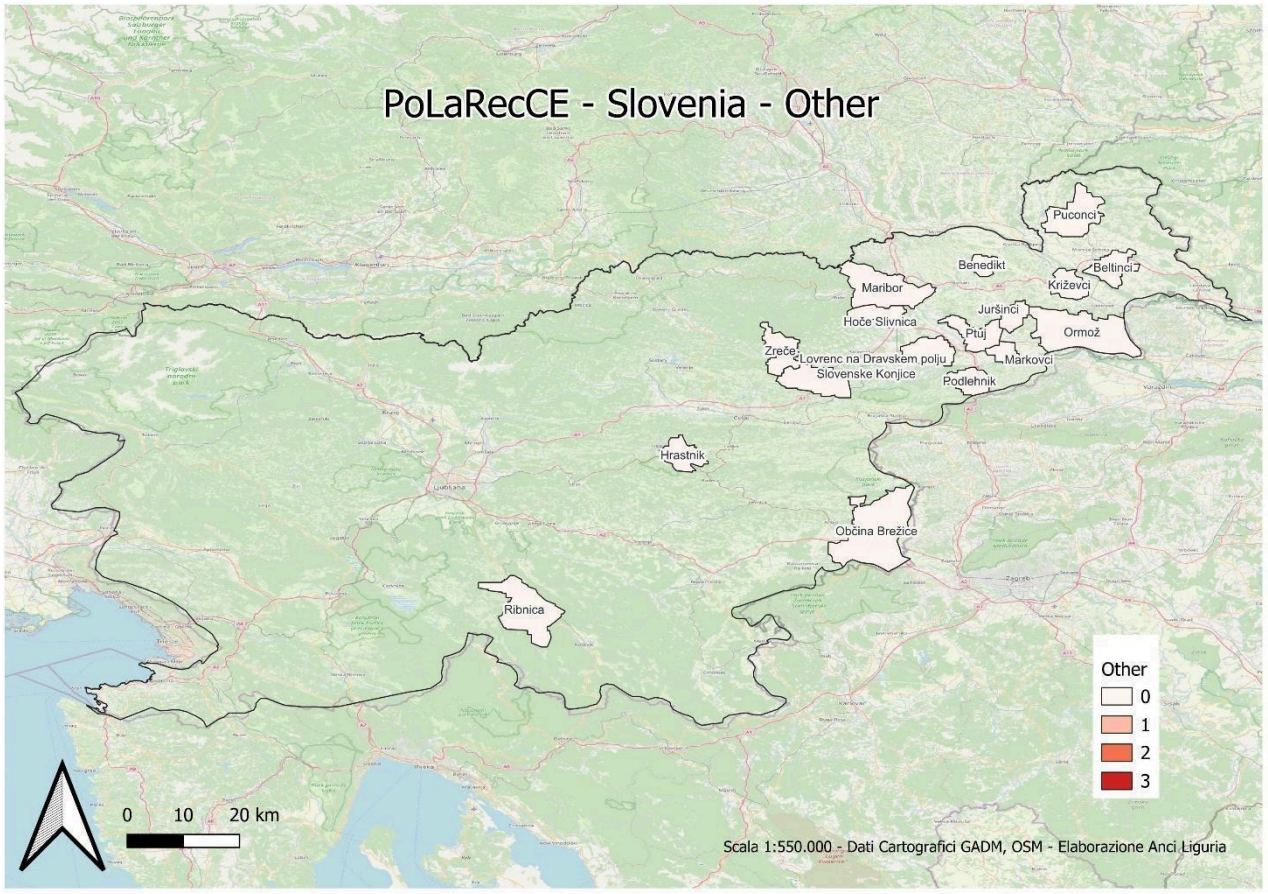


Fig. 72 - Other - SLO

3.4. Results Croatia

In Croatia the collection of the questionnaires was very poor, because Municipalities do not have interest to the issue.

From the 3 answers appear that they don't have specific data on land pollution. There is an issue of wrongly treated municipal waste in some micro locations, but not detailed info was given. Industrial pollution is almost not existing due to underdevelopment of industrial manufacturing in the area.

In municipality of Gradina some problems have been highlighted:

- at level 1 for the 30% of the surface flooding problems and soli sealing or compaction for the 40% of the surface.
- At level 2 for the 70% of the surface the presence of acidified soils.
- At level 3 for the 80% of the surface the effects of the long term poor agricultural farming practices (depletion of soil organic carbon and soil nutrients, over-fertilization, contamination by pesticides)

3.5. Results in Hungary

The total area of Békés County is 5,631.05 km2, which means 75 settlements, and a population of 315,222 (in 2022). We sent the PoLaRecCE questionnaire to all 75 settlements, and then we repeated the request once for those who did not respond. A total of 8 settlements returned the questionnaire, which is a response rate of 10.7%. Settlements cover 17.7% of the total area and 13.0% of the population.

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

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

Data collected: summary and key notes

The questionnaire consisted of 18 questions, each of which related to a specific soil degradation process, except for #18, in which municipalities could indicate soil degradation processes that were not yet included in the questionnaire.

The presence of industry in the county is very low, there used to be brick factories in every settlement, but these ceased to exist during the '90s. There is no ore mining and coal mining in the region (Great Plain region), there are no major chemical plants, but there are a large number of natural gas, oil and thermal water boreholes. In the southern part of the county, the glass industry has several significant plants.

There is a significant proportion of flood areas, which, however, are protected natural areas where there is no industrial activity. Flood areas are typically grove forests and large open grasslands, where agriculture and forestry are also severely restricted. These are rewilded areas with an extraordinary richness of species and a very high biomass. Several dam systems have been built at the upper reaches of the Körös River and the Maros River (in Romania) in recent decades, so there has been practically no flooding on the river sections of Békés County for decades. As a result, soils dry out, groundwater has subsided, which causes extreme problems for agriculture and forestry.

Agricultural irrigation with wastewater or its use has been practically prohibited so far, since 2024 there has been a legal possibility for this, but no farmer has yet submitted a permit application for it. Illegal wastewater treatment almost completely ceased towards the end of the 2000s, because households are almost without exception connected to the city grid, and industrial operators are very closely monitored. Sewage sludge placement is carried out in the county on an area of about 1200 ha/year, under strict environmental protection rules (it is not allowed in nature conservation areas). Slurry of agricultural origin is also significant, which farmers use locally, spraying on soils. In the county, the organic fertilized area is 16,824 ha, the fertilized area is 304,883 ha.

Illegal dumping of garbage is still a problem in some small settlements. The situation of conscious waste management among the population has changed drastically in the last 15-20 years. A large public garbage management company (holding) entered the garbage management market in 2023, which made residential waste collection very well organized and corporate waste collection and recycling a good business. In recent years, the operating model of communal and industrial waste has been completely reformed. The vast majority of illegal landfills have been eliminated with the help of local governments, and the entire material flow has been diverted into a legal channel. One of the pilot sites in the project was also such an illegal garbage dump, which we successfully recycled with our energy forest concept.

There are no large military shooting ranges in the county. There are small local shooting ranges (a few dozen) that serve the needs of local hunters and shooting clubs. These undergo a special end-of-crop procedure, the soil contamination is local, typically grasslands or forests.

The soil structure is typically clayey or loamy. The western and southern parts of the county are excellent agricultural soils, while the northern and eastern parts are typically meadow soils with a lot of saline. The soil quality is clay and loam. The soils have become acidic and compacted in many places due to long-term intensive agriculture (pesticides and fertilization, rotational tillage). The groundwater has sunk significantly due to river regulations. The soil structures have become dusty, deteriorated, and the landscape is drying out. Due to climate change, the summer drought, high temperatures and high albedo together have a particularly drastic effect. Agriculture and forestry have never faced such a challenge. The annual precipitation is around 350-400 mm, the number of snowy days has been below 10, for many years. Summer is very dry and hot, with hardly any rain in the months of June, July and August. Farmers are completely clueless and anxious about how they will be able to handle the changed climatic conditions. The drying of soils is the biggest identified problem in the county. The water flow of the rivers has dropped drastically due to the dam systems beyond the border, which causes further problems.

For the revitalization of soils, we held a focus group discussion with farmers (number of participants: 21 people, 12 May 2025, location: Gyomaendrőd, Gazdakör háza). Farmers have little information about what solutions they can incorporate into their tillage practices. Soil ventilation can provide a solution, but its effect lasts for a maximum of 5-6 years. The planting of tree rows and small forest areas improves the local microclimate and strengthens water retention. Farmers are open to the establishment of single or double row (twin-row) rows of trees (alleys), because not many twigs are taken away from the fields. They have heard about farming no-tillage, but they don't know how to start. In Békés County, farmers are the key players in preserving the health of the soils. They must be educated and locally applicable good practices must be collected for them.

During the questionnaire survey (returns and telephone conversations with local governments), it also became clear that the settlements are minimally aware of the steps they could take to preserve the soil health of the settlement. The land areas owned or used by the settlements are typically roads, parks, and a small amount of agricultural land owned by the settlements (local goverments), small gardens, house sites, industrial parks (typically residual areas). In these areas, the settlements could present exemplary soil

protection solutions (bee pasture, afforestation, no-till technics, establishment of rows of trees and groves). Local governments do not have the appropriate expertise for this. It is also a significant help to urban soil if tree rows on streets are supplemented and empty spaces are planted. Intensive tree planting in settlements is also effective against heat islands and protects the health of urban soils.

The most interesting case is the Municipality of Gyomaendrőd, where some more important risk's situations were indicated.

Gyomaendrőd has 12.000 inhabitants, small-town structure, the origin of airborne dust is basically by local and transit traffic.

At level 3 there is the dumping of non-degradable trash or plastics (municipal wastes), even though it creates problem in a small area (0,18 kmq), where the local landfill, legal, modern, owned by the local municipality (former illegal landfills was closed and recultivated after 1990). Much more disseminated is the heavily acidified soils (227,76 kmq); in fact, a significant portion of the area used as arable land may be affected due to the intensive use of fertilizers and pesticides. A same surface shows riks in term of long-term poor agricultural farming practices (depletion of soil organic carbon and soil nutrients, over-fertilization, contamination by pesticides), always at level 3 for arable land on the outskirts of the settlement, half of which has been used since the Middle Ages and the other half since the regulation of the Hármas-Körös River (1872-1890), during the river regulation, large areas that were previously temporarily or permanently covered with water became cultivable.

Some other problems emerged, specifically of Hungary:

- inner area (urban area), which is urbanized, with typical small town soil compaction and degradation problems, roads, ditches, areas taken out of rural cultivation (loading yards, port, etc.), the vast majority of which are unpaved, where soil compaction is an obvious problem
- A national phenomenon, the Great Plain is critically affected by the lack of groundwater - its depletion, the drying out of agricultural lands. Of all the issues, this is currently the most pressing and difficult to treat in our settlement.

As a result of the PoLaRecCE project, we will send a practical guide to each municipality on how they can use their own areas cheaply and efficiently with solutions that support soil health, with demonstration purposes.

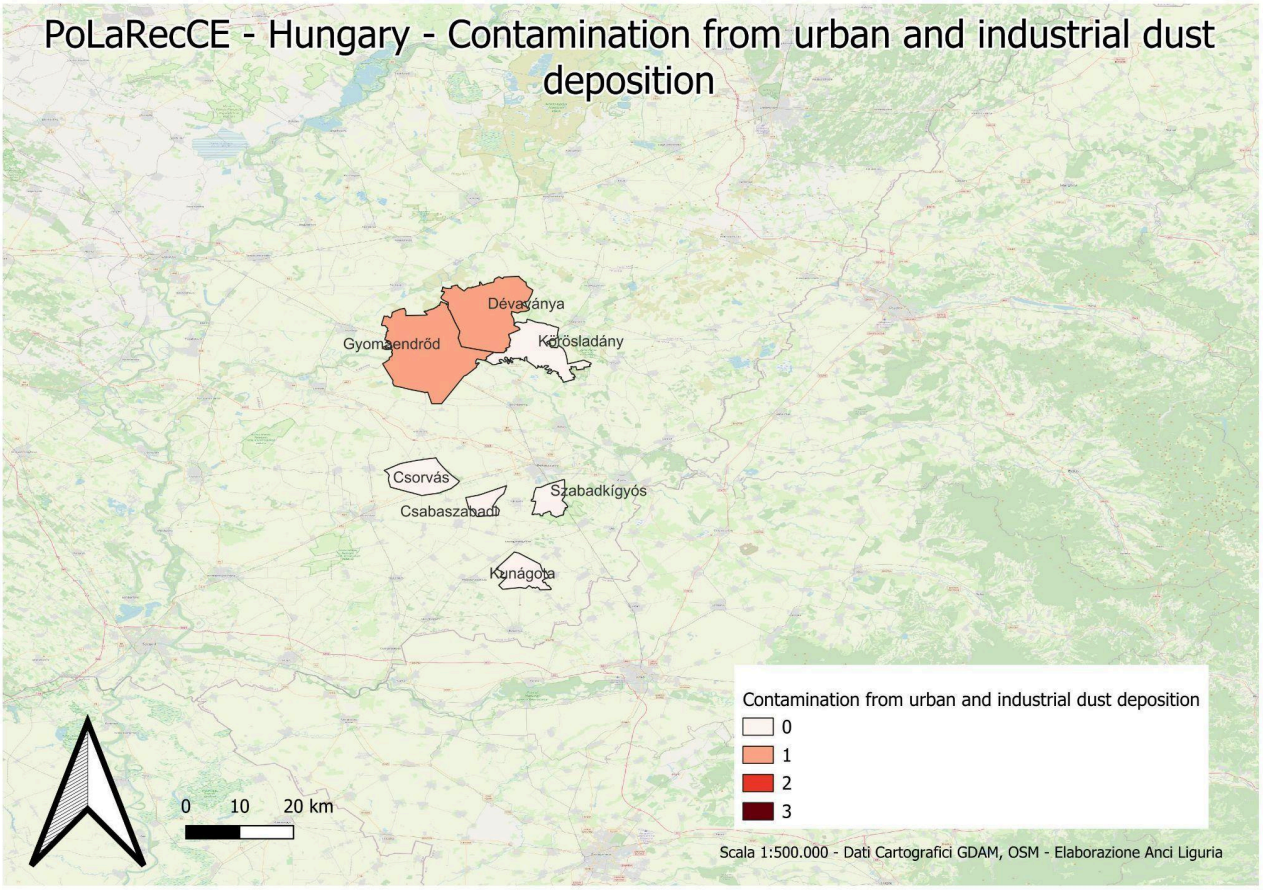


Fig. 73 - Contamination from urban and industrial dust deposition - HUN

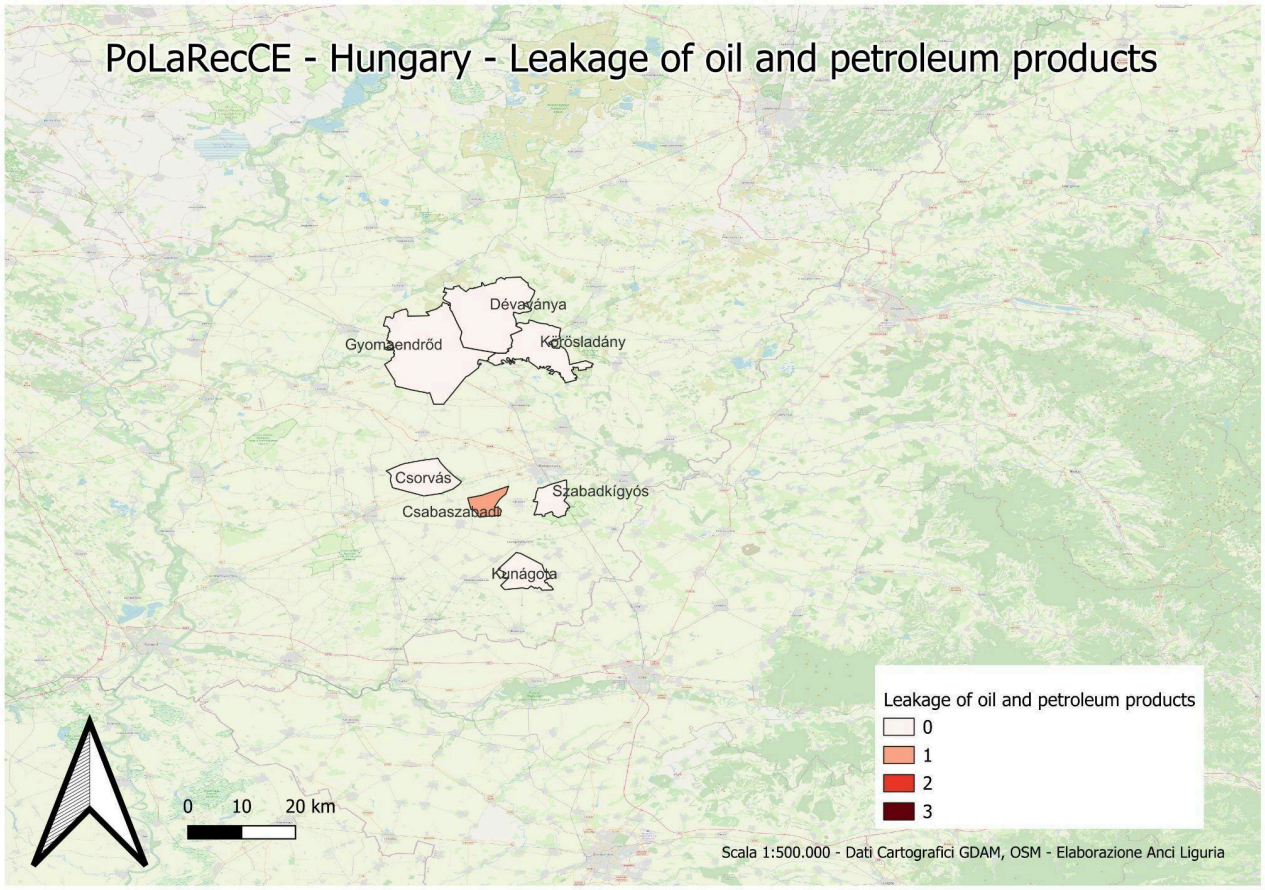


Fig. 74 - Leakage of oil and petroleum products - HUN

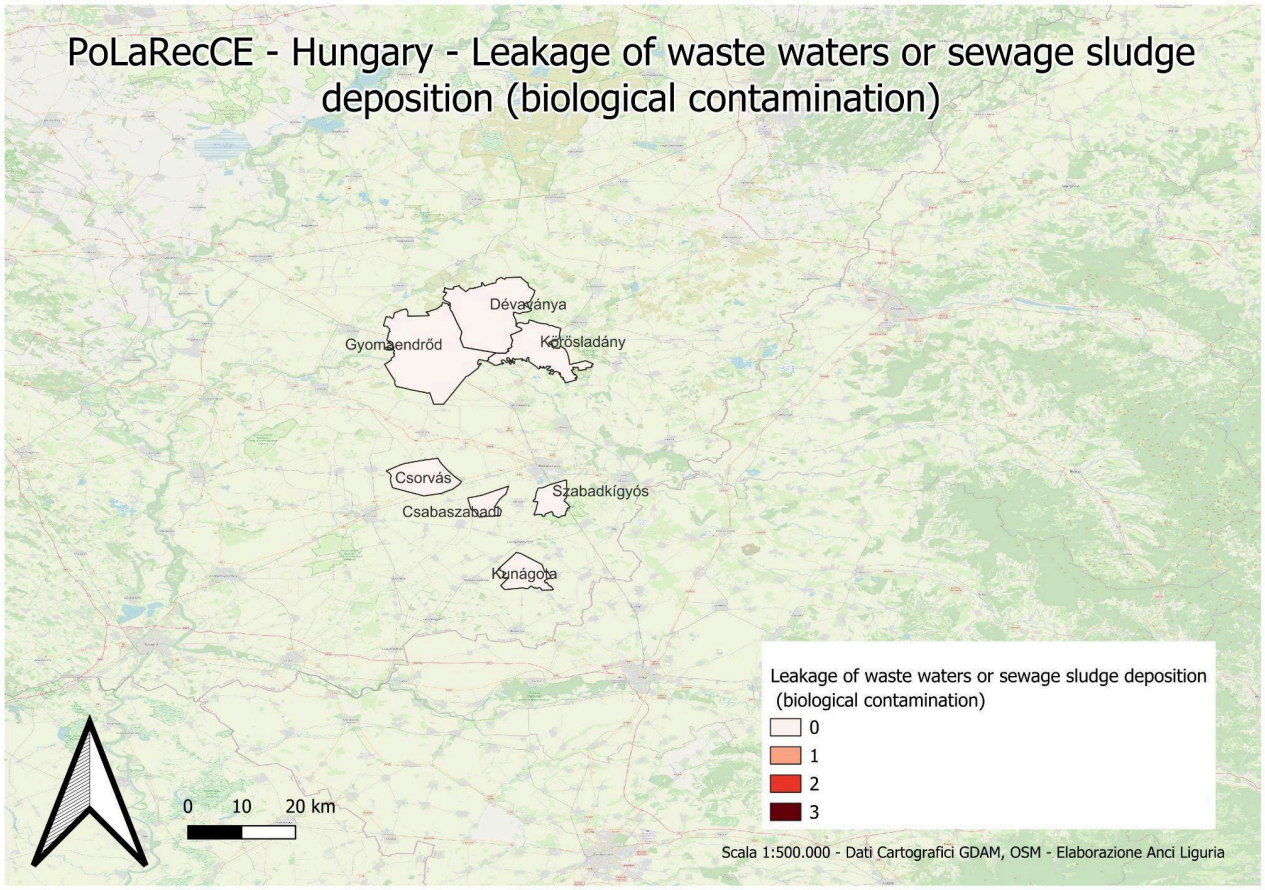


Fig. 75 - Leakage of waste waters or sewage sludge deposition (biological contamination) - HUN

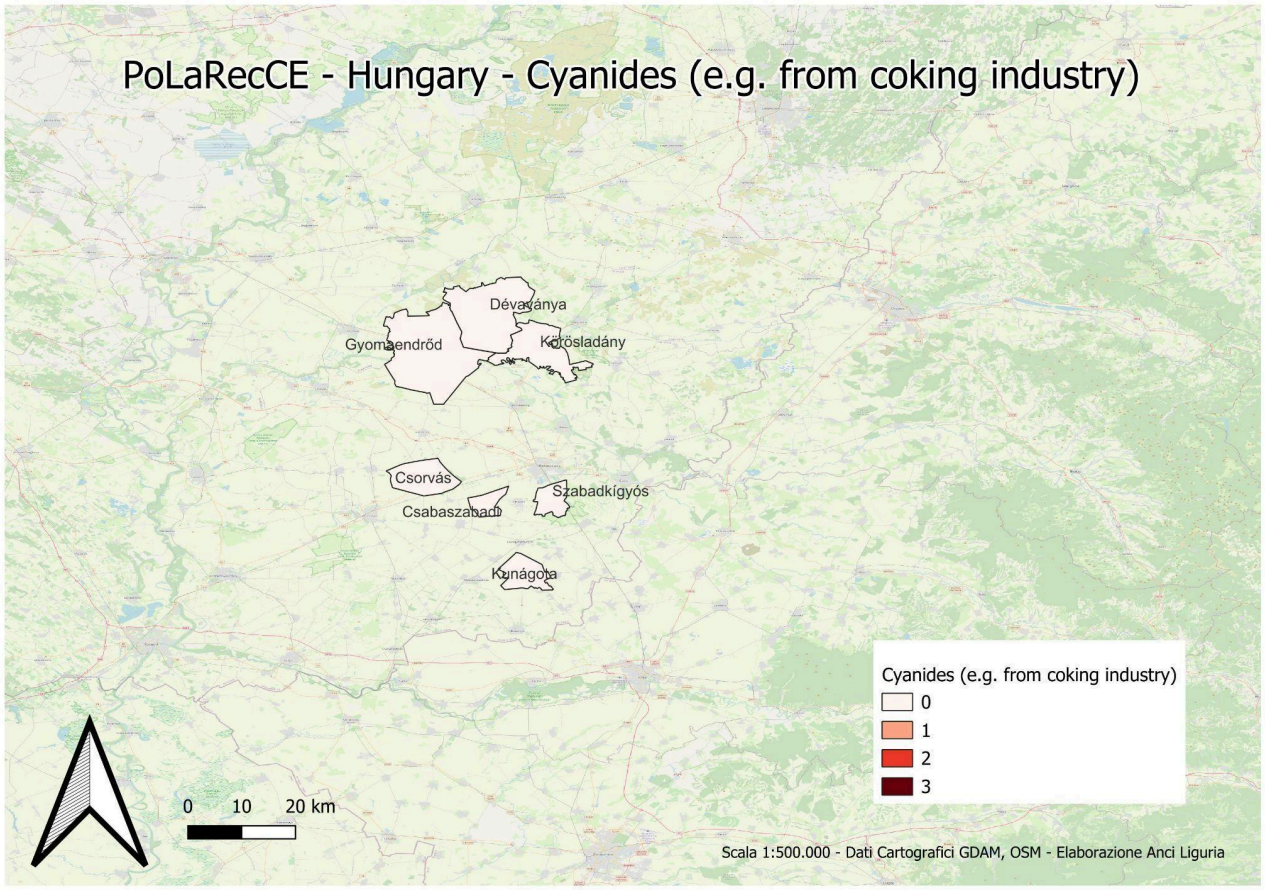


Fig. 76 - Cyanides (e.g. from coking industry) - HUN

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

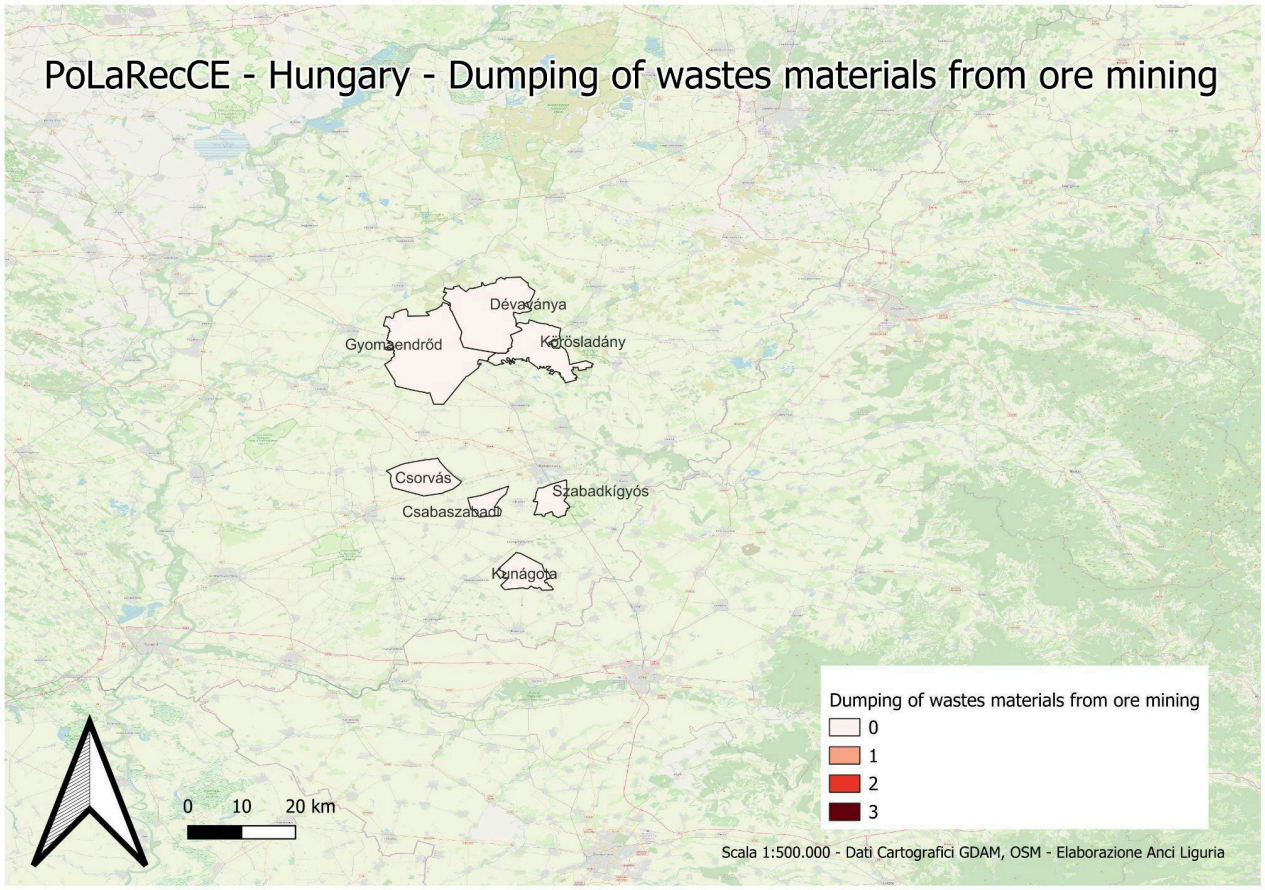


Fig. 78 - Dumping of wastes materials from ore mining - HUN

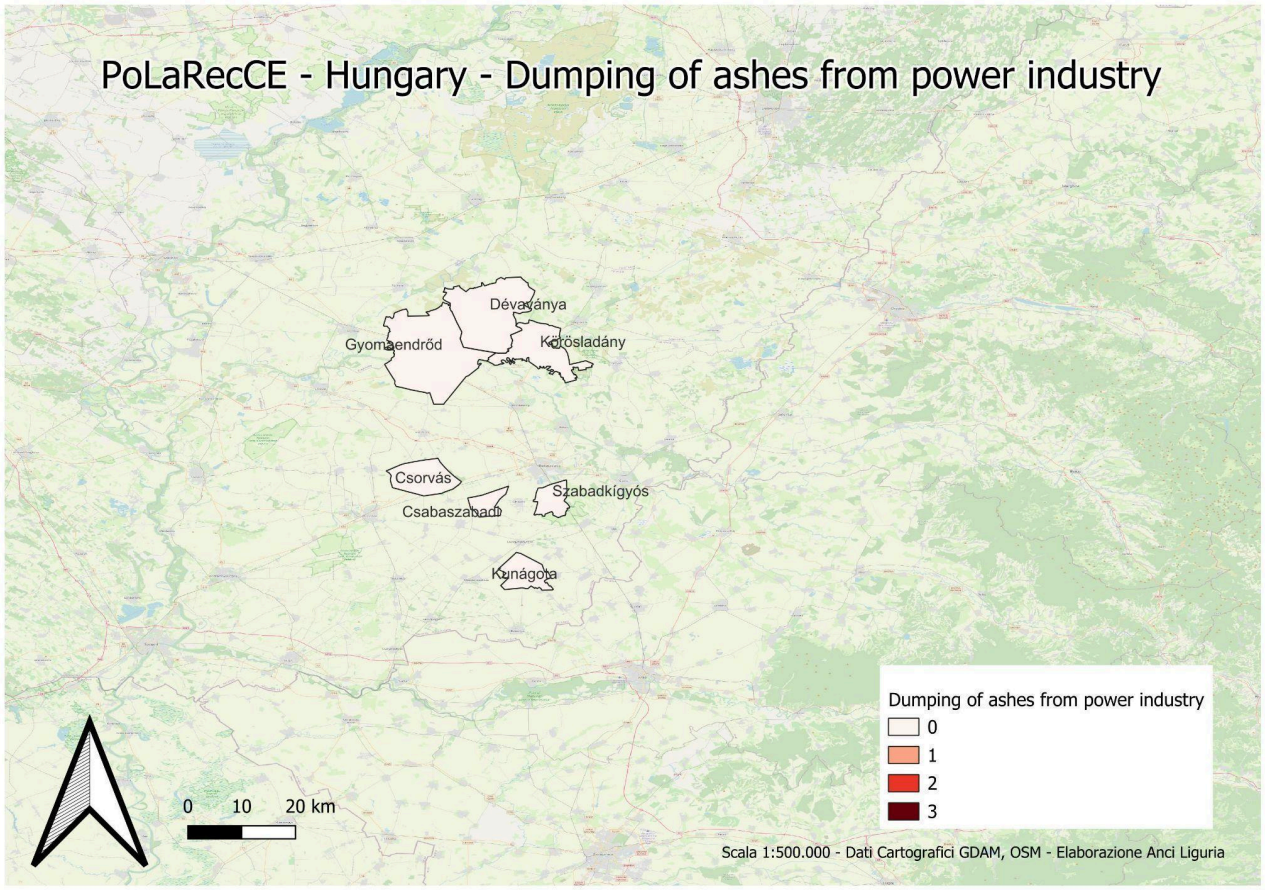


Fig. 79 - Dumping of ashes from power industry - HUN

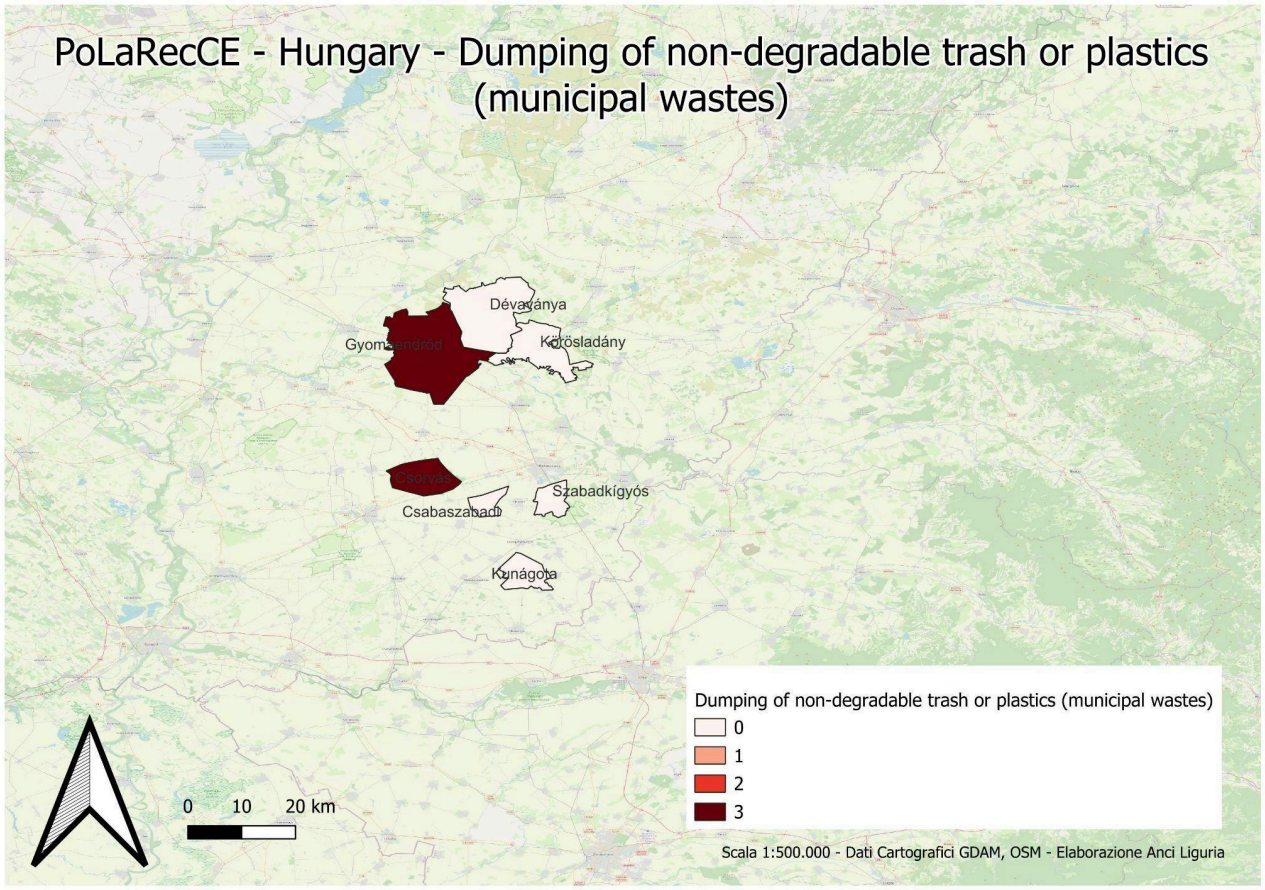


Fig. 80 - Dumping of non-degradeted trash or plastic (municipal wastes) - HUN

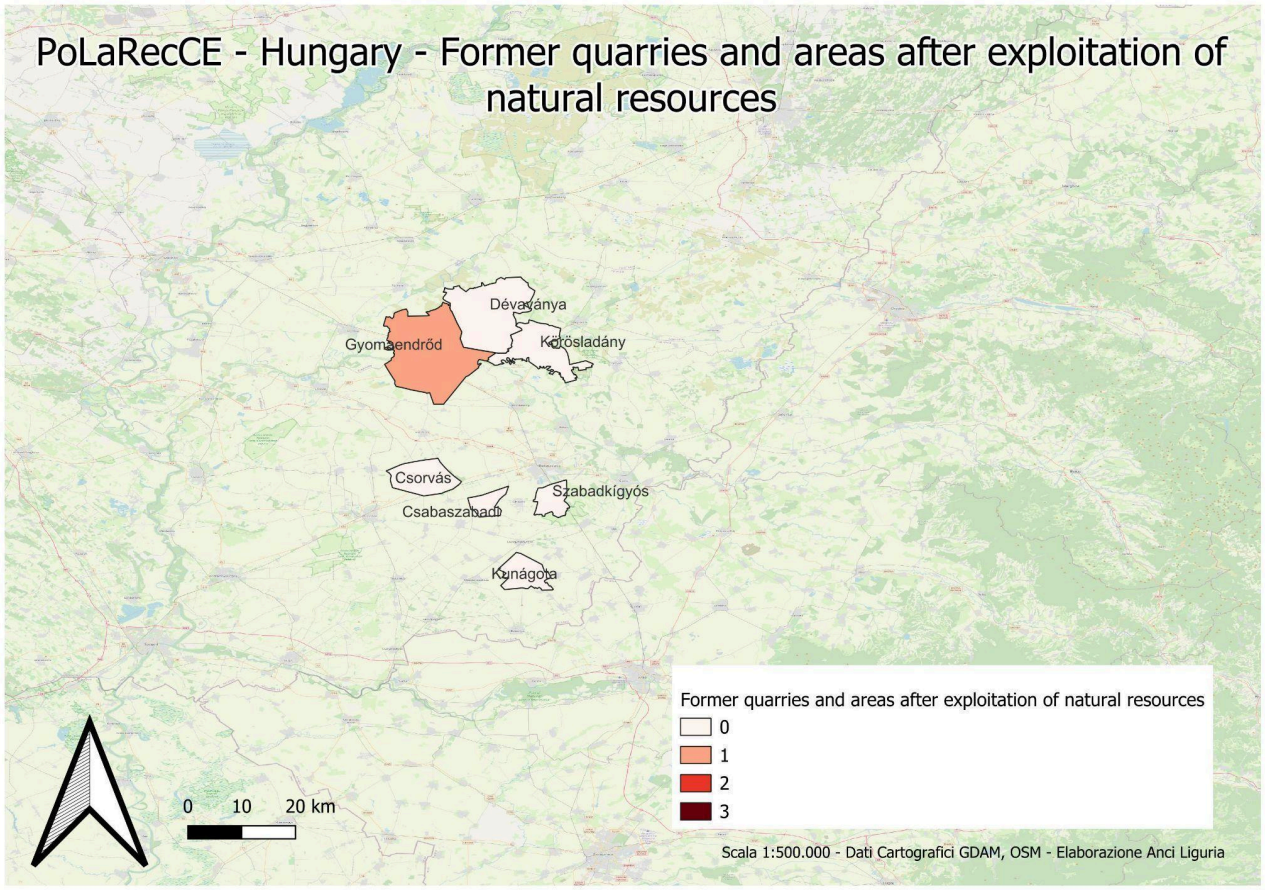


Fig. 81 - Former quarries and areas after exploitation of natural resources - HUN

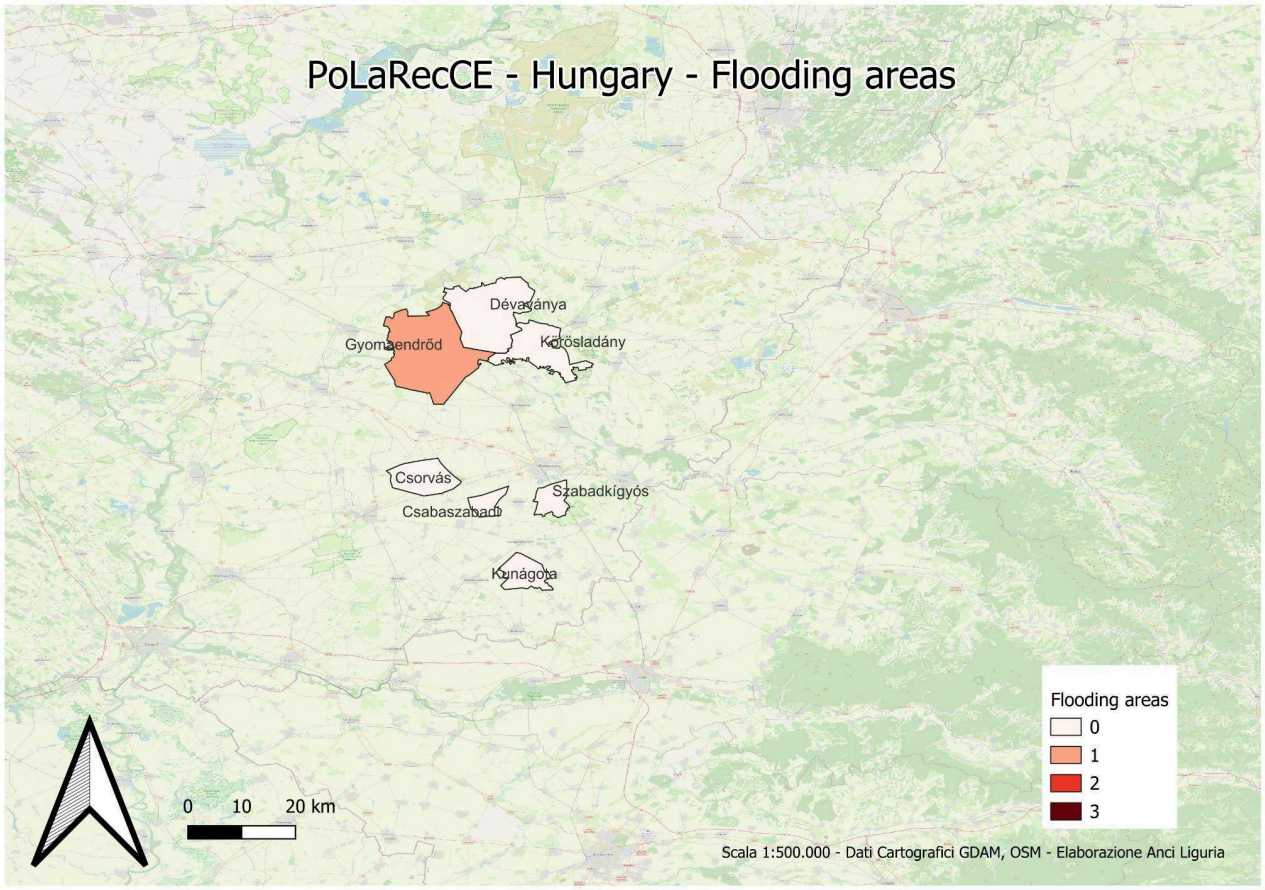


Fig. 83 - Flooding areas - HUN

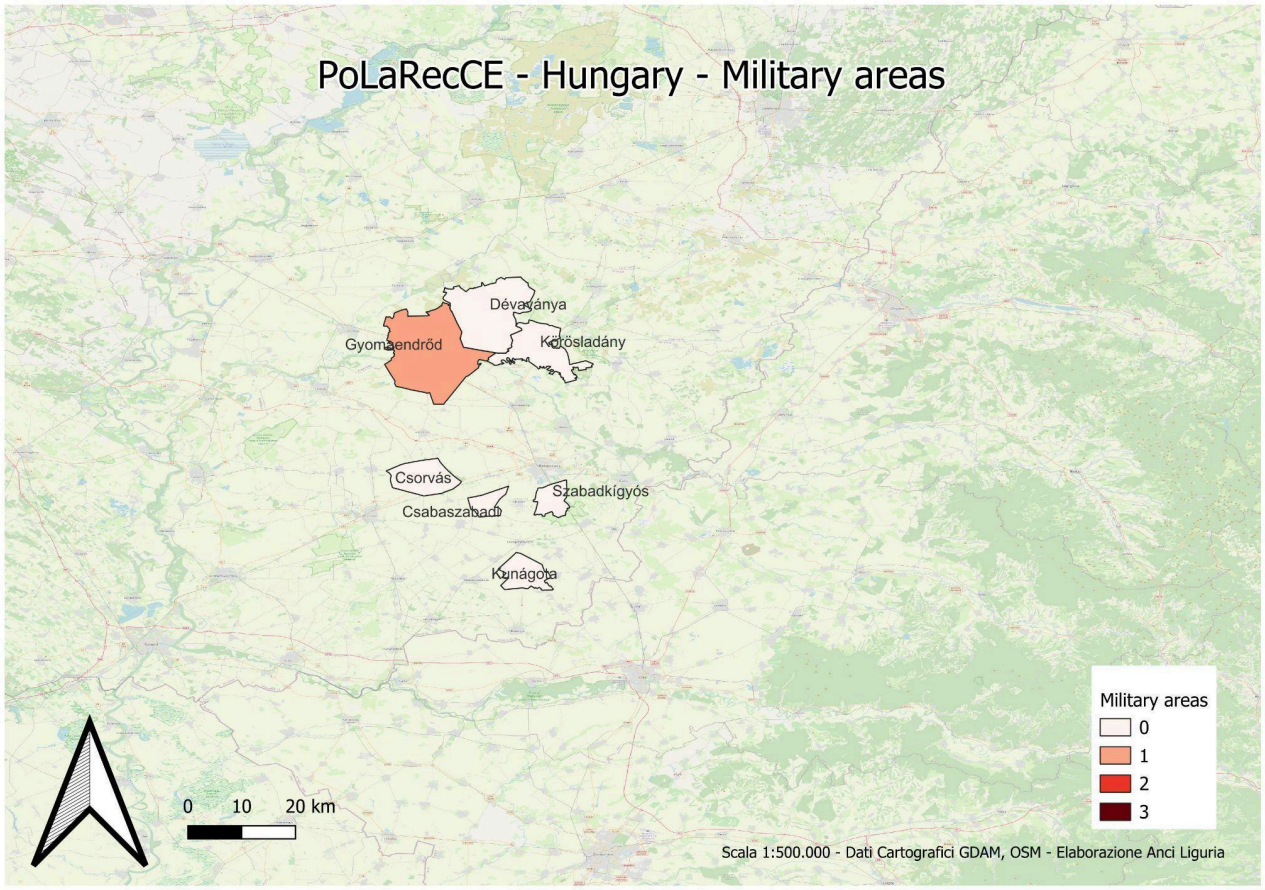


Fig. 84 - Military areas - HUN

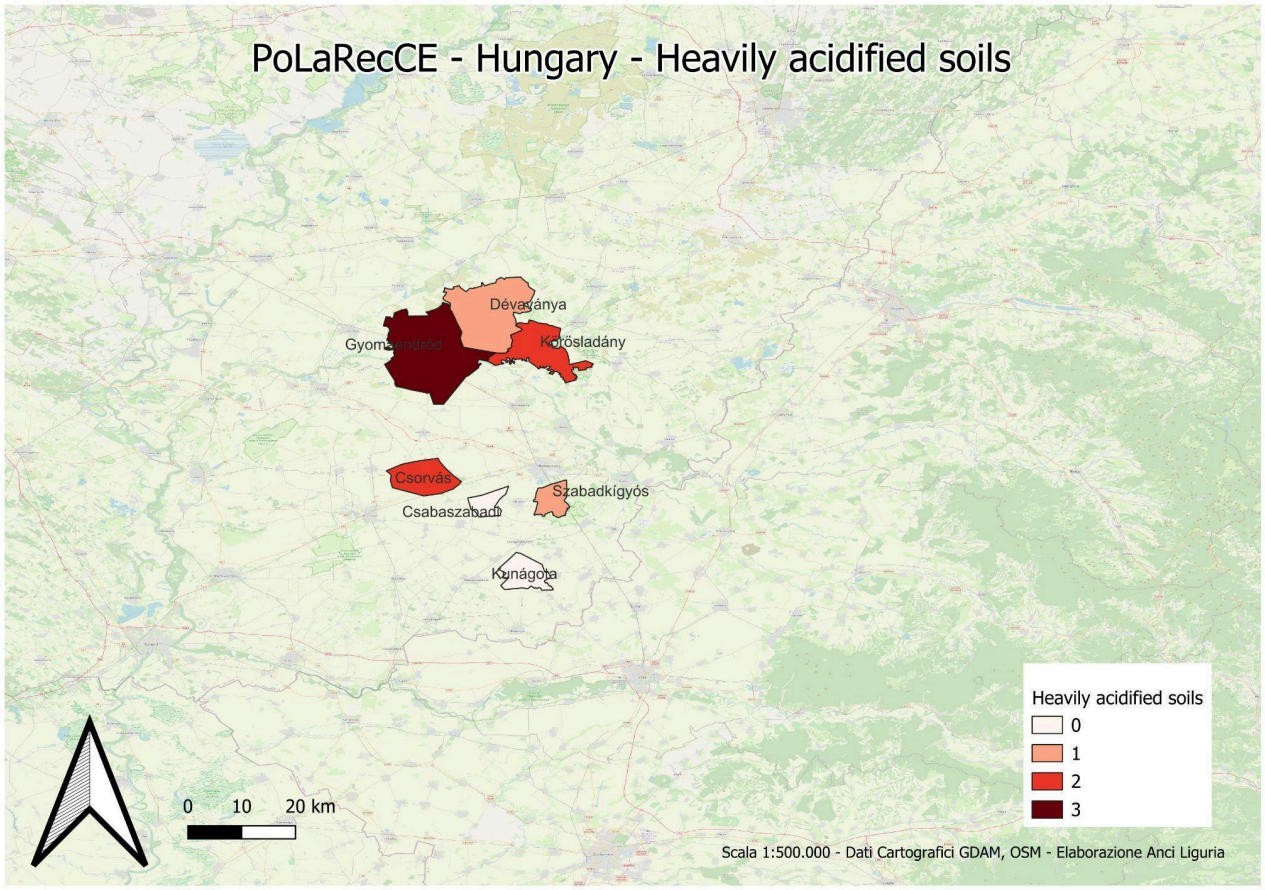


Fig. 85 - Heavily acidified soils - HUN

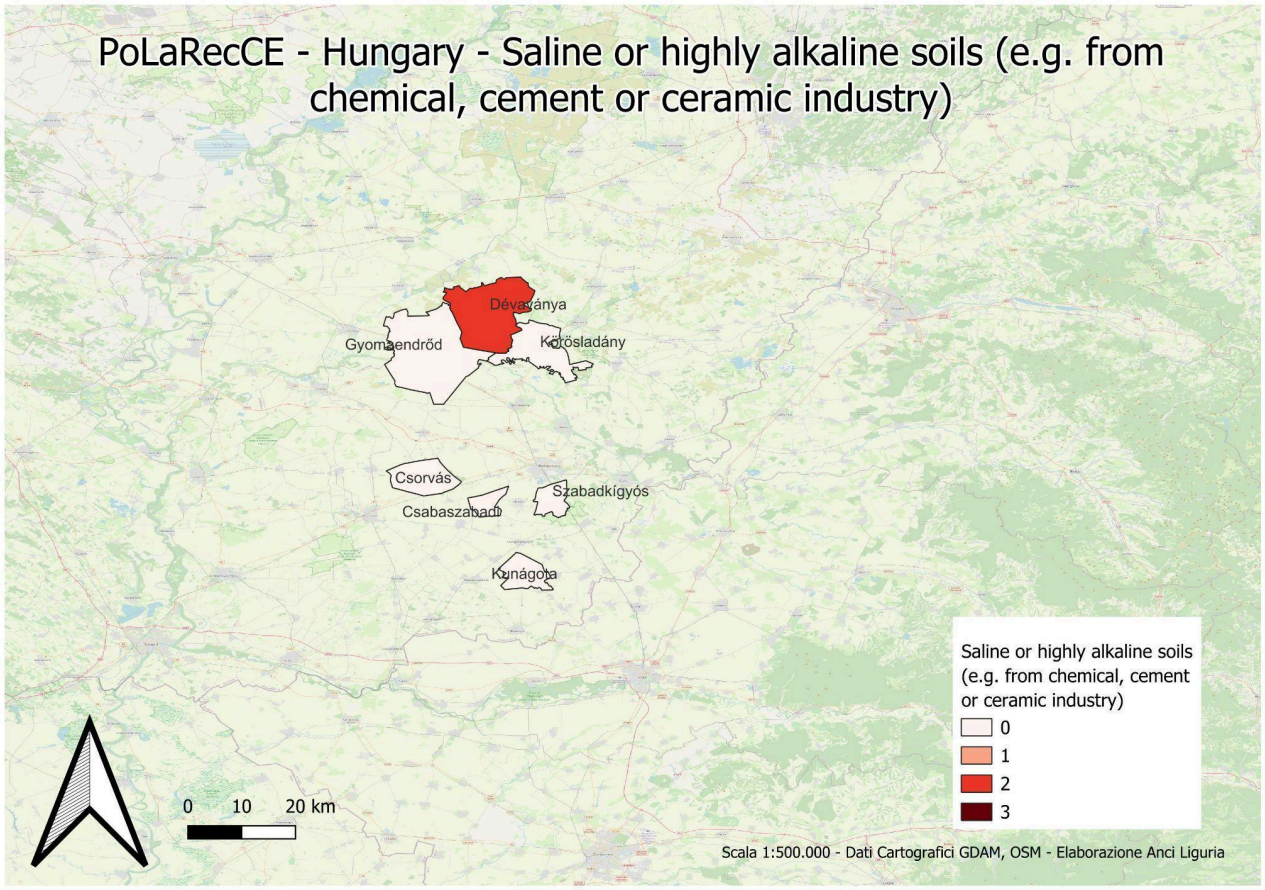


Fig. 86 - Saline or highly alkaline soils (e.g. from chemical, cement or ceramic industry) - HUN

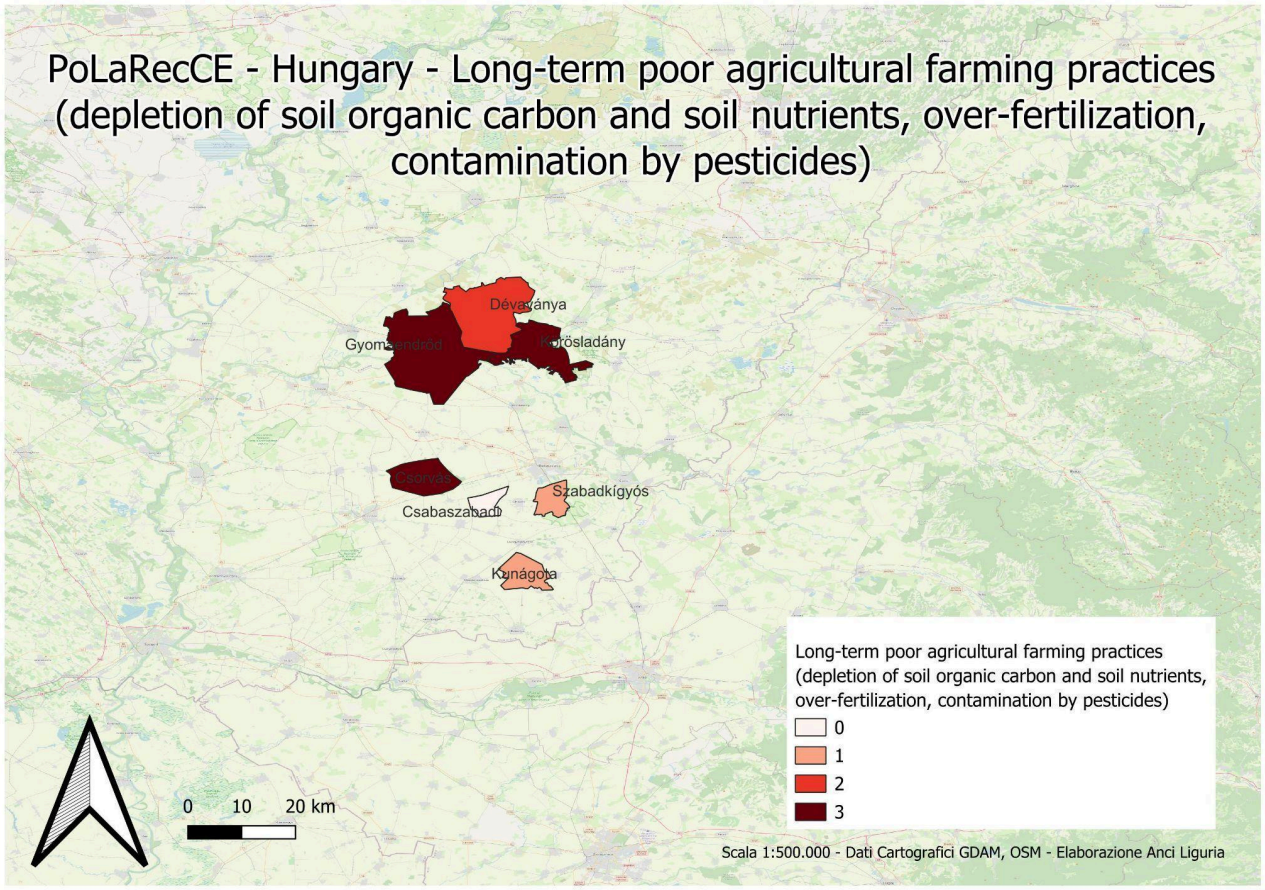


Fig. 87 - Long-term poor agricultural farming practices - HUN

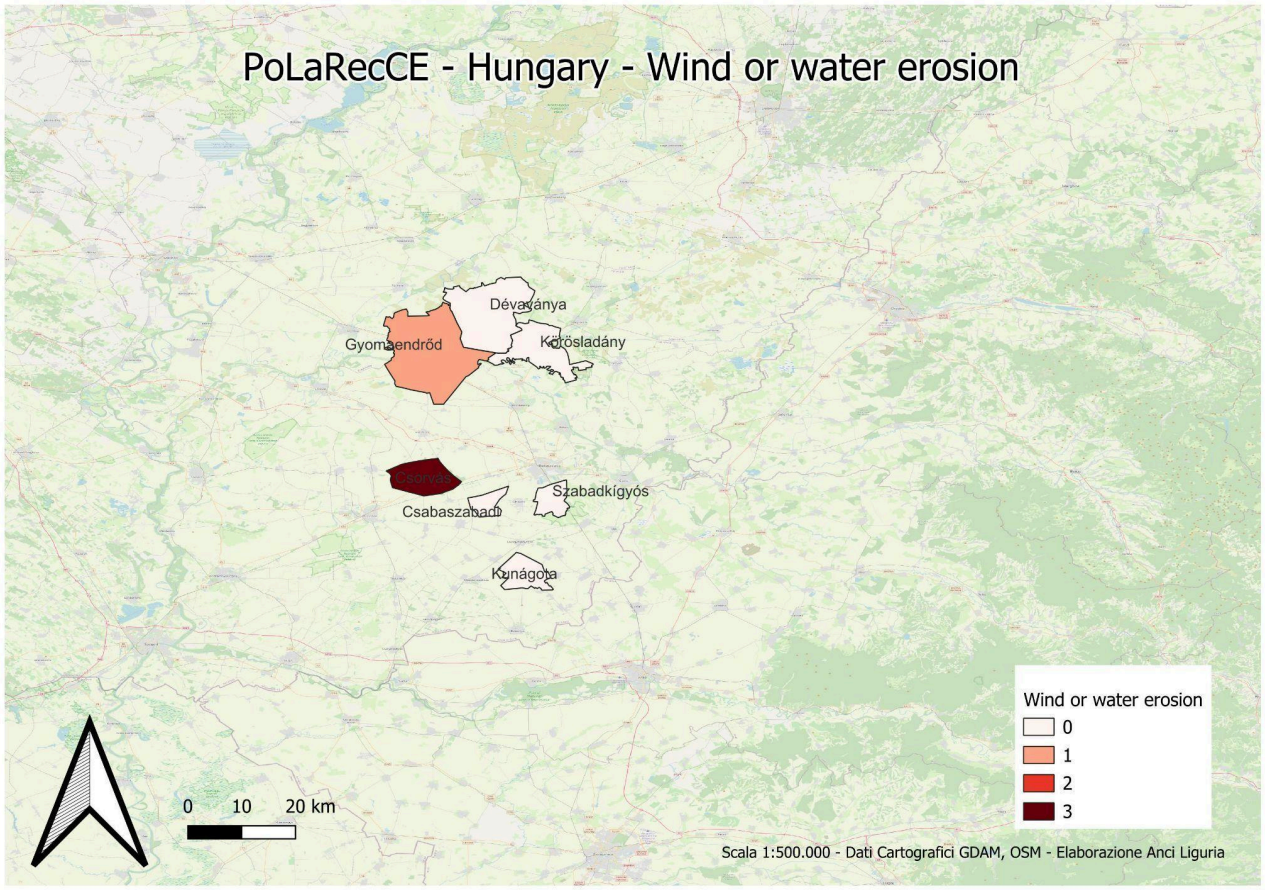


Fig. 88 - Wind or water erosion - HUN

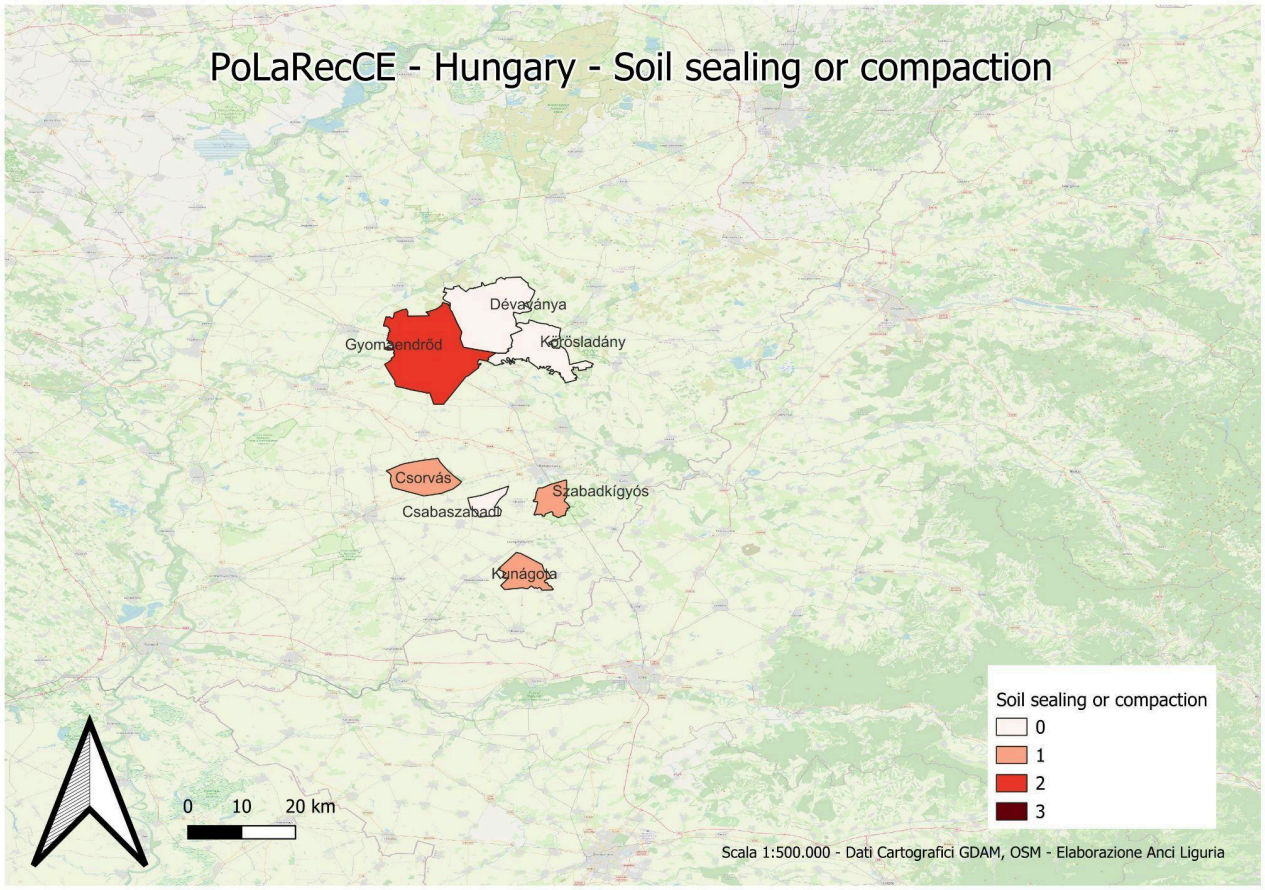


Fig. 89 - Soil sealing or compaction - HUN

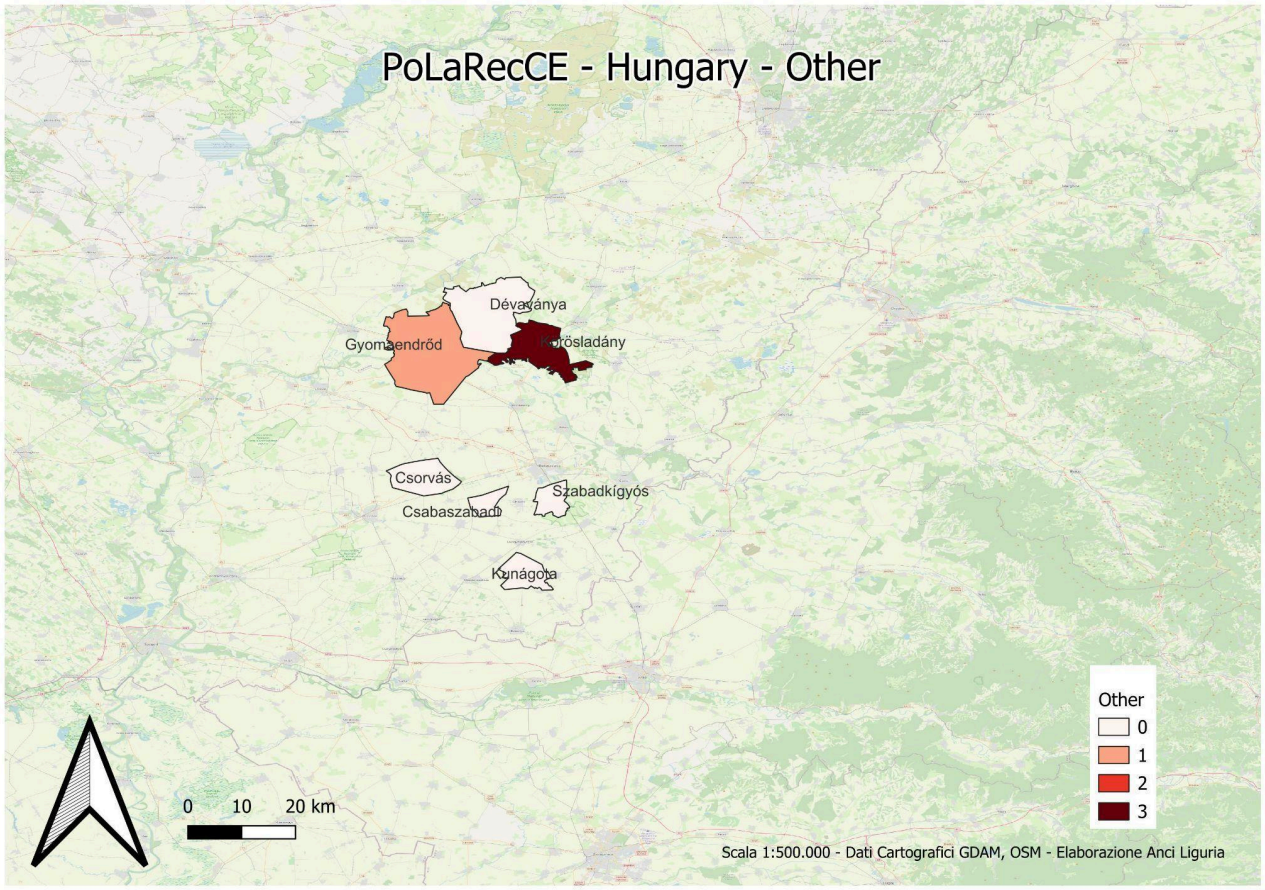


Fig. 90 - Other - HUN

3.6. Results in Austria

For Austria the land survey was conducted for Corinthia, the southernmost province where also the demonstration site Arnoldstein is located. Corinthia has in total 132 municipalities of which 17 are cities and 48 are market towns. The survey was sent out via email to the official contacts on January 20th, 2025, and as second time as a reminder on February 20th, 2025. After a short description of the project and aim of the study receivers were asked to do an online survey where the project-wide harmonized survey questions were asked. The online tool "UmfrageOnline.com" was used for a user-friendly filling out of the survey. From the 132 municipalities 48 filled out the survey which represents 36 %. The municipalities where more or less evenly distributed over the province. Besides Arnoldstein, which is well known for historical contamination due to industrial activities, some other municipalities described contamination. Lavamünd, Nöthsch im Gailtal, St. Gertraud, Weitensfeld, Finkenstein and Feistritz an der Gail reported medium contamination from urban and industrial dust deposition. Some of them concerned areas of several km². St Gertraud and Finkenstein also reported leakage of oil and petroleum products. As wastewater treatment is well regulated in Austria, no municipality reported any significant problem with that. Ebene Reichenau reported a medium problem with organic contaminants which affects 30 km². From the municipalities is no problem reported regarding cyanide contamination. Also, dumping of wastes from coal or ore mining and dumping of ashes from power industry is unproblematic in Carinthia. Ebene Reichenau mentioned a medium problem on the dumping of non-degradable trash or plastics. Paternion reported a medium problem on former quarries and areas after exploitation of natural resources. Most of the municipalities describe that there is a medium or high problem with flooding areas. This gained special attention after the historically high flooding happened in September 2024. Spittal an der Drau and Globasnitz describe military areas but with low or no problem. Ebene Reichenau describes heavily acidified soils of approx. 5 km². Apart from that, no municipality reports any problem of high acidification or alkalinization of soils. Only a few municipalities mention problems with long-term poor agricultural farming practises. However, this may not represent the actual problem, since depletion of soil organic carbon, soil nutrients and contamination by pesticides and problematic issues due to fertilisation (nitrate leaching, nitrous oxide emissions, ammonia volatilization) are extensively known and researched in Europe. Mörtschach reported a high degree of importance of wind or water erosion. Also, Großkirchheim and Bad Eisenkappel categorize as medium. Many municipalities rank soil sealing or compaction as medium or high. Central Europe generally faces issues with soil sealing but especially in Austria, the soil sealing rate and therefore soil loss is very high. The use of heavy machinery in Agriculture often comes with soil compaction issues. Approximately 20% of Carinthia's area is used for agriculture (Statistik Austria). Two municipalities mention other contamination issues than asked in the other questions. Arnoldstein reports lead dust emissions of ca. 70 ha and Stadt Villach reports noise pollution over a wide range.

Going into the merits of the state of the soil in the municipalities analysed, it emerges that contamination from the deposition of industrial dust (fig. 54) is a fairly widespread problem with peaks in the municipalities of Arnoldstein (where approximately 50% of the territory is affected by the problem) and other municipalities located in the vicinity of the previous one, suggesting that the distribution of the phenomenon has a common cause in these territories.

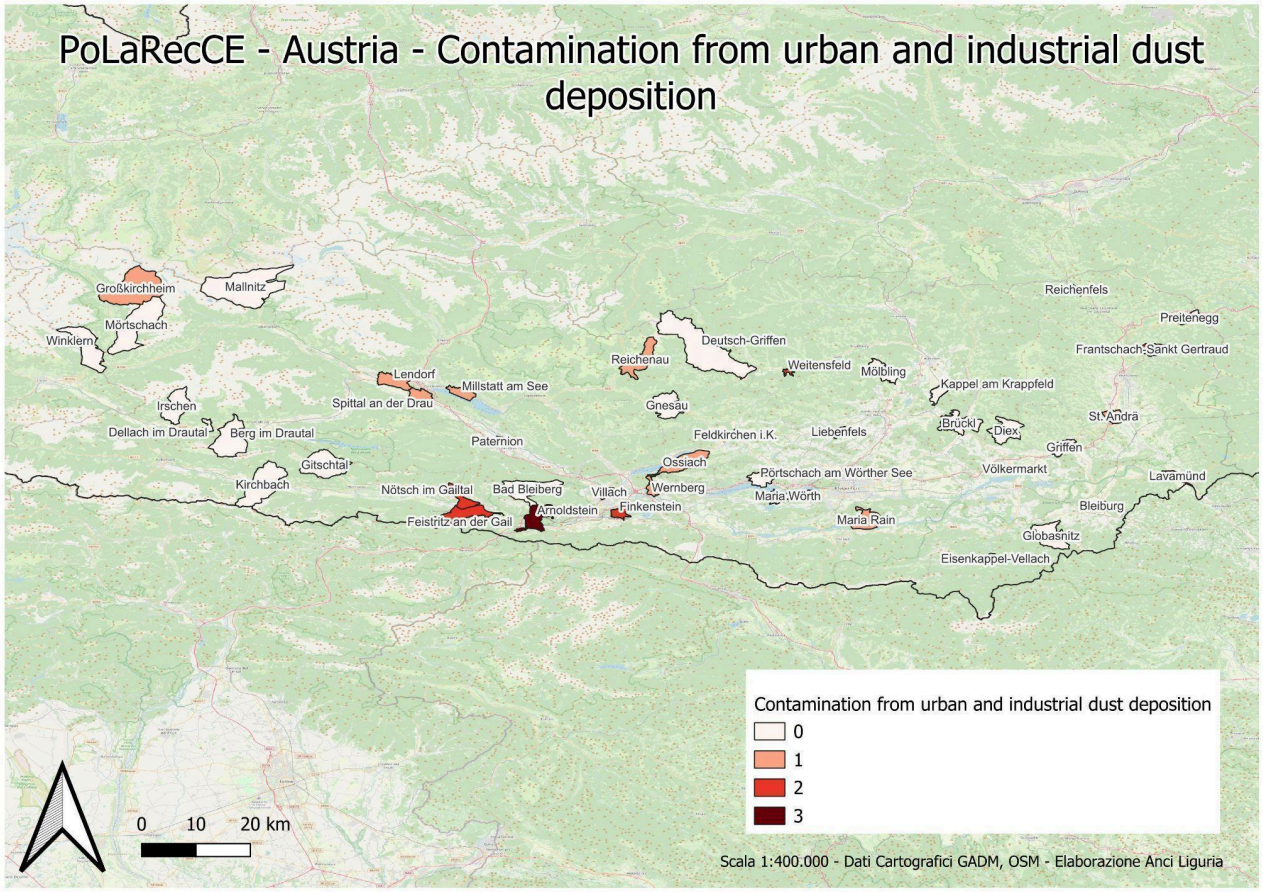


Fig. 91 - Contamination from urban and industrial dust deposition - AUT

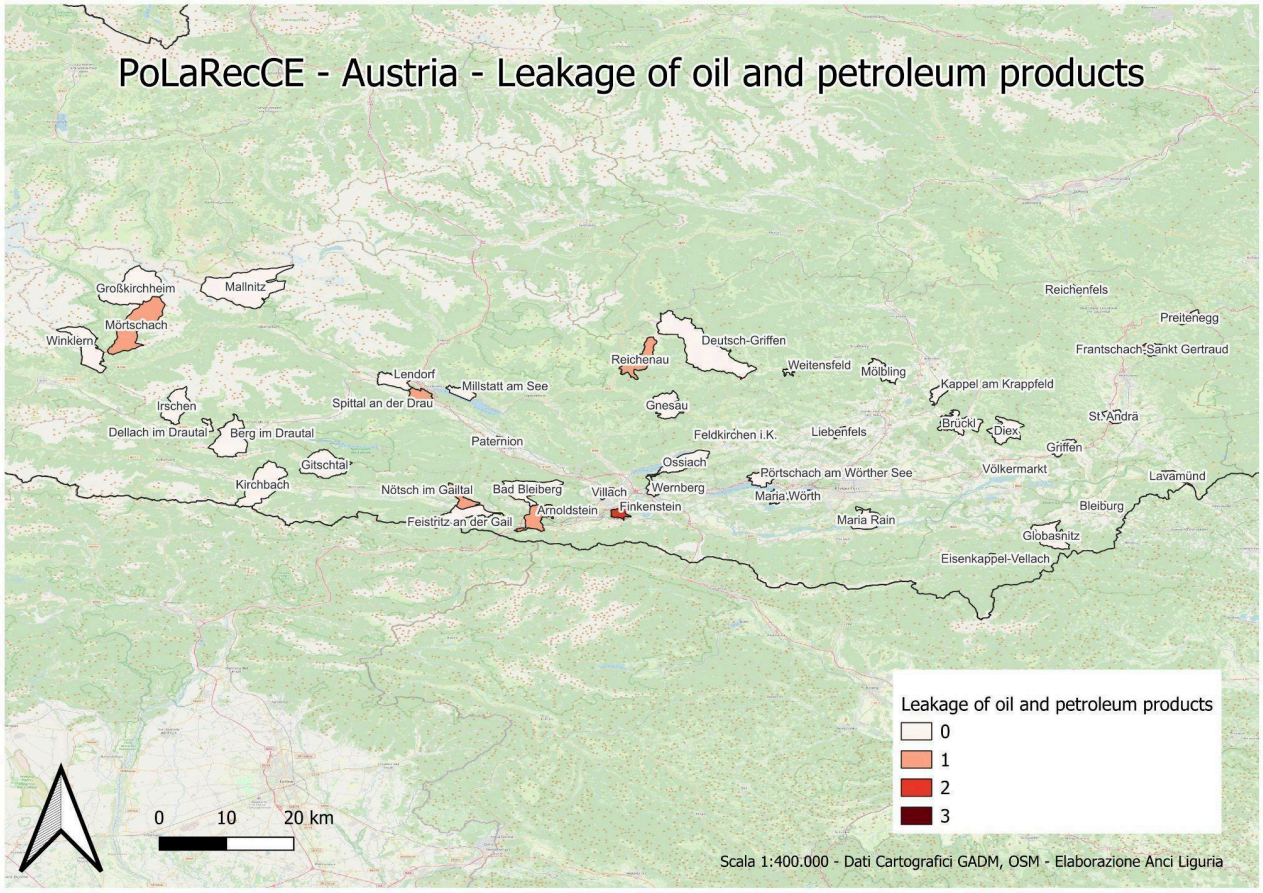


Fig. 92 - Leakage of oil and petroleum products - AUT

Less significant are the soils contaminated by oil leaks and derivatives, with the only exception of the municipality of Finkenstein (fig. 92), or by contamination from waste water (fig. 93).

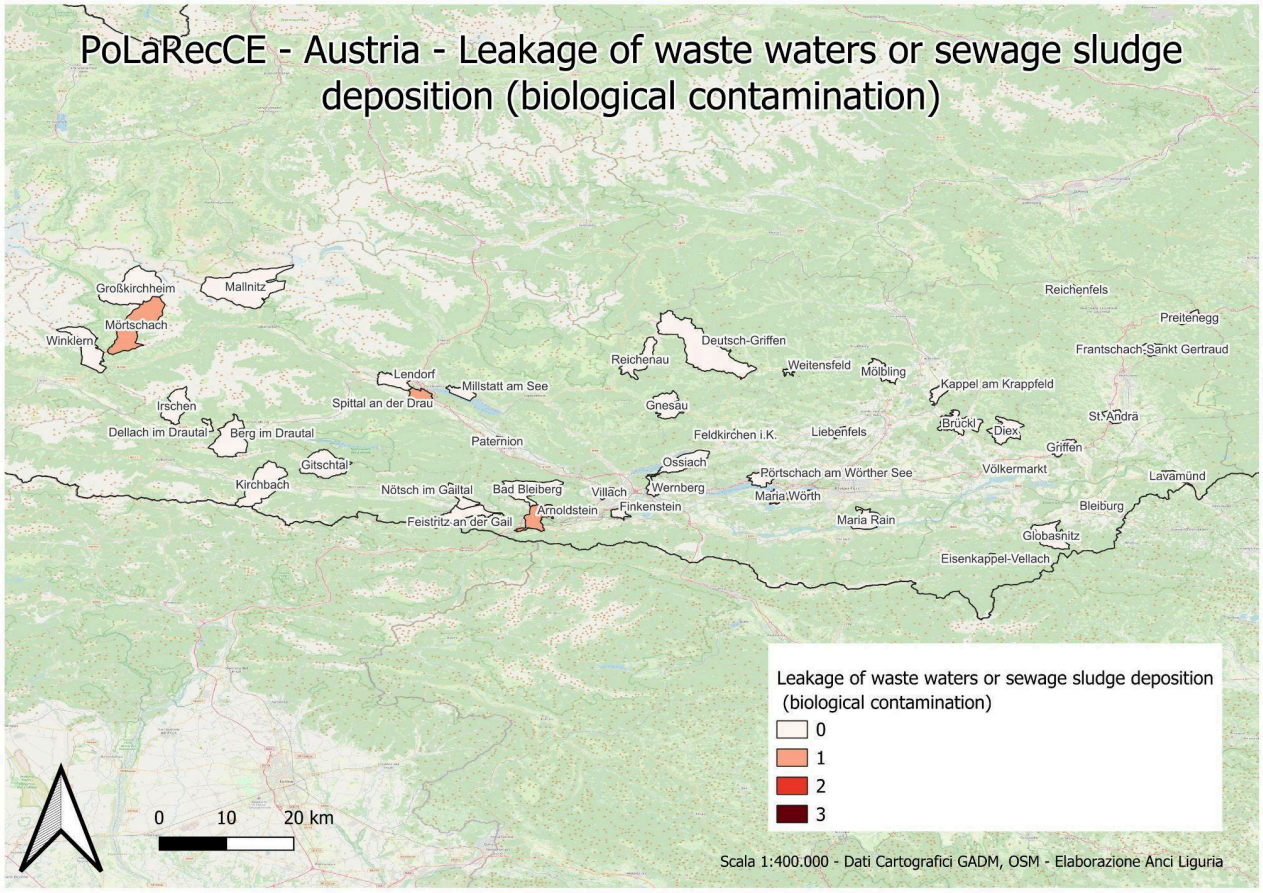


Fig. 93 - Leakage of waste waters or sewage sludge deposition (biological contamination) - AUT

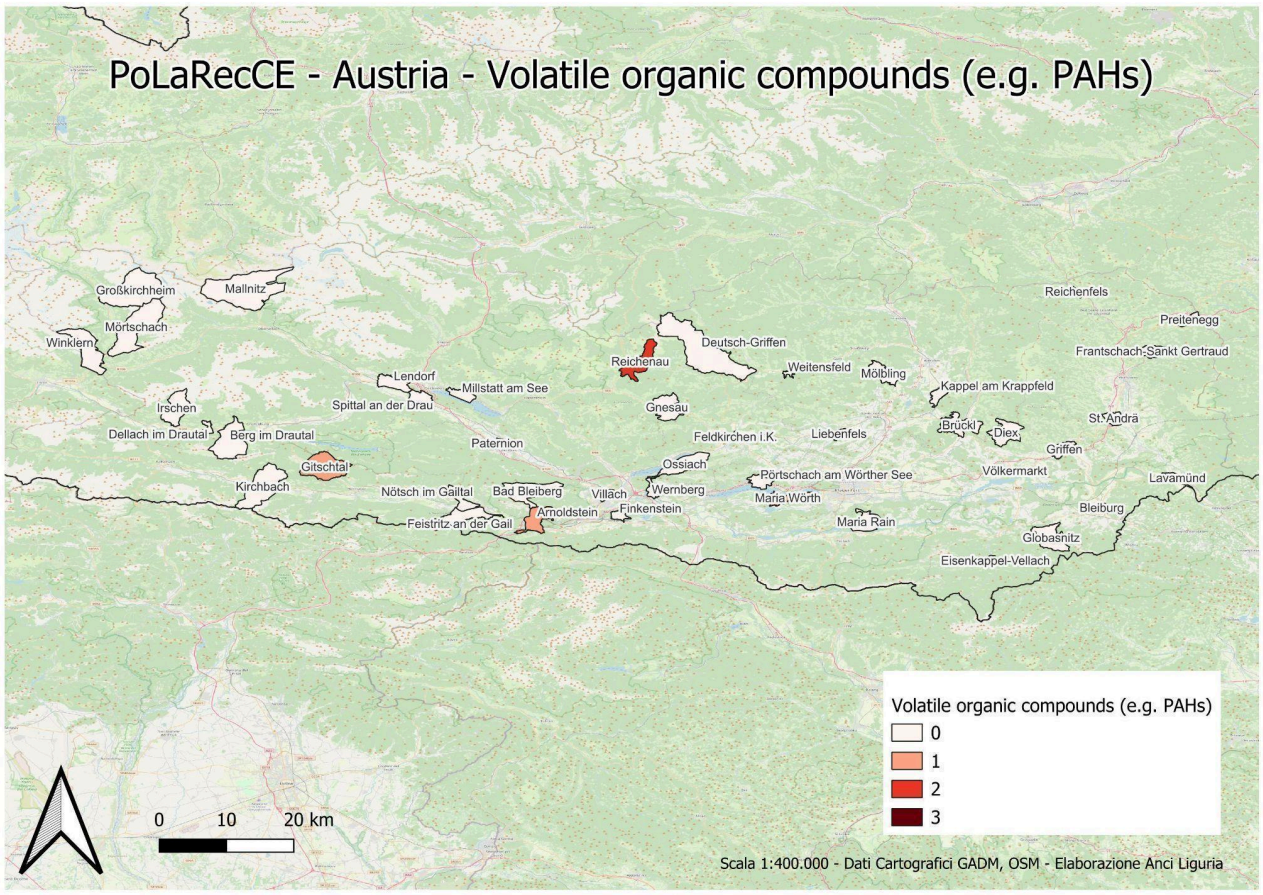


Fig. 94 - Volatile organic compounds (e.g. PAHs) - AUT

Pollution from volatile organic compounds (fig. 94) is also limited and is perceived as a problem of medium importance for the soils of the territory only in the municipality of Reichenau. Pollution from cyanide, waste or ash dumping from coal, metal or energy extraction industries (fig. 95, 96, 97 and 98) are of little relevance while pollution from landfills of non-degradable materials, plastics and urban waste mainly affects Richenau and Arnoldstein (fig. 99).

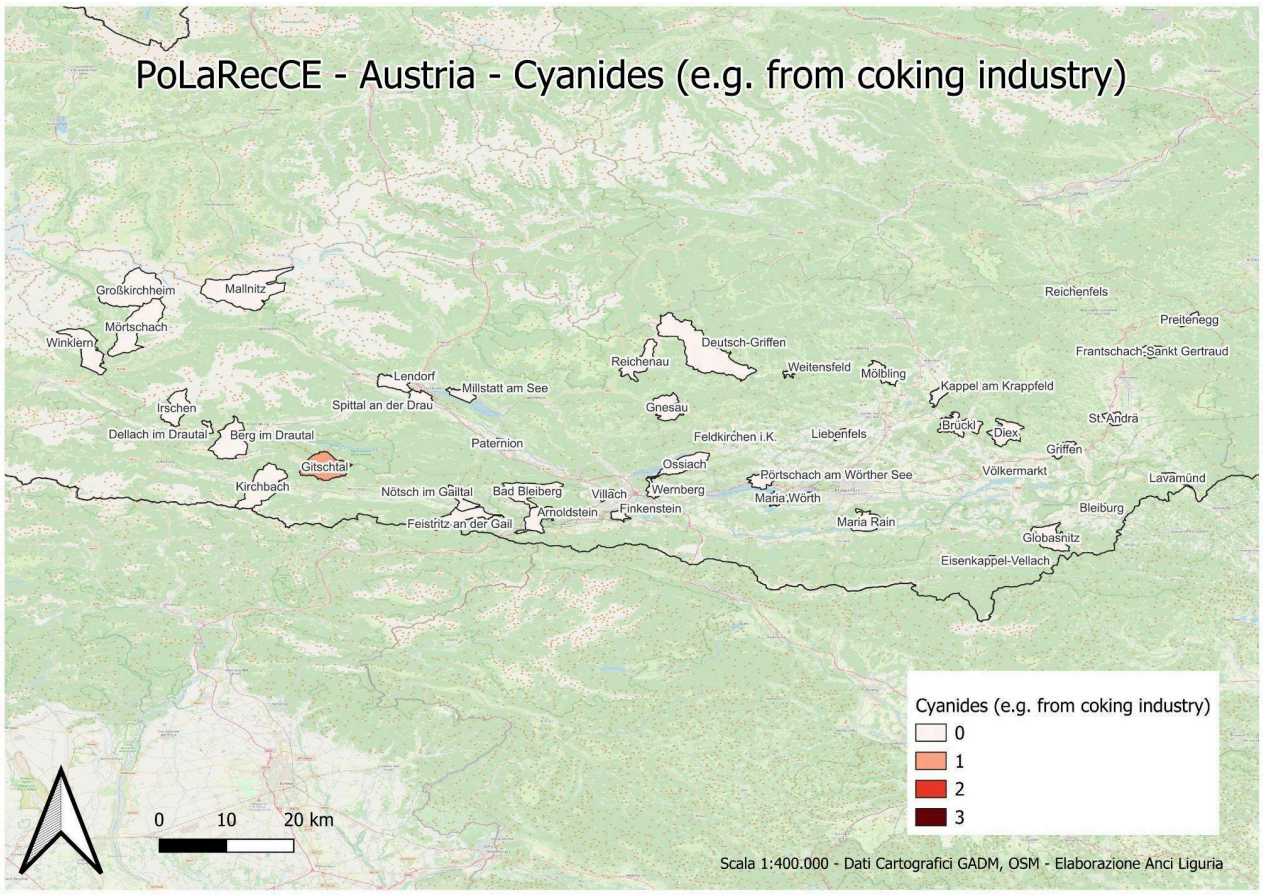


Fig. 95 - Cyanides (e.g. from coking industry) - AUT

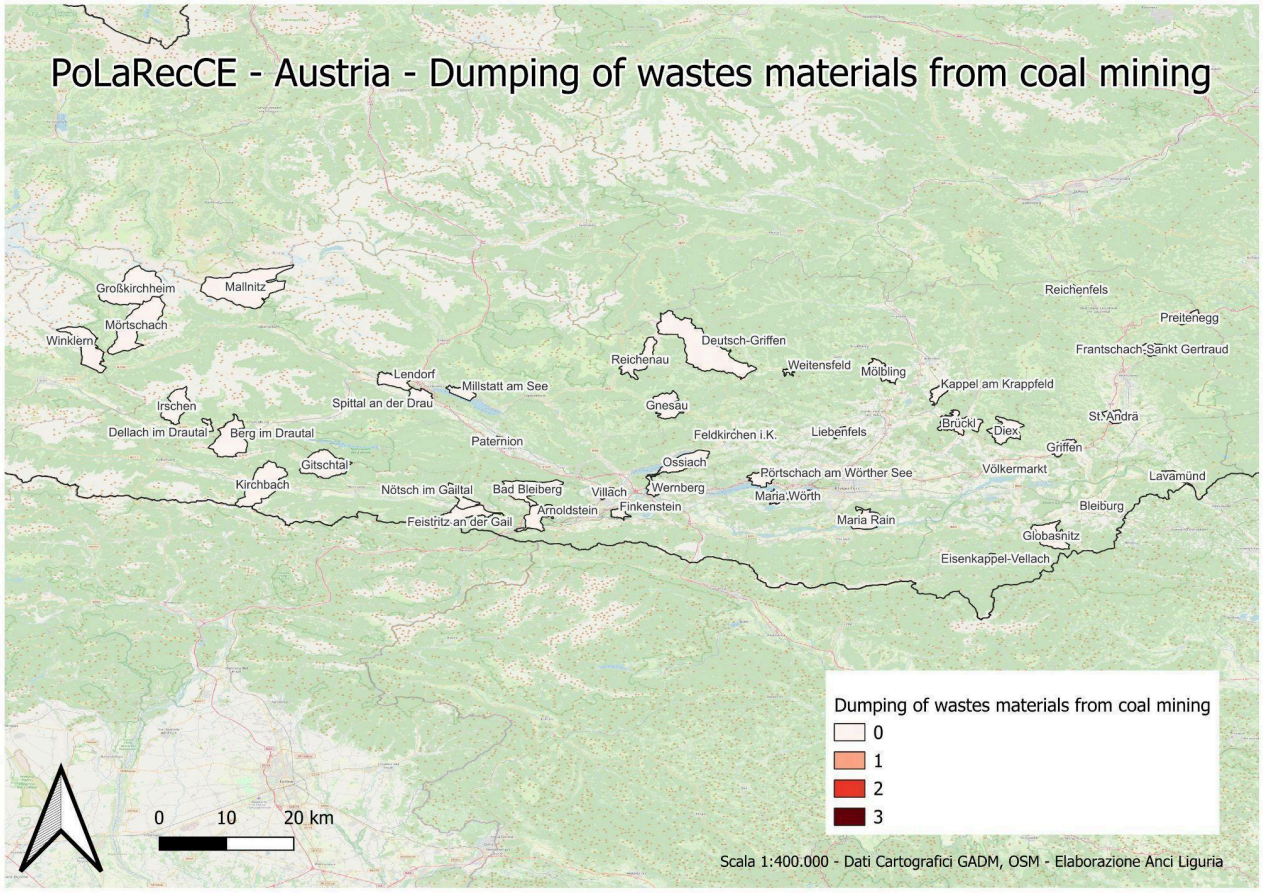


Fig. 96 - Dumping of wastes materials from coal mining - AUT

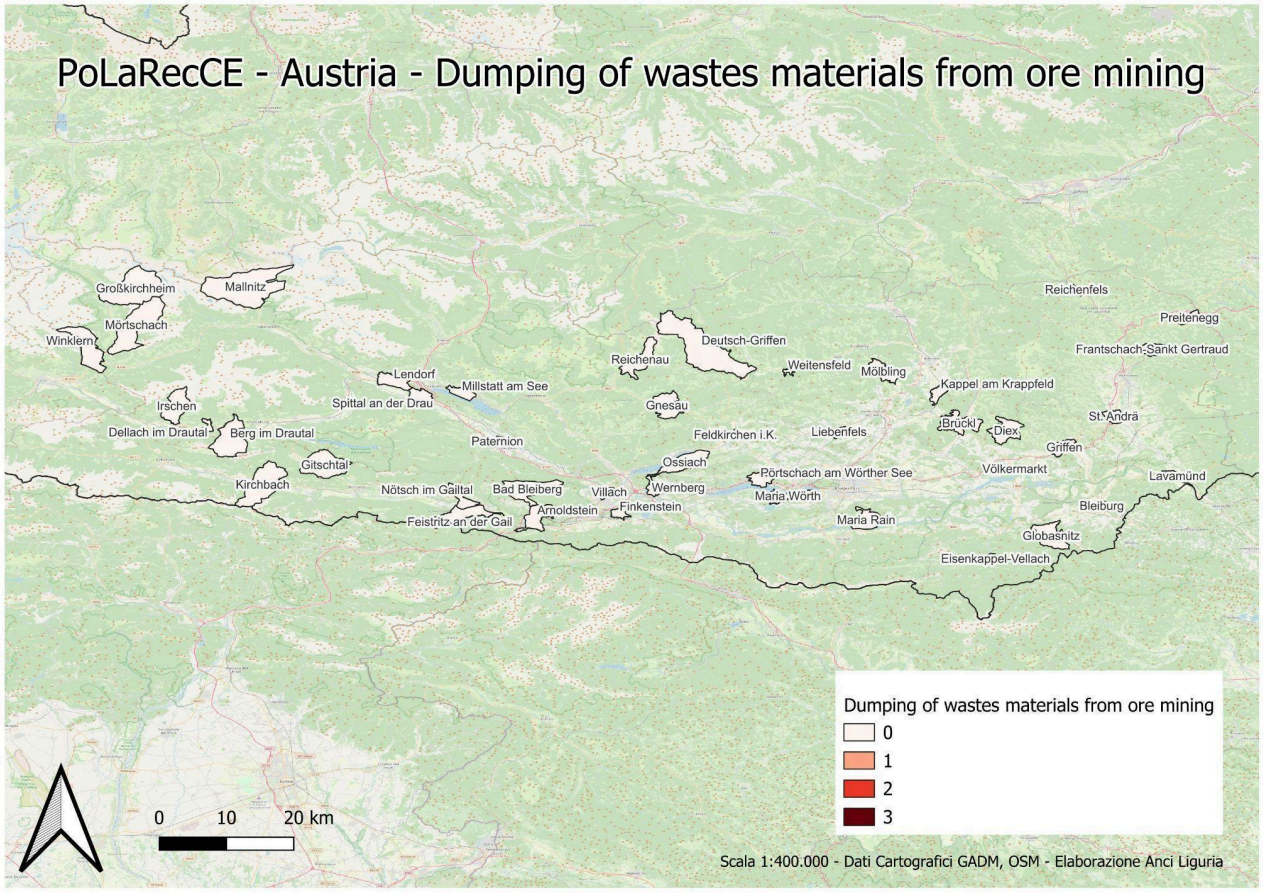


Fig. 97 - Dumping of wastes materials from ore mining - AUT

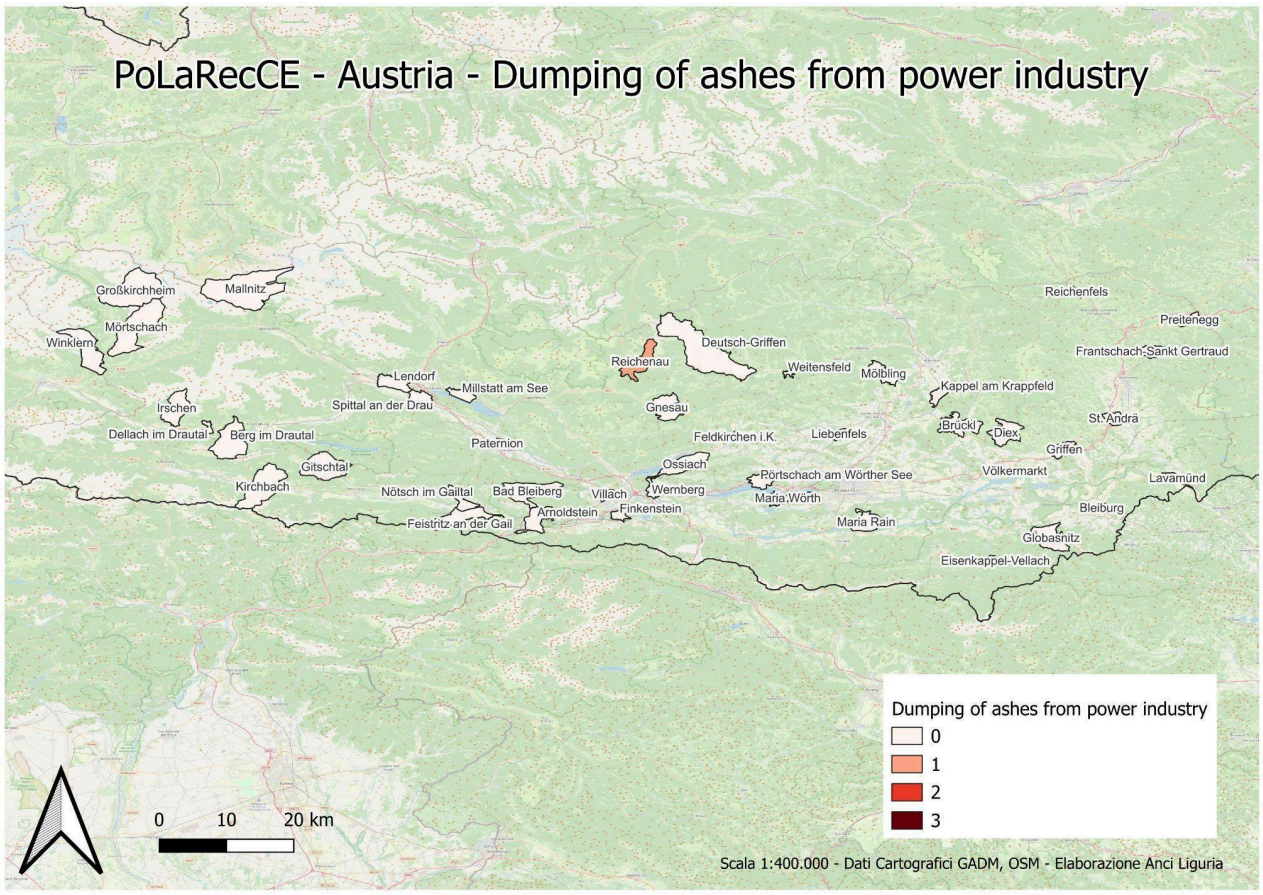


Fig. 98 - Dumping of ashes from power industry - AUT

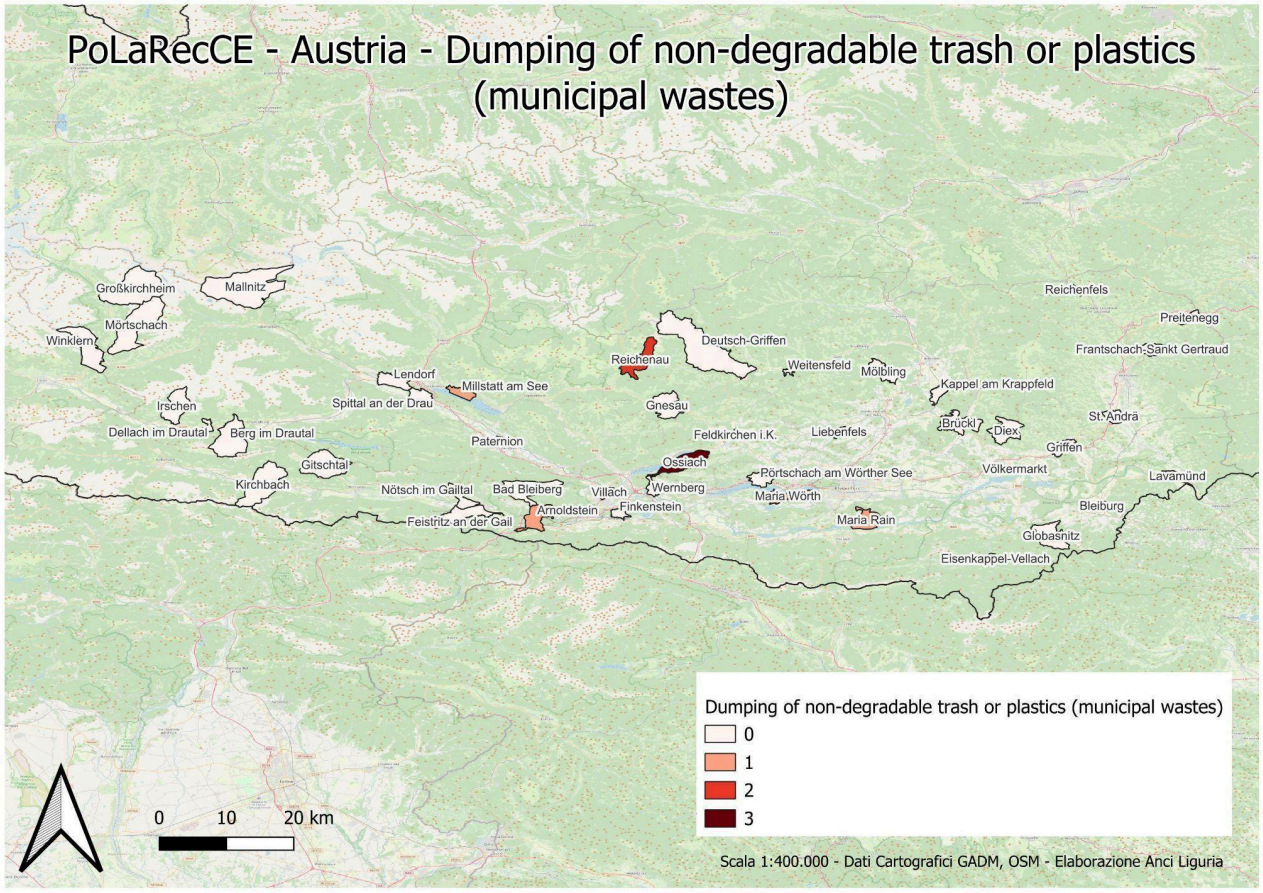


Fig. 99 - Dumping of non-degradeted trash or plastic (municipal wastes) - AUT

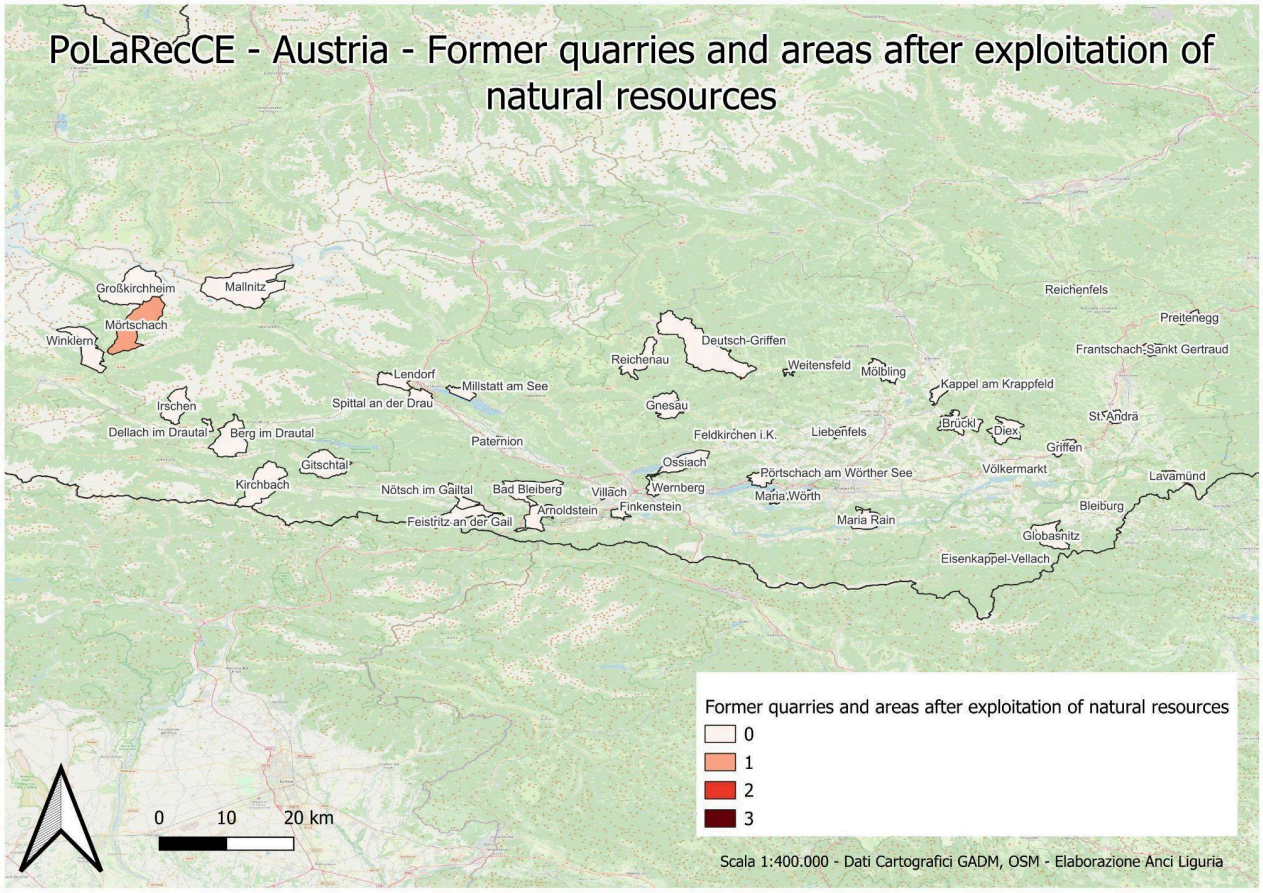


Fig. 100 - Former quarries and areas after exploitation of natural resources - AUT

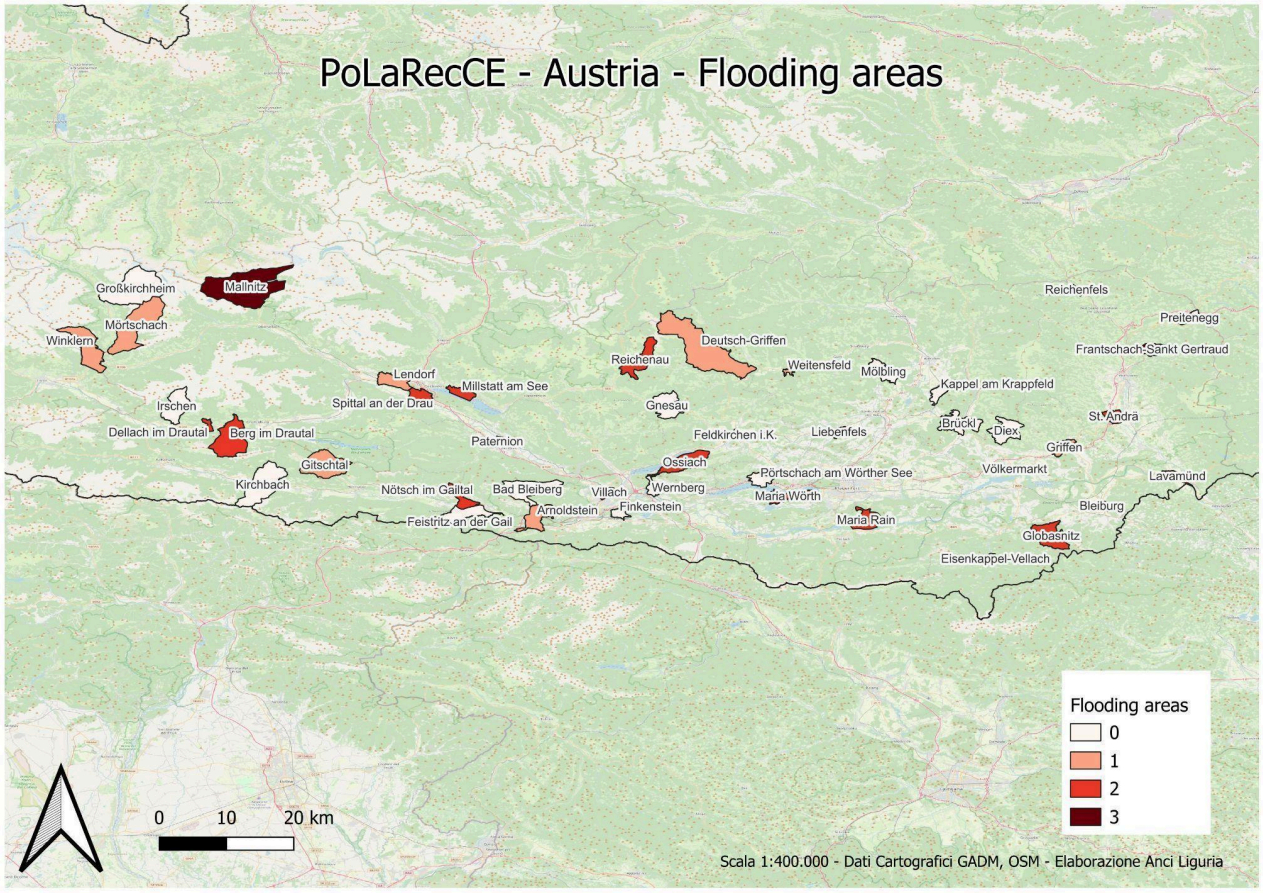


Fig. 101 - Flooding areas - AUT

With regard to the other data emerging from the questionnaires, it is interesting to note how the types of degradation related to flooded areas (fig. 101), soils impoverished by prolonged intensive agricultural practices (fig. 105), soil erosion by wind and water (fig. 106) and soil sealing and compaction (fig. 107) present widespread values of perception of the problem. This data suggests that the greatest impact on the deterioration of soil quality in the Austrian sample is determined by natural factors (flooding and inundations accentuated by climate change, soil erosion by wind and water) or by human activities linked to agricultural exploitation or territorial planning rather than industrial activities.

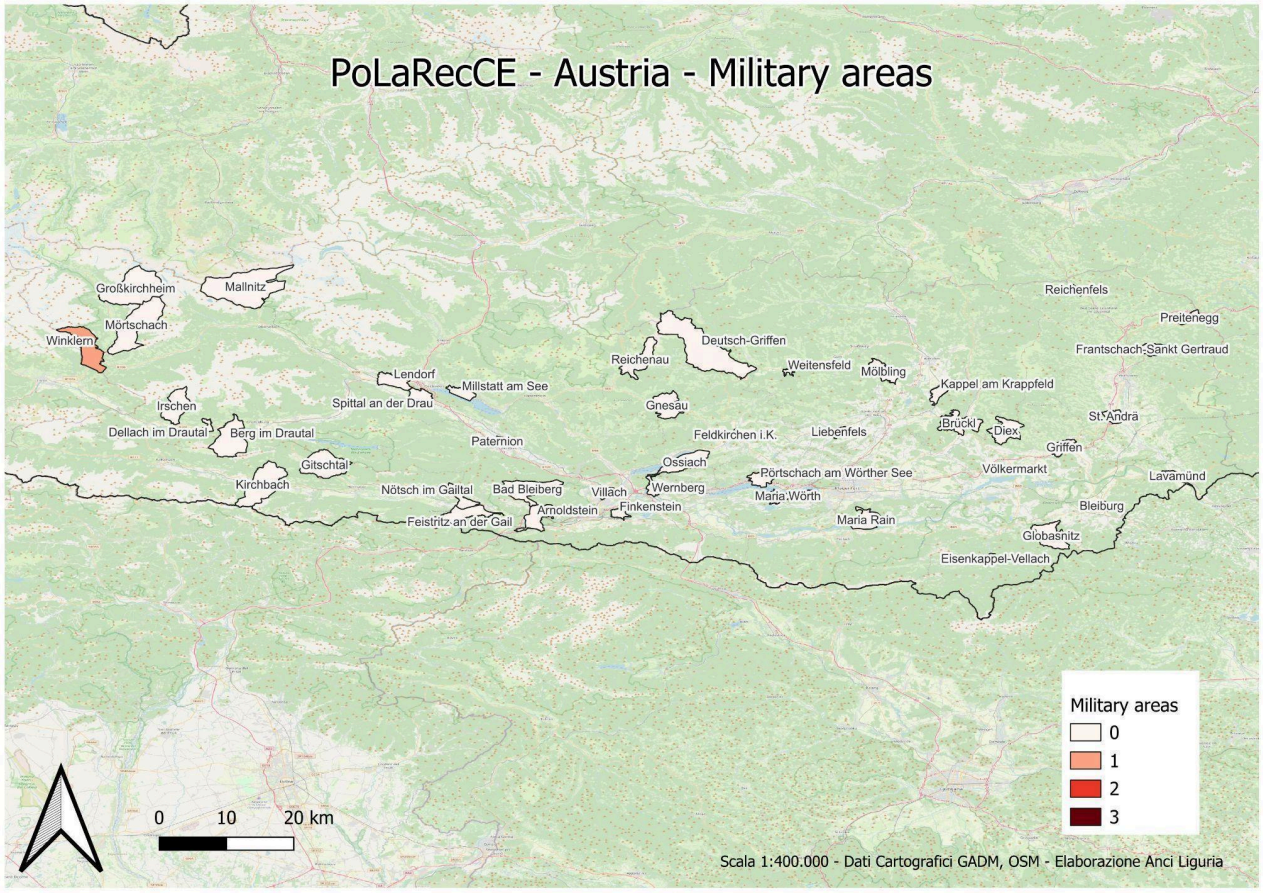


Fig. 102 - Military areas - AUT

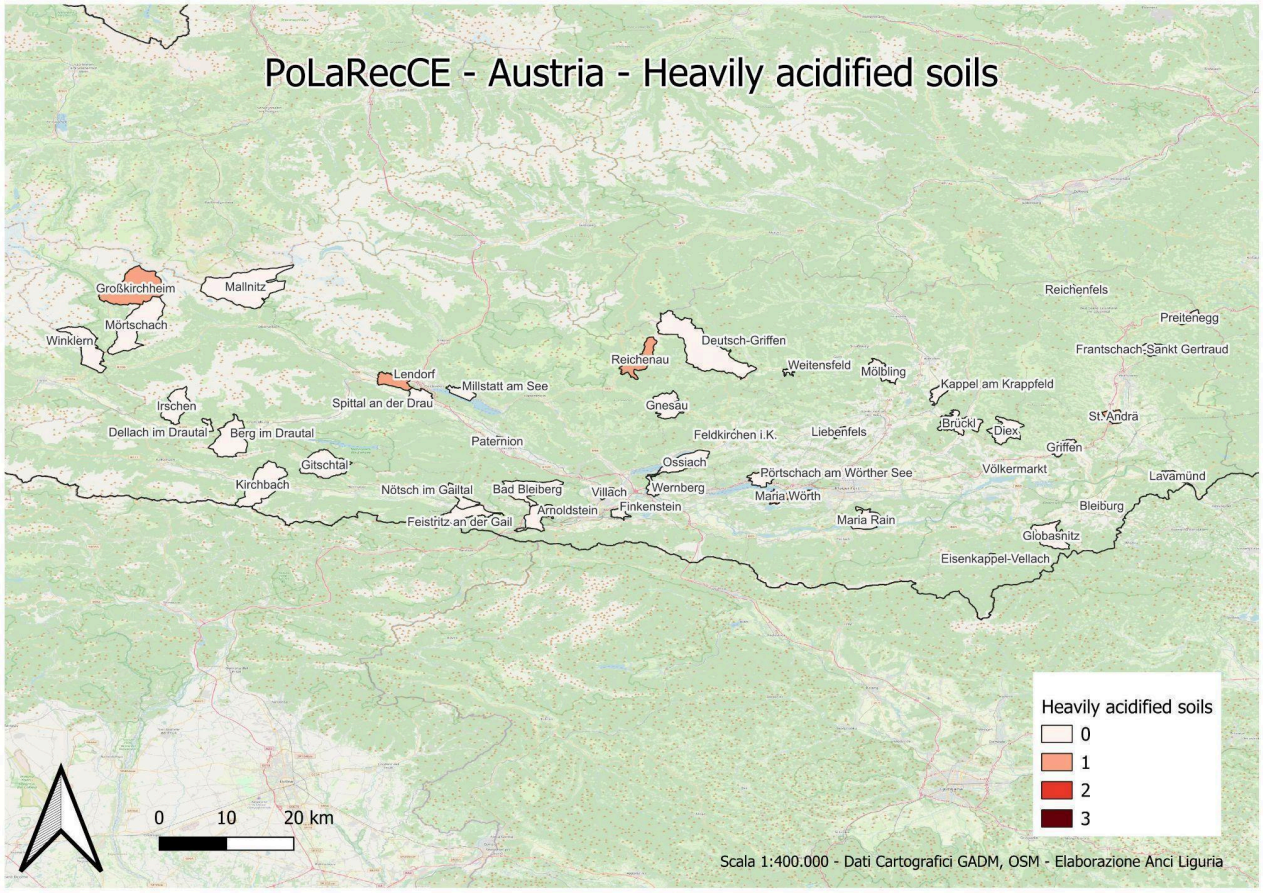


Fig. 103 - Heavily acidified soils - AUT

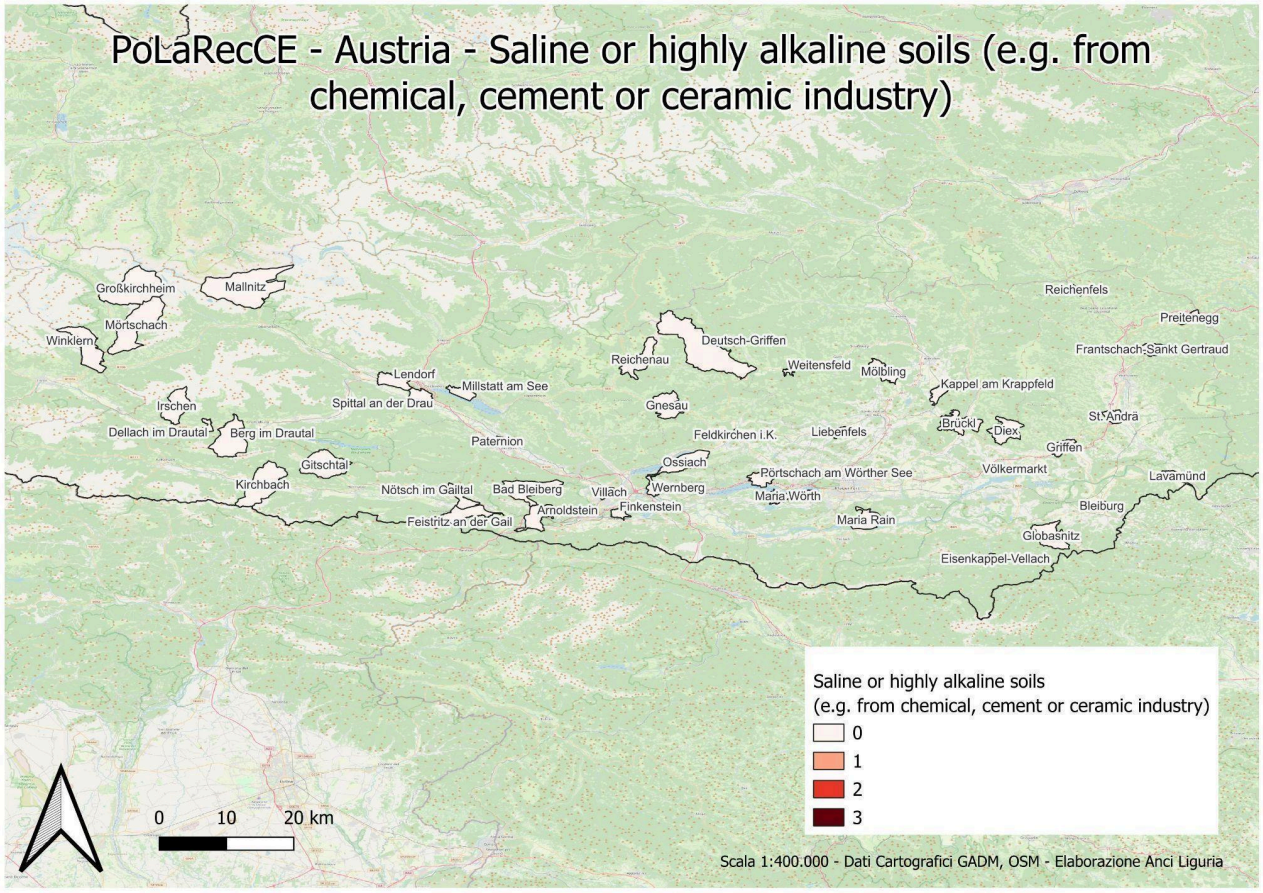


Fig. 104 - Saline or highly alkaline soils (e.g. from chemical, cement or ceramic industry) - AUT

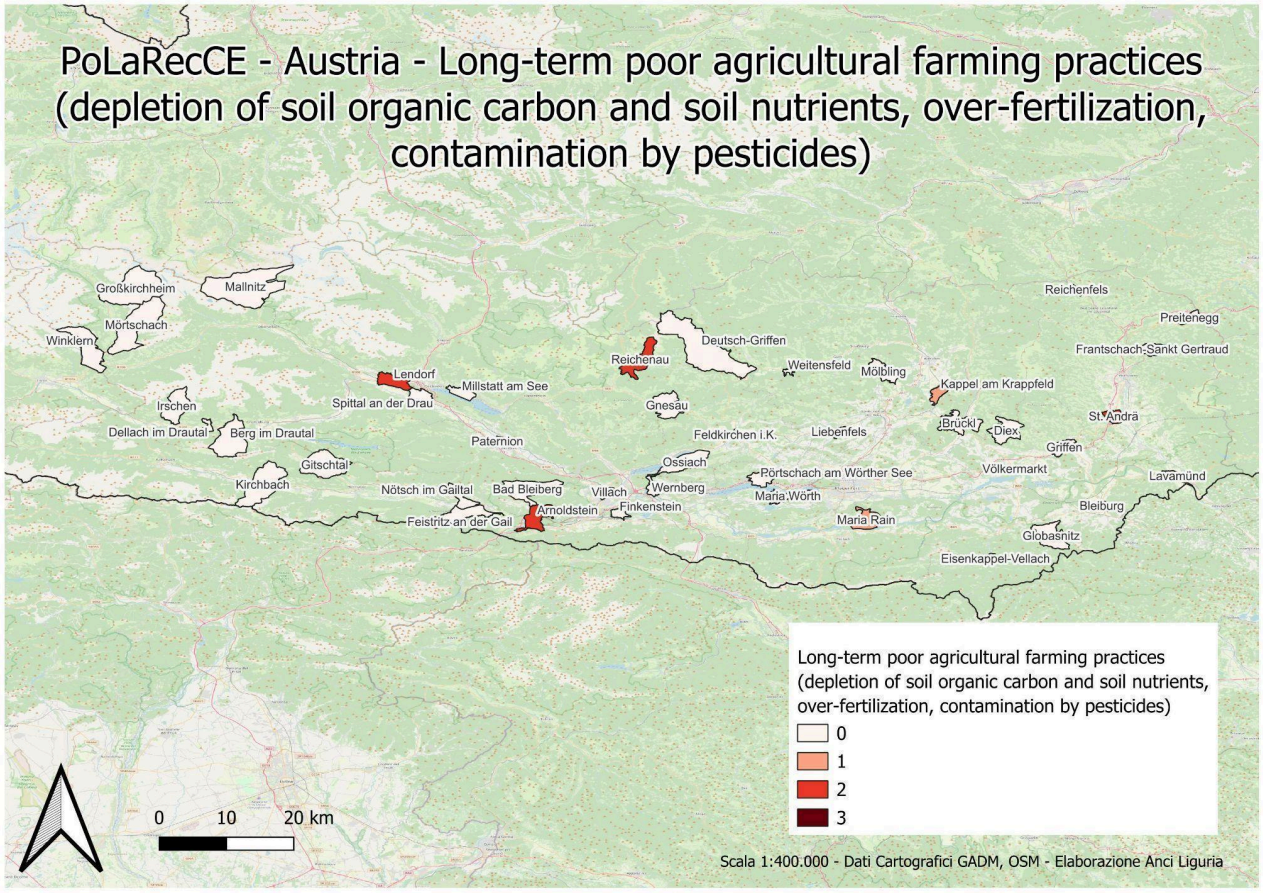


Fig. 105 - Long-term poor agricultural farming practices - AUT

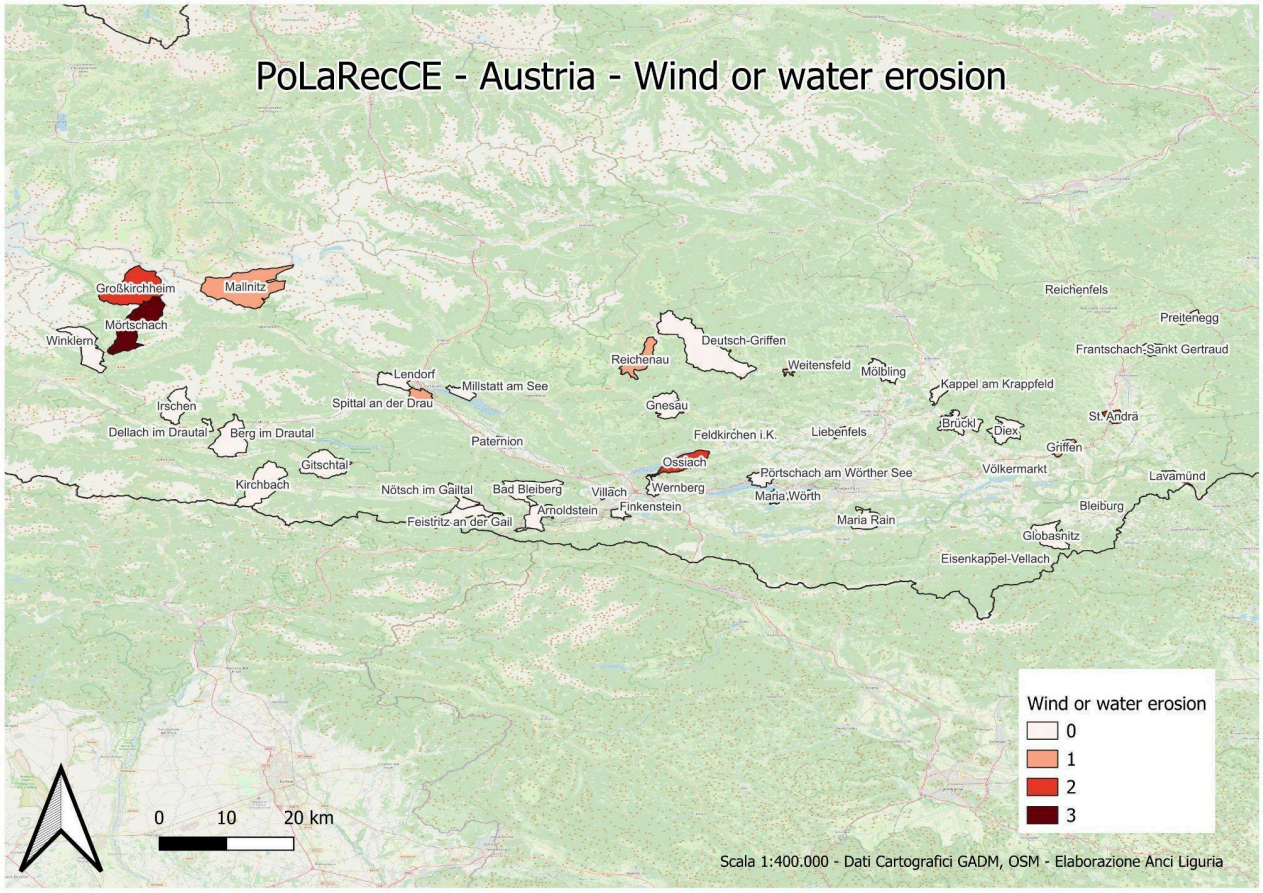


Fig. 106 - Wind or water erosion - AUT

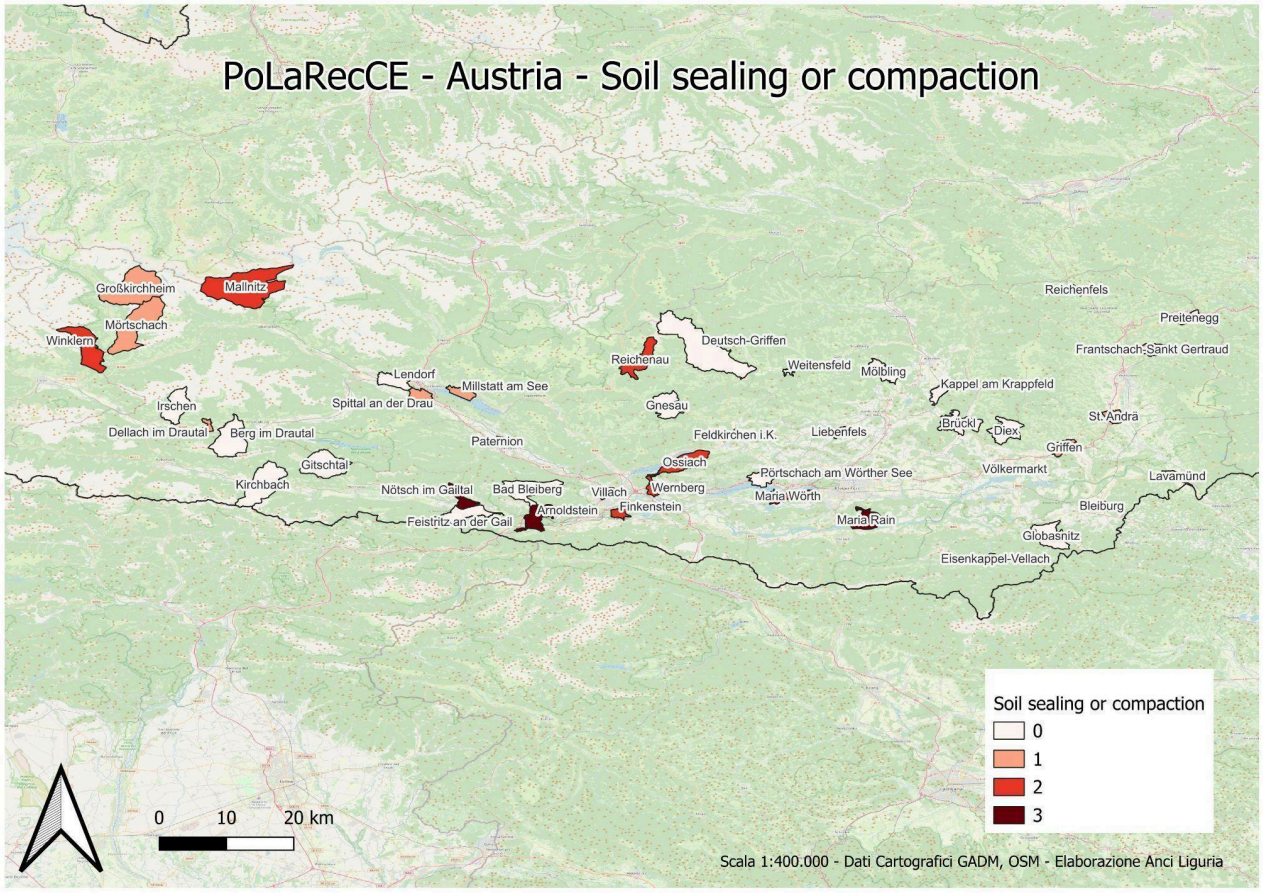


Fig. 107 - Soil sealing or compaction - AUT

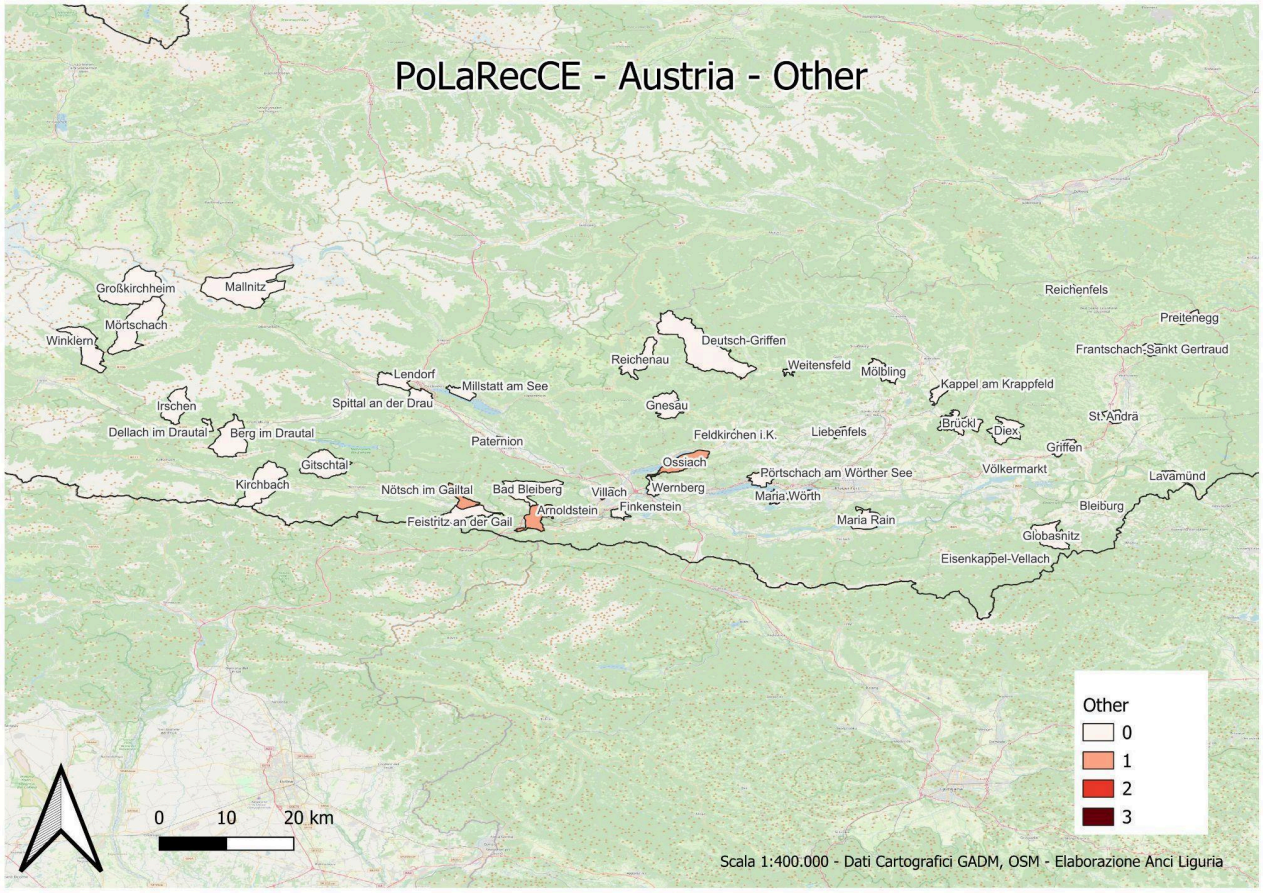


Fig. 108 - Other - AUT

3.7. Main problems in CE regions

The extent of soil degradation varies across the countries included in the survey. Significant degradation levels are associated with historical industrial settlements, as observed in Italy, Austria, and Poland.

The most prevalent degradation issue identified across all territories is flooding, which results in continuous land instability and soil deterioration.

A second significant issue primarily impacting Italy and Austria is soil erosion driven by both water and wind forces, which contributes to the progressive loss of topsoil and degradation of land productivity.

4. Conclusion

Overall, municipal participation in the survey was limited, despite securing a substantial sample size of 200 responses. However, the spatial representativeness of data collection remained insufficient relative to the overall geographic distribution.

Moreover, it was observed that few municipal leaders adequately recognize the actual environmental risks associated with land degradation processes—such as accelerated soil erosion, contamination by industrial pollutants, and decline in soil fertility—or acknowledge these issues as being effectively addressed through current land management and remediation practices.

The study conducted, supported by detailed spatial analyses and cartographic representations, delineates the territorial distribution and demonstrates that the areas selected by project partners across various regions are the most significant and emblematic. These sites have been identified as optimal for the implementation of pilot actions designed to serve as demonstrative case studies, with methodologies and outcomes that are scalable and transferable to analogous environmental and land management contexts.

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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 km²	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)					