Interreg CENTRAL EUROPE
Co-funded by the European Union
PoLaRecCE

Action plan development for technogenic soils formed on industrial or mining wastes

WP2 - Best available practices and on-site techniques for environmental site assessment and soil recovery

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1. Introduction

Action plan outlines the strategy and action plan for the development of the Cairo Montenotte pilot sites in Liguria, Italy. It presents alternative land-use pathways and identifies the optimal approach for implementation.

The document also includes an investment financial model and a cost–benefit analysis for end-users. The pilot sites are in Cairo Montenotte, an urban zone historically influenced by both agricultural use and industrial expansion. The soils are technogenic and contaminated with heavy metals—primarily chromium, nickel, and cobalt, with localized exceedances of copper, lead, and arsenic. However, contamination levels remain below limits for commercial and industrial use, allowing for non-food agricultural applications.

Soil conditions are further constrained by the presence of industrial waste layers, poor carbon distribution along the soil profile, and signs of water stagnation. These factors highlight the need for careful soil management to prevent erosion and protect the organic-rich topsoil.

This document serves local and regional authorities, policymakers, advisors, farmers, and landowners. The report provides strategic guidance, technical recommendations, and economic evaluations to support the sustainable redevelopment of the Cairo Montenotte pilot sites.

For the Cairo Montenotte pilot sites, non-food agricultural production has been identified as the most suitable development path. Specifically, the cultivation of ornamental flowering species was analyzed as a viable alternative that aligns with soil constraints, market opportunities, and low-risk agricultural practices.

Action plan supports local governments, regional authorities, policymakers, advisors, landowners, and farmers in designing viable redevelopment strategies for degraded urban marginal land.

It integrates environmental assessment, agronomic guidelines, economic evaluation, and regional development considerations to provide a comprehensive plan for the sustainable revitalization of the Cairo Montenotte pilot 5 sites. The polluted-land recovery project in Cairo Montenotte successfully integrates environmental restoration with sustainable economic development.

The initiative:

- Demonstrates strong financial returns and manageable risk.
- Aligns with regional development strategies and floriculture market trends.
- Supports circular land use and contributes to social inclusion through job creation.
- Offers a replicable model for other municipalities in Liguria and beyond.

The project validates the use of integrated public and private investment to revitalize degraded land and promote long-term community well-being.

2. Methodology

A common methodology was defined to manage the different pilot areas of the project. In the figure below it is possible to identify the different steps that have been followed.

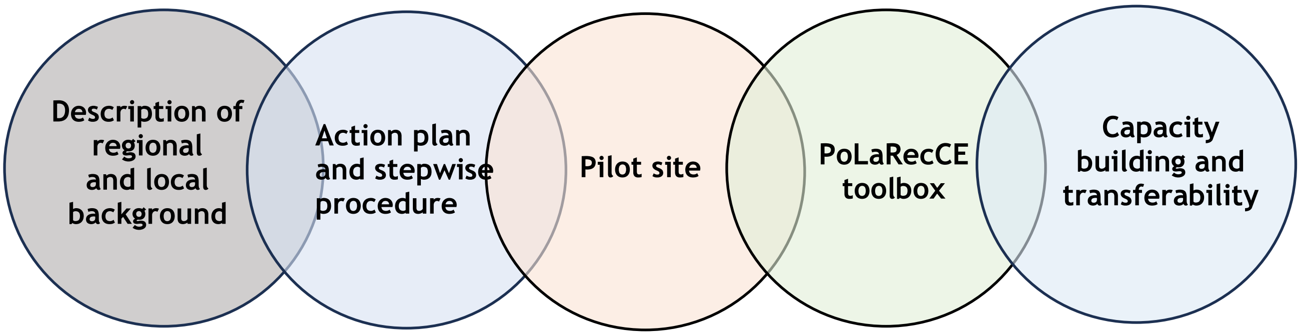

Figure 1. Five-element PoLaRecCE strategy diagram

The background section constitutes the analytical part of the study, identifying and monitoring emerging issues and signals of change in both the internal and external environment, while describing the current situation at the regional and local levels. The primary step is to properly identify driving forces and evaluate the state of the art with the collection of **background data** of the pilot area, in our case Cairo Montenotte Municipality.

After a thorough analysis of the sites, a work plan was developed outlining the steps that must be followed to transform degraded land into cultivated land—specifically, in the case of Cairo Montenotte, for flower production. All stages have been identified, from soil preparation to production.

The procedure was tested in the two **pilot sites** located in Cairo Montenotte Municipality. The optimal solution was selected from several possible alternatives, considering local environmental conditions, climate change impacts, social circumstances, and the investment financing model, as well as a cost-benefit analysis for end users.

The PoLaRecCE toolbox consists of capacity building suggestions that means developing skills and enhancement of competencies among local and regional authorities, farmers and members of farmers' organizations as well as of the third sector. Alongside the enhancement of degraded land through a redevelopment process, the aim was also to propose a new employment opportunity that could be of interest to social cooperatives, which could involve and integrate migrants and other individuals with disadvantaged social backgrounds into professional pathways. supports local governments, regional authorities, policymakers, advisors, landowners, and farmers in designing viable redevelopment strategies for degraded urban marginal land. It integrates environmental assessment, agronomic guidelines, economic evaluation, and regional development considerations to provide a comprehensive plan for the

sustainable revitalization of the Cairo Montenotte pilot site sites.
The last step of the strategy is transferability **and dissemination**, understood as the potential to apply the developed solutions in other areas of Central Europe degraded by mining and industrial waste.

3. Background

3.1 Regional background

Bormida Valley, located beyond the mountain divide that separates it from the coast, lies just a few kilometers from the sea and the city of Savona, which has historically been a major port in the Western Mediterranean. Its location supported pre-industrial development from the 15th to the 19th centuries, with the establishment of ironworks and glassworks, made possible by the abundance of forests and streams that provided essential driving power. In the following century, the area experienced extensive industrialization, further encouraged by railway access to the sea. This development, which largely drew land and labor away from traditional agriculture, has slowed in recent decades.

Figure 2. Val Bormida Location in Liguria Region

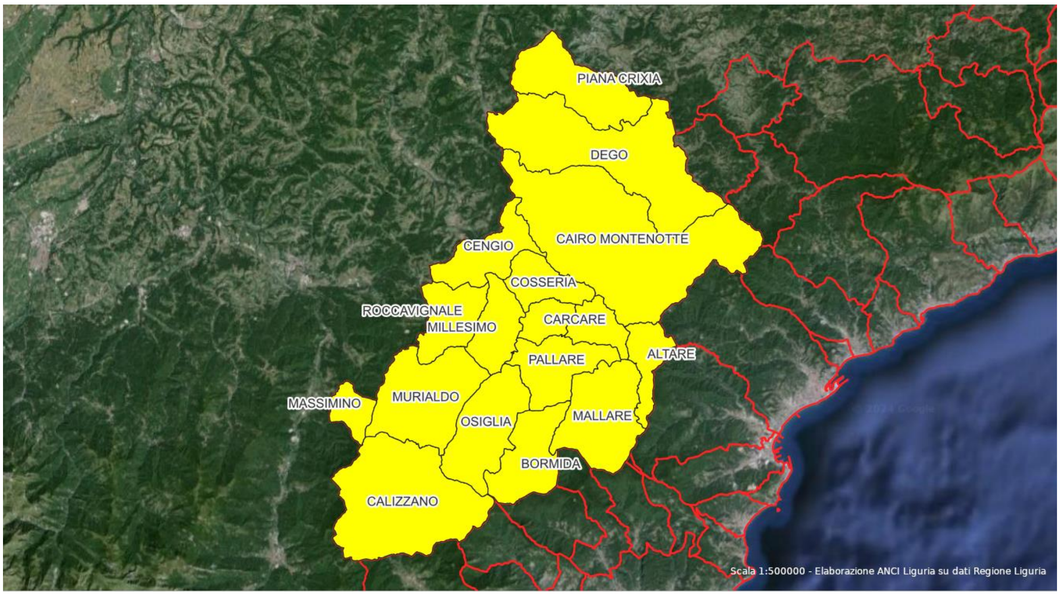

Figure 3. Val Bormida Municipalities

The municipality of Cairo Montenotte, with more than 12,000 inhabitants and a surface area of over 100 km², is one of the largest and most populous municipalities not only in the Bormida Valley but in the entire Province of Savona. Located just a few kilometers from the sea and the port of Savona, it extends mainly across the Bormida di Spigno plain, while also including several hilly hamlets. The area is characterized by a continental climate, with hot summers and cold winters, and is only minimally influenced by the nearby sea due to its position beyond the watershed.
Its geographical location shaped its early proto-industrial and industrial vocation, placing it among the centers of the historic Genoa–Turin–Milan industrial triangle. Like many other manufacturing hubs, it has experienced significant industrial decline in recent decades. Today, the main industries operating in the area are in the chemical, energy, and transport sectors.

3.2 Local background

The pilot sites are located in the Buglio area, an urban zone historically influenced by both agricultural use and industrial expansion. Previous environmental assessments indicate that the soils are technogenic and contaminated with heavy metals—primarily chromium, nickel, and cobalt, with localized exceedances of copper, lead, and arsenic. These concentrations surpass Italian threshold values for public and residential green areas, making the land unsuitable for food or feed production. However, contamination levels remain below limits for commercial and industrial use, allowing for non-food agricultural applications, continuous monitoring is ensured.

The land can be used for non-food agriculture, but pollution monitoring is recommended during agricultural activities.

The anthropogenic layer composed of industrial waste, located below a depth of 15 cm, is the main source of soil pollution. However, airborne deposition (both current and historical) directly onto the organic horizon is also a source of heavy metals. The subsurface layer is highly heterogeneous, but the spatial distribution of heavy metals cannot be effectively monitored using soil magnetometry, as the waste material likely originates from various sources. These sources may all contain technogenic magnetic particles, which act as carriers of different PTEs, depending on the industrial processes responsible for their formation. Soil conditions are further constrained by the presence of industrial waste layers, poor carbon distribution along the soil profile, and signs of water stagnation. These factors highlight the need for careful soil management to prevent erosion and protect the organic-rich topsoil. Nutrient levels, particularly nitrogen, phosphorus, and potassium, are low and require supplementation to support any planned non-food cultivation. This Action plan serves local and regional authorities, policymakers, advisors, farmers, and landowners. The report provides strategic guidance, technical recommendations, and economic evaluations to support the sustainable redevelopment of the Cairo Montenotte pilot sites.

For the Cairo Montenotte pilot sites, non-food agricultural production has been identified as the most suitable development path. Specifically, the cultivation of ornamental flowering species—hydrangeas and peonies—was analyzed as a viable alternative that aligns with soil constraints, market opportunities, and low-risk agricultural practices.

The polluted-land recovery project in Cairo Montenotte successfully integrates environmental restoration with sustainable economic development.

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4. Action Plan

4.1 Recognizing the problem (PoLaRecCE- EU policy)

Based on the analyses carried out, it can be stated that the soil at both sites is of technogenic origin (Technosol). It was probably formed on the surface of industrial waste storage, which was later covered by approximately 10 cm of a humus layer that now constitutes the organic horizon. The soil is unsuitable for agricultural use for food and feed production. However, the concentrations of PTEs are well below the threshold values to produce ornamental plants, like flowers, that can restore a degraded area.

The PoLaRecCE project is fully aligned with European Union policies aimed at reducing environmental pollution and restoring the functionality of degraded land. Both the Soil Monitoring Law (Directive (EU) 2025/2360) and the PoLaRecCE strategy share the objective of reducing soil contamination to levels that are no longer harmful to human health or the environment.

By putting this strategy into practice, the project will contribute to the gradual improvement of soil conditions in Bormida Valley, with the potential to be replicated in other area with similar problem in Central Europe and the EU. It represents one of the first comprehensive efforts to restore soils degraded by industrial and urban pollution, supporting the broader goal of achieving healthy soils by 2050.

This is particularly important given that soils host more than 25% of global biodiversity and represent the second-largest carbon reservoir on the planet. Healthy soils play a key role in capturing and storing carbon, thereby contributing to the EU’s climate objectives. In addition, the project supports the enhancement of biodiversity, ecosystem functions and services, as well as ecological integrity and connectivity, in line with the Convention on Biological Diversity.

Finally, the PoLaRecCE project strategy aims to develop innovative tools and approaches that support land management practices to better adapt degraded soils to the environmental, social, and economic needs of local communities. The guidelines developed within the project emphasize the need to assess soil condition before restoring its productive role in order to propose appropriate land management directions.

4.2 Considered solutions for the development of soils formed on industrial or mining wastes

In the case of Cairo Montenotte pilot sites, the following directions of land management were considered plantation of Hydrangeas and Peonias

Detailed Technical Sheet for the Professional Cultivation of Hydrangeas

General Information: Hydrangeas (Hydrangea), perennial ornamental plants, are highly valued for the beauty of their flowers, which range from white to pink, blue, and purple. The professional cultivation of hydrangeas is widespread to produce cut flowers, garden use, and public space decoration. To achieve good results, it is essential to understand the agronomic requirements and cultivation techniques for these plants.

Detailed Technical Sheet for the Professional Cultivation of Peonies

General Information: Peonies (genus Paeonia) are perennial herbaceous plants.

These two flowers have recently been rediscovered by the floriculture market, particularly for bouquet arrangements; this ensures that the market consistently absorbs the product, even in periods of overproduction.

Both species thrive in cooler climates, making them well suited to the environmental conditions of the target area.

The initiative proposed by the project in the Municipality of Cairo Montenotte is particularly significant, not only in relation to the municipality's development plans, but also as a model of good practice at the regional level. The project has the potential to serve as an "exemplary" model that could be replicated in other similar territories and supported through European rural development funds administered by the Liguria Region.

In this context, additional areas within the Municipality of Cairo Montenotte, as well as other zones in Val Bormida, could be rehabilitated for agricultural use. Such recovery efforts could create new employment opportunities for young people and for individuals currently excluded from the labor market, thereby contributing to both social and economic development in the region.

4.3 Initiation and Activation of local administration

The choice of the Municipality of Cairo Montenotte was driven by the need to identify an area where it would truly be important and meaningful to carry out a restoration intervention through regenerative approaches involving the introduction of ornamental greenery, which would help improve soil quality, while also being clearly visible to the local community. Initially, the project was presented to the Mayor, and subsequently to the municipal offices. The municipality later hosted the project partnership, during which the local community was involved in the organization, and the objectives of the initiative and the expected outcomes were explained. The final step of the community engagement process will take place during the presentation of the results achieved, namely the blooming of the cultivated fields. This will also be an opportunity to propose the initiative as a potential economic activity for young people and/or job seekers, achieving the dual outcome of restoring the territory and creating employment opportunities. Furthermore, a local organization was involved in the implementation of the activities, facilitating participation and engagement.

Figure 4. Starting phase

Figure 5. Starting phase

Figure 6. Working in progress

4.4 Influence of national legislative for implementation of "Action Plan"

D.M. Ambiente 1 marzo 2019, n. 46

This law applies to areas intended for agri-food production and livestock farming that have historically or currently been affected by events that may lead to contamination.

It defines agricultural and food production as farming, grazing, and livestock breeding activities aimed at producing food for human consumption or feed for animals intended for human consumption.

Therefore, this decree does NOT apply to land used for agricultural cultivation to produce flowers or ornamental/woody plants (i.e., non-food products).

BONIFICATION TECHNIQUES indicated by the decree:

Bioremediation: the use of natural or recombinant microorganisms to break down toxic substances in the soil, particularly organic compounds, through processes that may be aerobic or anaerobic (example: Biostimulation - Bioaugmentation).

5. Pilot site and economic development

5.1 Financial model for investment

Following the pre-feasibility assessment outlined in a previous document, industrial flower cultivation has been identified as a strategic solution for revitalising degraded land affected by historical industrial activity in Cairo Montenotte municipality. Cultivation of peonies and hydrangeas has emerged as the preferred action, leveraging Liguria's established floriculture ecosystem and favourable Mediterranean climate.

Liguria stands as Italy's leader in flower production, accounting for EUR 437 million or 30% of national output. The region benefits from a favourable Mediterranean climate, established horticultural infrastructure, and excellent connectivity to export markets through the Mercato Florovivaistico in Genova and the Port of Genova. The sector has demonstrated impressive 11,7% annual growth over the past five years, indicating strong market dynamics supporting the proposed investment.

The selection of peonies and hydrangeas reflects careful consideration of market conditions and local climate suitability. Liguria's unique microclimate—combining warm sea air with cold mountain air—creates ideal conditions for these flowers. Furthermore, Cairo Montenotte's elevation enables extended flowering seasons, allowing producers to access premium pricing windows when coastal production has concluded.

In this section we are presenting the financial model detailing the financial costs and benefits of the selected investment.

Cost category	EUR
Soil Preparation	1.750
Fertilisation	500
Plant Purchase Costs	8.450
Planting	7.000
Irrigation System	6.100
Pest Control Treatment	9.000
TOTAL	32.800

Table 1. Project investment costs (year 0)

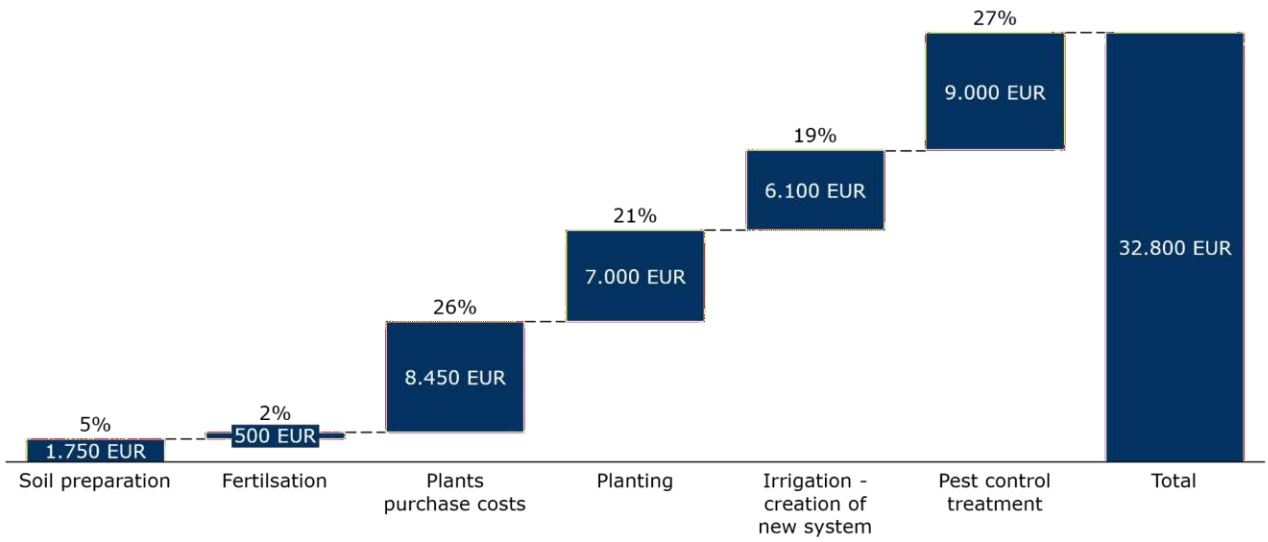

Figure 7. Project investment costs (year 0)

The total initial investment amounts to EUR 32.800, funded through the PoLaRecCE project. This represents the establishment phase capital expenditure required to prepare the site and establish commercial flower production. The investment breakdown comprises six principal cost categories, detailed in the table above, reflecting the specialised requirements of horticultural production compared to conventional agriculture.

Soil Preparation (EUR 1.750)

Soil preparation accounts for 5% of total investment and addresses the specific requirements of peonies (EUR 800) and hydrangeas (EUR 950). Given the site's history as industrial land, comprehensive soil preparation proves essential to ensure optimal growing conditions. Activities, as described in this document, include soil testing to determine contamination levels, mechanical tillage to improve structure and drainage, incorporation of organic matter to enhance fertility, and pH adjustment to meet the distinct requirements of each species. The differential allocation reflects hydrangeas' more demanding soil preparation needs.

Fertilisation (EUR 500)

Initial fertilisation, distributed equally between peonies and hydrangeas (EUR 250 each), represents 2% of investment. This covers base fertiliser application prior to planting, establishing nutrient reserves that support initial root development and plant establishment. The allocation reflects the use of slow-release formulations that provide sustained nutrient availability during the critical first growing season.

Plant Purchase Costs (EUR 8.450)

Plant material represents 26% of total investment, reflecting the capital-intensive nature of establishing perennial flower production. The allocation covers procurement of 900 peony plants (EUR 1.650) and 900 hydrangea plants (EUR 6.800), with the substantial cost differential reflecting the relative market prices and production characteristics of each species. Quality plant material proves critical to long-term productivity, justifying the investment in certified, disease-free stock from reputable nurseries.

Planting (EUR 7.000)

Planting labour accounts for 21% of investment, split between peonies (EUR 3.600) and hydrangeas (EUR 3.400). This encompasses labour for site layout, planting operations following species-specific spacing requirements, initial watering, and mulching to conserve soil moisture and suppress weeds. The allocation recognises the labour-intensive nature of establishing horticultural production, where attention to planting depth, spacing, and initial care significantly influences long-term productivity.

Irrigation System (EUR 6.100)

Irrigation infrastructure represents 19% of investment, allocated between peonies (EUR 3.100) and hydrangeas (EUR 3.000). This covers materials and installation of drip irrigation systems designed to deliver precise water quantities whilst minimising disease pressure from foliar wetness. The system includes main lines, laterals, emitters, filtration equipment, and basic automation to optimise water use efficiency—a critical consideration in Mediterranean climates characterised by summer drought.

Pest Control Treatment (EUR 9.000)

Initial pest control accounts for 27% of investment, distributed equally between species (EUR 4.500 each). This substantial allocation reflects comprehensive establishment phase protection, including preventative fungicide applications to limit disease establishment, insecticide treatments against key pests, and monitoring systems (traps, scouting protocols) enabling early detection of problems. The investment in preventative pest management during establishment proves economically efficient compared to curative interventions once problems have developed.

The investment structure reflects the perennial nature of flower production, where substantial upfront capital establishes productive capacity that generates returns over extended periods. The municipality's access to PoLaRecCE funding eliminates financial barriers whilst demonstrating commitment to innovative land use solutions that align economic, environmental, and social objectives.

Following the establishment phase, the plantation transitions to ongoing operational management, with annual costs structured to reflect the maintenance requirements of commercial flower production. Total operational costs in Year 1 amount to EUR 12.310, escalating annually at 3% to account for inflation. The cost structure, detailed in the table above, reflects the labour and input-intensive nature of horticultural production compared to conventional agriculture.

Cost category	EUR
Plant Maintenance	8.300
Fighting Fungal Diseases	1.000
Fight Harmful Insects	1.000
Pruning	1.300
Fertilisation	1.000
General Maintenance	4.000
Harvesting Costs	2.673
Cost of Goods Sold	1.337
TOTAL	**12.310**

Table 2. Operational costs (year 1 onwards)

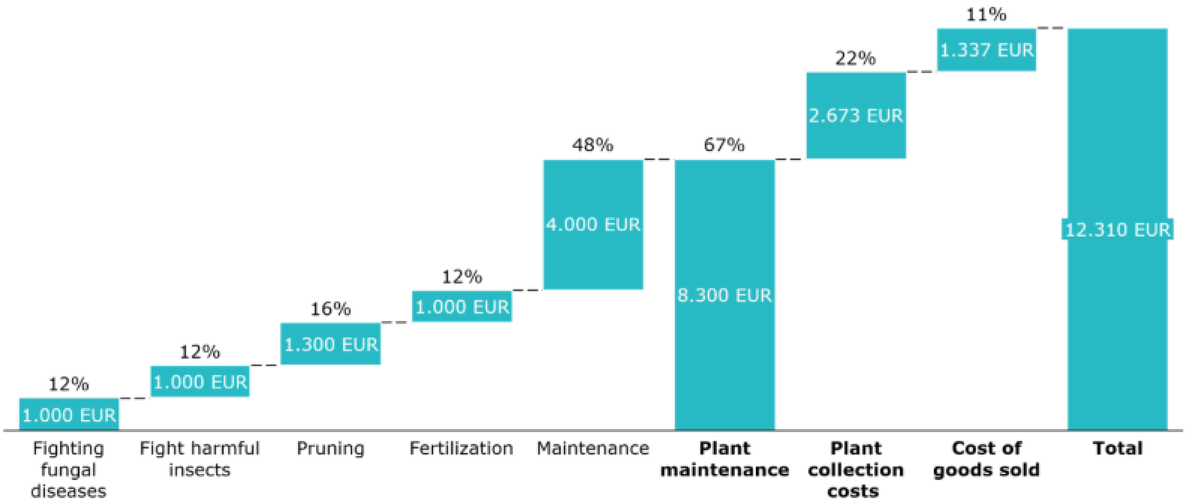

Figure 8. Operational costs (year 1 onwards)

Plant Maintenance (EUR 8.300 annually in Year 1)

Plant maintenance represents the largest cost component at 67% of annual operational expenditure. This consolidated category encompasses Disease and Pest Management, Pruning, Fertilization, and General Maintenance described in detail below. The substantial allocation reflects the intensive management required to maintain commercial flower quality standards, where plant bloom quality directly determines market prices and customer satisfaction.

Disease and Pest Management (EUR 2.000 annually in Year 1)

Disease and pest control together account for 24% of Plant Maintenance costs, split equally between fungal disease management (EUR 1.000) and insect pest control (EUR 1.000). Peonies and hydrangeas face distinct disease pressures; peonies particularly susceptible to botrytis blight, hydrangeas to powdery mildew; necessitating species-specific protection programs. The allocation covers both preventative applications during high-risk periods and curative treatments when problems arise.

Pruning (EUR 1.300 annually in Year 1)

Pruning accounts for 16% of Plant Maintenance costs and proves essential to maintaining plant health and flower quality. Peonies (EUR 800) require removal of diseased foliage, with periodic division of mature clumps to maintain vigor. Hydrangeas (EUR 500) demand species-specific pruning regimes that vary by cultivar type, with timing and severity significantly influencing bloom production. Skilled labor performs pruning operations, as improper techniques can severely reduce flowering or plant health.

Fertilization (EUR 1.000 annually in Year 1)

Annual fertilization, split equally between species (EUR 500 each), represents 12% of Plant Maintenance costs. Flower production demands significant nutrient inputs, with nitrogen supporting vegetative growth, phosphorus enhancing root development and flowering, and potassium improving overall plant health and stress resistance. The program balances spring applications supporting active growth with summer supplementation, maintaining vigor through flowering periods. Soil and tissue testing guide fertilizer formulations, optimizing nutrient use efficiency whilst preventing wasteful or environmentally damaging over-application.

General Maintenance (EUR 4.000 annually in Year 1)
General maintenance is the largest subcategory of the Plant Maintenance and represents 48% of this cost category. It encompasses infrastructure upkeep, irrigation system maintenance, path maintenance, and other routine operations not captured in specific categories. The allocation covers equipment repair and replacement, irrigation component servicing, and site tidying to maintain professional appearance, a factor influencing customer perceptions in commercial floriculture.

Harvesting and Post-Harvest Costs (EUR 4.010 annually in Year 1)
Harvesting (EUR 2.673) and cost of goods sold (EUR 1.337) together represent 33% of operational expenditure. Harvesting costs reflect labour requirements for cutting flowers at optimal maturity, initial processing (stem trimming, cleaning), and temporary storage. The model assumes 150 flowers harvested per hour, with total annual harvest requiring 178 hours (including 10% contingency) at EUR 15 per hour. Cost of goods sold covers packaging materials, cold storage for maintaining flower quality, and transport to market. These post-harvest costs significantly influence profitability, as maintaining cold chain integrity and minimising time from harvest to sale directly affect product quality and market price realisation. Within the scope of this pilot project it is assumed that the main market will be local florists in Cairo Montenotte, due to overall volume of production, hence we do not expect major post-harvest costs, as both time and distance to the market are relatively small.

The operational cost structure demonstrates the intensive nature of commercial flower production, with annual costs representing 38% of initial investment. This cost intensity reflects the labour and input requirements necessary to maintain commercial quality standards in competitive floriculture markets. The allocation patterns align with industry norms for perennial cut flower production in Mediterranean climates.

Parameter	Peonies	Hydrangeas
Number of Plants	900	900
Flowers per Plant (Year 1)	2	2
Flowers per Plant (Year 4+)	7	20
Base Price per Flower (Year 1)	EUR 1,75	EUR 0,95
Annual Price Escalation	1,00%	1,00%
Total Revenue Year 1	**EUR 3.150**	**EUR 1.710**
Total Revenue Year 4	**EUR 11.359**	**EUR 17.619**
Combined Total Revenue	**Year 1: EUR 4.860**	**Year 4: EUR 28.978**

Table 3. Revenue Projections

Revenue generation commences in Year 1 with initial harvest from newly established plants, reflecting the perennial nature of flower production where productivity increases as plants mature. The revenue model operates on distinct parameters for peonies and hydrangeas, recognising their different production characteristics and market positioning. The table above summarises key revenue assumptions and projected outcomes.

Production Ramp-Up

The financial model projects graduated yield increases as plants mature. Peonies produce 2 flowers per plant in Year 1, increasing to 3 in Year 2, 4 in Year 3, and reaching full productive capacity of 7 flowers per plant from Year 4 onwards. Hydrangeas follow a similar pattern: 2 flowers per plant in Year 1, 8 in Year 2, 12 in Year 3, and 20 from Year 4 onwards. This stepped approach recognises the biological reality that perennial flower crops require several years to reach full productive potential.The conservative yield assumptions reflect commercial production norms for these species in Mediterranean climates. Actual performance may exceed projections with optimal management, though the model deliberately avoids aggressive assumptions to maintain credibility. The stable yield assumption from Year 4 onwards implicitly assumes ongoing replacement of underperforming plants and maintenance of soil fertility—practices standard in commercial floriculture.

Price Assumptions

Base pricing reflects current Ligurian wholesale flower markets: EUR 1.75 per peony stem and EUR0.95 per hydrangea stem. These prices represent realistic wholesale values, with peonies commanding premium pricing due to their luxury market positioning and shorter availability window. Hydrangeas, whilst less expensive per stem, compensate through higher per-plant productivity.

The model incorporates modest 1% annual price escalation, substantially below the 3% inflation rate applied to costs. This conservative stance recognises competitive pressures in floriculture markets, where productivity improvements and international competition often constrain price growth. The differential between price and cost inflation creates margin compression over time, incentivising operational efficiency improvements.

Assumption	Value
Inflation Rate (Costs)	3% per annum
Price Escalation (Revenues)	1% per annum
Discount Rate	8% per annum
Corporate Income Tax Rate	10,00%
Project Timeline	15 years

Table 4. Financial assumptions

The financial model operates on several critical assumptions that fundamentally shape the project's economic assessment, as summarised in the table above. These parameters reflect both general economic conditions in Italy and specific characteristics of the floriculture sector.

Inflation Rate (3%)
The 3% annual inflation rate applied to operational costs reflects the European Central Bank's medium-term inflation target and recent Italian inflation trends. This assumption ensures costs escalate in line with general price movements, preventing underestimation of future expenditure. Despite the fact that recent inflation represented a much larger value than the one assumed in the model, considering the fact that we need to project the model for 15 years, we project that the inflation rate will stabilise in the future. Furthermore, this inflation figure ensures that any potential inflation increases in the future are accommodated, as it smooths out the peaks and troughs of inflation. The uniform application across all cost categories represents a simplification, recognising that actual inflation varies by input category, labour costs often rising faster than material inputs—though 3% provides a reasonable central estimate for planning purposes.

Price Escalation (1%)
The 1% annual price escalation for flower revenues reflects the competitive dynamics of European floriculture markets. Despite growing demand, international competition (particularly from African and South American producers) and productivity improvements constrain price growth. The differential between 3% cost inflation and 1% revenue growth creates progressive margin compression, typical of mature horticultural sectors. This conservative pricing assumption provides downside protection, as actual price performance may exceed projections if quality premiums or favourable market timing materialise.

Discount Rate (8%)
The 8% discount rate reflects the higher risk profile of horticultural ventures compared to long-term public infrastructure investments. This rate accounts for: (i) biological risks inherent in agricultural production (disease, pest damage, weather impacts); (ii) market price volatility characteristic of floriculture; (iii) the relatively short track record of the pilot scale operation; and (iv) opportunity costs of capital in small-scale commercial horticulture. The 8% rate aligns with returns expected by small agricultural enterprises in Italy, balancing the need for financial prudence with recognition of non-financial benefits.

Corporate Tax Rate (10%)
The 10% corporate income tax rate reflects standard Italian taxation on small agricultural enterprises. This rate applies to net income after all operational expenses.

Project Timeline (15 years)
The 15-year project horizon reflects the productive lifespan of peony and hydrangea plantings under commercial management. Whilst individual plants can persist longer, commercial productivity typically declines after 15-20 years due to accumulated pest and disease pressure, soil fatigue, and plant senescence. The 15-year timeframe represents a conservative productive period, after which replanting or alternative land use would be considered.

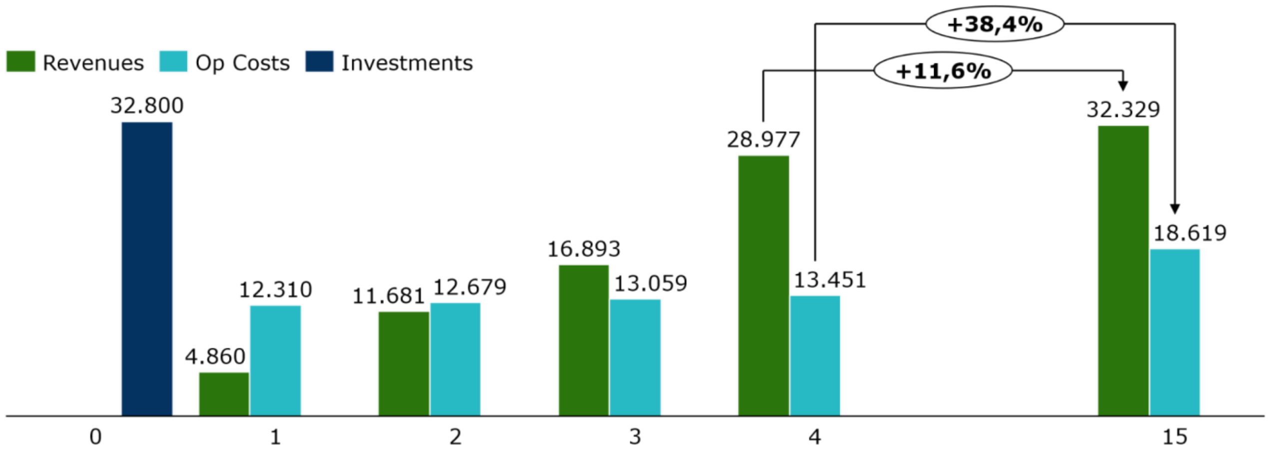

Figure 9. Assumption summary

The chart above projects the relevant project assumptions in the first 4 years, as well as showcasing the projected growth in prices and costs due to inflation between the year 4 and year 15

Combined revenue commences at EUR 4.860 in Year 1 (EUR 3.150 from peonies, EUR 1.710 from hydrangeas), rising to EUR 28.978 in Year 4 as plants reach full productivity (EUR 11.359 from peonies, EUR 17.619 from hydrangeas). By Year 15, projected combined revenue reaches EUR 32.329, reflecting the compounding effect of 1% annual price escalation, resulting in total revenue increase in this period of 11,6%, partially offset by stable physical volumes.

The revenue structure demonstrates diversification benefits, with different species providing complementary income streams. Hydrangeas generate higher absolute revenues due to greater per-plant productivity, whilst peonies achieve higher per-unit prices. This diversification reduces risk compared to monoculture production, as market conditions rarely affect both species identically.
The projection assumes consistent market access and stable quality standards. Actual revenues will vary based on seasonal timing (with premium prices for early or late season production), flower quality (with top-grade stems commanding significant premiums), and market conditions (with major events or supply disruptions creating price spikes). The municipality's location in Cairo Montenotte, enabling extended flowering through altitude and microclimate effects, positions producers to capture premium pricing windows when coastal production has concluded.

The operational costs commence in year 1 as well with EUR 12.310 and it rises steadily under assumed inflation rate reaching EUR 13.451 in year 4. It should be noted that the ramp up in production within the years 1-4 indicates that for the first three years the plantation is not generating operational profit, which changes in year 4 when the plants reach full yield. In year 15 we expect operational costs to be EUR 18.619, demonstrating the effect of compounding growth of inflation.

Investment costs are presented only in year 0 as the project does not assume any significant investments to be made after the initial set-up. Any replacement equipment and similar is funded through amortisation and from operational expenses.

Financial model results and interpretation

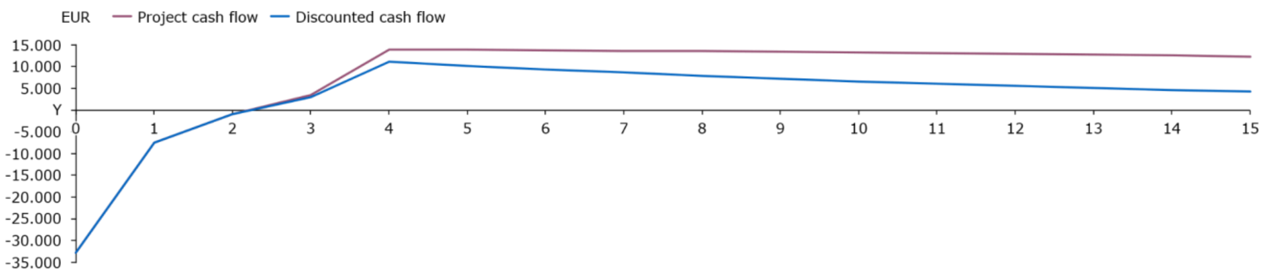

Figure 10. Projected project cash flow (free and discounted)

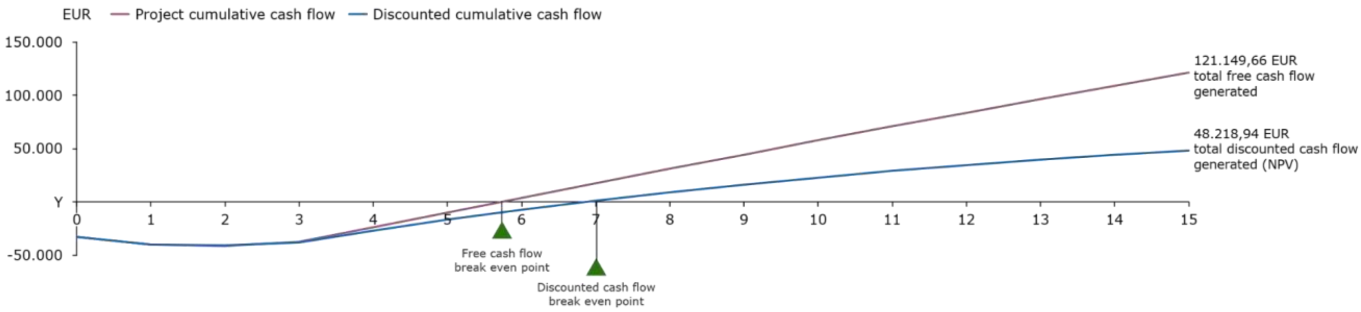

Figure 11. Projected project cumulative cash flow (free and discounted)

Metric	EUR
Net Present Value (NPV)	48.219
Internal Rate of Return (undiscounted)	18,69%
Internal Rate of Return (discounted)	10,90%
Money Multiple	2,29x
Payback Period (undiscounted)	6 years
Payback Period (discounted)	7 years
Total Cumulative Cash Flow (15 years)	**121.150**

Table 5. Total cumulative cash flow (15 years)

The table above, and the two charts, summarise the key financial performance metrics derived from the 15-year financial model.

Years 0-1 - Establishment Phase

The project commences with the full EUR 32.800 investment expenditure in Year 0, establishing plantation infrastructure and initiating plant growth. Year 1 generates modest revenue of EUR 4.860 from initial flowering, insufficient to cover operational costs of EUR 12.310, resulting in a net loss of EUR 7.450. The cumulative cash flow deficit reaches EUR 40.250 by end of Year 1, representing the maximum capital requirement.

Years 2-4 - Production Ramp-Up

Years 2 and 3 continue to generate operational losses as revenue growth (EUR 11.681 in Year 2, EUR 16.893 in Year 3) lags escalating costs. However, Year 4 marks a critical transition as plants reach full productivity. Revenue increases dramatically to EUR 28.977 whilst costs rise moderately to EUR 13.451, yielding positive EBITDA of EUR 15.526. This is mostly due to the fact that in year 4 we expect a full plant maturity enabling full flower yield. After taxation, net income reaches EUR 13.974, marking the first profitable year. The cumulative cash flow remains negative at EUR 23.824, but rapid improvement is evident.

Years 5-15 – Mature Production

The subsequent years demonstrate consistent strong performance, with annual net income ranging from EUR 13.871 (Year 5) to EUR 12.339 (Year 15). The gradual decline reflects margin compression as 3% cost inflation outpaces 1% revenue growth, though profitability remains robust throughout. The cumulative undiscounted cash flow turns positive in Year 6, representing the undiscounted payback period. By Year 15, cumulative cash flow reaches EUR 121.150, demonstrating substantial wealth creation over the project lifetime.

The discounted analysis shows cumulative cash flow turning positive in Year 7, the discounted payback period is reached in year 8.

Net Present Value (NPV): EUR 48.219 positive, indicating the project substantially exceeds the minimum return threshold established by the 8% discount rate. This positive NPV confirms strong economic viability from a present-value perspective, representing 147% return on initial investment in present-value terms.

Internal Rate of Return (IRR): 18,69% on undiscounted cash flows, more than double the 8% discount rate and confirming that the project generates returns substantially above the opportunity cost of capital. The discounted IRR of 10,90% reflects a more conservative measure whilst still exceeding the discount rate by significant margin, indicating robust project economics even under conservative valuation.

Money Multiple: 2,29, indicating that total discounted cash flows generated (EUR 86.435) exceed total discounted investment (EUR 37.797) by 129%. This strong positive multiple demonstrates substantial value creation, positioning the project favourably within municipal investment portfolios.

Payback Period: 6 years (undiscounted) or 7 years (discounted). These relatively short payback periods. The short payback periods reduce risk exposure and demonstrate rapid capital recovery, important considerations for municipalities considering pilot projects with unproven local markets.

Total Cumulative Cash Flow: EUR 121.150 over 15 years (undiscounted), demonstrating strong cumulative revenue potential despite the small scale of operations. The substantial cumulative return represents 269% return on initial investment before considering time value of money.

5.2 Cost-benefit analysis

The financial analysis demonstrates strong economic returns with NPV of EUR 48.219 and IRR of 18,69% (discounted IRR 10,90%). However, the true value proposition extends considerably beyond monetary metrics. The investment delivers environmental, social, and strategic benefits that strengthen the investment case and position the project as a catalyst for broader municipal development.

Environmental Remediation and Land Regeneration

The project site represents a former paint plant, where the establishment of flower production initiates land rehabilitation through several mechanisms. Horticultural management improves soil structure through regular tillage and organic matter incorporation. Irrigation leaches mobile contaminants below the root zone, what establishing vegetative cover prevents wind and water erosion that could spread contamination. The intensive management regime enables ongoing monitoring of soil and plant health, providing early warning of contamination issues requiring intervention. Unlike food production, flower cultivation enables productive land use without direct human consumption risk

Urban Regeneration and Municipal Image

The transformation of derelict industrial land into a flowering landscape delivers immediate visual impact, converting an eyesore into an aesthetic asset. This improvement enhances the municipality's image, signalling regeneration and forward-looking governance to residents, visitors, and potential investors. The flower cultivation pilot aligns with the municipality's broader vision of developing the area as a technology and company park. The horticultural operation provides immediate activation of the site whilst infrastructure development proceeds, preventing extended periods of visible abandonment. The aesthetic quality of flowering plants enhances the overall park environment, potentially influencing location decisions of companies considering the park for operations.

Entrepreneurship and Youth Engagement

The municipality has explicitly identified youth entrepreneurship as a strategic objective for the pilot project. Commercial floriculture offers accessible entry points for young entrepreneurs, with relatively modest capital requirements (especially with grant support), clear markets through established regional infrastructure, and technical support available through Liguria's extensive horticultural knowledge base.
The project demonstrates viable business models for agricultural entrepreneurship adapted to small-scale operations feasible for individual operators or small partnerships. Success in the pilot phase could create demonstration effects that extend beyond the immediate project boundaries. The direct employment generated, whilst modest in absolute terms, proves significant in context. Seasonal harvest labour creates flexible employment opportunities suitable for students or supplementary income seekers.

Knowledge Development and Capacity Building

The pilot project generates valuable knowledge applicable to broader municipal development strategies. Experience managing the establishment phase, navigating market access challenges, and optimising production techniques creates intellectual capital transferable to other initiatives. This learning proves particularly valuable given the small-scale enabling experimentation without excessive risk exposure. Municipal staff gain experience managing complex projects combining environmental, economic, and social objectives. This capacity building strengthens institutional capabilities applicable to future strategic initiatives, improving overall governance effectiveness. Successful implementation enhances municipal credibility in applications for future funding opportunities across various thematic areas.

Strategic Positioning within Regional Value Chains
The project positions Cairo Montenotte within Liguria's EUR 437 million floriculture sector, connecting the municipality to established value chains, market infrastructure, and knowledge networks. This integration provides access to Mercato Florovivaistico distribution channels, Port of Genova export opportunities, and regional technical support systems that enhance long-term viability beyond pure project economics.The municipality's elevation and microclimate enable extended flowering seasons, creating competitive advantage through access to premium pricing windows. This natural advantage differentiates Cairo Montenotte within regional production, potentially attracting additional horticultural investment as producers seek locations offering temporal diversification from coastal production patterns.
The demonstration of successful innovative land use in a post-industrial context positions Cairo Montenotte as a knowledge leader in adaptive reuse strategies. This reputation could attract research partnerships, study visits, and knowledge exchange initiatives that generate spillover benefits beyond immediate project outcomes.

5.3 Site specific action for Cairo Montenotte

The two pilot sites in Buglio, within the Municipality of Cairo Montenotte, are located in an urban area on the right bank of the Bormida di Spigno River, in Liguria, Italy. The sites are situated on opposite sides of Corso Brigate Partigiane. Site CM 1039 is located approximately 50 meters to the east, while site CM 611 is about 100 meters to the west of the road. Together, the sites cover a total area of 3,040 m^2, where human activity has caused significant soil pollution through airborne deposition from local industrial and urban sources, as well as the historical dumping of industrial waste.
Historically, the Buglio area has been affected by territorial development linked to traditional agricultural practices, having been part of the land connected to a monastery active in the area for centuries. In the years after the Second World War, the territory was soon incorporated into the physical and demographic growth of Cairo Montenotte and its proximity to the administrative center made it a place destined to satisfy the growing need for housing due to the growth of the city linked to the industrial relaunch of the area. The current appearance is typical for residential neighbourhoods with the presence of public housing and buildings in the style of the 60s and 70s. The built-up areas are interspersed with grassy areas in memory of the ancient vocation of the territory.
Due to heavy rainfall in October 2024 and partial flooding of pilot site CM 611, magnetic pre-screening—typically used for identifying magnetic “hot spots” and associated geochemical anomalies according to the ISO 21226:2019 procedure could not be carried out. Only 10 topsoil cores were collected from pilot site CM 1039, which is approximately twice the size of CM 611, and 5 cores from the smaller CM 611 site. The cores, each up to 30 cm deep, were taken using a HUMAX SH 300 sampler equipped with plastic tubes (35 mm in diameter). The collected soil material from both pilot sites was transported to the laboratory, where magnetic susceptibility (κ) was measured using a Bartington MS2 system with a C sensor, at 1 cm vertical intervals.
In addition, the topsoil samples were processed in the laboratory of IEE PAS and analyzed using ICP-MS/OES (Inductively Coupled Plasma Mass Spectrometry / Optical Emission Spectrometry) following sample digestion in aqua regia. The concentrations of selected

elements (Al, As, B, Ba, Cd, Co, Cr, Cu, Mn, Mo, Ni, Pb, Sn, W, and Zn) were determined in mg/kg. Samples for chemical analysis were collected from both the upper and lower parts of each core, based on the vertical distribution of magnetic susceptibility (κ) values. This included the uppermost 10 cm and the section corresponding to the local maximum κ value in the lower part of the core. In total, 15 samples from the upper portions and 15 from the lower portions of the soil cores were analysis - Based on these data, relevant distribution maps of magnetic and chemical parameters were produced.

In six randomly located pits, samples were collected from soil horizons and layers at fixed depth down to 50 cm depth. Samples were transported to the laboratory for quantification of C content (TOC) by elemental analyser and measurement of bulk density (BD). For each pit, soil quality was evaluated by FAO's Visual Soil Assessment (VSA) methodology. Pedotransfer function (PTF), determined and validated on all pilot sites, was used for prediction of BD of soil horizons and layer BD. Soil C storage in each pit has been determined in Mg ha-1 to a soil depth of 0-50 cm. Nitrogen (Nmin), phosphorus (P) and potassium (K) were determined for the investigated pilot site to assess the fertilisation needs.

The soil study revealed that the soil at both sites is of technogenic origin (Technosol). It was likely formed on the surface of industrial waste storage, which was later covered with approximately 10 cm of a humus layer that now constitutes the organic horizon. The soil is contaminated with chromium, nickel, and cobalt across the entire surface of both pilot sites, and in some areas also with copper, lead, and arsenic. The concentrations of these elements exceed the Italian national threshold values for public, private, and residential green areas; therefore, the soil is unsuitable for agricultural use related to food and feed production. However, the concentrations of PTEs are well below the threshold values for commercial and industrial sites, and there is no urgent need for remediation or immobilization of these elements in the soil. The land can be used for non-food agriculture, but pollution monitoring is recommended during agricultural activities.

The anthropogenic layer composed of industrial waste, located below a depth of 15 cm, is the main source of soil pollution. However, airborne deposition — both current and historical — directly onto the organic horizon is also a source of heavy metals. The subsurface layer is highly heterogeneous, but the spatial distribution of heavy metals cannot be effectively monitored using soil magnetometry, as the waste material likely originates from various sources. These sources may all contain technogenic magnetic particles, which act as carriers of different PTEs, depending on the industrial processes responsible for their formation.

Based on the analysis of samples taken from six soil pits, it can be stated that the soil is relatively rich in carbon at the surface. Its quality, as defined by the VSA, is moderate. This apparent discrepancy is likely due to the strong accumulation of SOC in the surface layer and the lack of organic carbon distribution along the soil profile, especially in the technogenic layers. This was confirmed by the low VSA score for soil colour. Additionally, water stagnation occurred at both sites (CM611 and CM1039), as indicated by the presence of a Bg horizon in all soil profiles. According to the VSA, this was particularly evident at site CM1039, which showed a low score for mottles. The lack of carbon distribution throughout the soil profile, combined with water stagnation, suggests that good soil management practices should be implemented to allow for non-food production. In all soil-related practices, specific attention should be paid to preventing soil erosion or the loss of the uppermost soil layer, which is richest in organic carbon. Loss of the topsoil in these soils could lead to severe carbon depletion and expose the soil to the risk of rapid and significant degradation. All plots show low N_{min} values, below 40 kg N ha−1, meaning that the full amount of nitrogen required should be applied. For grassland with legumes, 0–40 kg N ha−1 is recommended annually, while for grassland without legumes, 40–80 kg N ha−1 should be applied each year. Additionally, nutrient contents are rather low, so the application of phosphorus and potassium is also recommended.

5.4 Risk assessment for Cairo Montenotte pilot site

Despite strong projected returns, several risk factors warrant attention:

Market price volatility: Flower prices fluctuate significantly based on seasonal supply, competing production regions, and demand patterns. The 1% annual price escalation assumption may prove optimistic if international competition intensifies or if production from lower-cost regions expands.

Biological risks: Disease outbreaks or pest infestations could substantially reduce yields or require costly interventions beyond budgeted amounts. Climate-related risks (drought, frost damage, excessive rainfall) could affect both yield and quality, impacting revenue realization.

Market access: The financial model assumes consistent market access and absorption of production volumes. Whilst Liguria's established floriculture infrastructure supports this assumption, new producers must establish buyer relationships and demonstrate consistent quality to achieve projected pricing.

Operational complexity: Flower production requires skilled labor, sophisticated pest management, and precise timing of operations. The pilot scale operation may face challenges recruiting experienced horticultural workers or accessing specialized inputs, potentially increasing costs or reducing yields below projections.

These risks can be partially mitigated through conservative management, diversification across species, establishment of buyer relationships prior to first harvest, and engagement of experienced horticultural advisors. The positive NPV and strong IRR provide a buffer against moderate adverse developments, though severe problems could affect viability.

Overall, we deem this pilot to be worthy as is, which is mainly since the pilot itself is extensive, covering more than a usual pilot would, hence going beyond the proof of concept. In our discussions with the municipality, it was outlined that only 1/3 is used in this pilot. This would mean that after the initial investment proves that the flower cultivation in this plot is feasible, and the above outlined risks are manageable, we see no problem in recommending extending to the full plot.

6. Durability, upscaling and dissemination plan

6.1. Durability model in practice

If the cultivation of peonies and hydrangeas proves to be of good, high quality, that is, a level of production that meets market demands— the first objective will have been achieved, namely the one that allows production to be considered of interest and with potential placement in the flower market. Furthermore, if the first milestone is successfully met, production may also be of interest for urban landscaping not only for the municipality of Cairo Montenotte, but also for other municipalities in the valley.

The project's durability is supported by its ease of replication. Moreover, the project concept could be replicated through mainstream funding for agricultural enterprises, helping to foster the creation of new startups by young farmers.

6.2. Comprehensive upscaling plan

This model of soil improvement and use has had positive outcomes thanks to close collaboration with municipal institutions and local businesses, the general public, and the academic community that drafted the guidelines. The idea of testing techniques for improving and recovering soils contaminated by industrial waste or mining activities for non-edible agricultural production, particularly floriculture, is certainly easily transferable to other Mediterranean climate regions such as Liguria, with similar soil and climate characteristics, soil pollution patterns, and agricultural economies to those of Ligurian municipalities. However, it is interesting to note how the choice of the municipality of Cairo Montenotte, with its more "continental" climate compared to the coastal strip, suggests that other areas of Central Europe could follow this model, perhaps focusing on different flower varieties. The methodology also has regional and transnational strategic value as a response to climate change and the economic damage it can cause to a fragile sector like floriculture, which is by its very nature heavily impacted by climate variations. This production has historically been established in coastal areas closest to the sea, but with rising average temperatures and increasingly unpredictable and extreme weather variability, some plantations (such as peonies, which require extended cold periods) are endangered in traditional production areas. Demonstrating that the relocation of these activities to inland areas made suitable by climate change and to lands currently unused for agriculture due to pollution from industrial sources has significant demonstrative value and can serve as an example of community resilience and adaptability at the regional and international levels.

Target group or area and timetable	Description
Local administration **September 2024**	A meeting with local administrators in Bormida Valley to present the idea.
Technicians of Provincia di Savona and ARPAL **September 2024**	Online meeting with the technical referents of Provincia di Savona and ARPAL (institutions with competences on degraded soils). The project idea has been discussed with them and demonstrative example.
Regional local and regional administration of Liguria Province (Italy) **October 2024**	The involvement of local and regional administration and the development of networks relevant to land management and soil restoration initiatives on polluted soils were achieved during meetings in Genoa and Cairo Montenotte.
Municipality Castenaso Emilia-Romagna (Italy) **June - July 2025**	A targeted meeting in the Municipality of Castenaso took place at the PoLaRecCE demonstration site and municipal office. Discussions focused on opportunities for rehabilitating polluted areas and innovative techniques to be demonstrated, including indicators for assessing soil status and recovery potential. This activity strengthened cooperation with local authorities and supported the preparation of demonstration actions.
A peony for Europe - an event to present the results of Interreg Project in Liguria Region. **11 May 2026**	Anci Liguria organized together with Liguria Region an event to present around 25 Interreg projects and their results. PoLaRecCE gave the title to the event and the pilot action in Cairo Montenotte was illustrated to a wide audience of institutions, municipalities, departments of Genoa University, associations, chambers of commerce, research centers.
Regione Liguria, Agricolture Department, Istituto Regionale per la floricoltura **April - June 2026**	Meetings to present the pilot experience in Cairo Montenotte, to define possible dissemination' s activities (upscaling project ...)
Regione Liguria Agricolture Department **September - October 2026**	Meetings with the referents of the mainstream funds and cohesion funds to verify the opportunities to finance similar actions in other areas, as instrument to regenerate the soils.
Municipalities belonging to the National Strategy for Inner Areas (around 80 municipalities*)* *September - October 2026*	The National Strategy for Inner Areas is an important instrument for the social and economic development of rural areas. There are 8 Strategies in Liguria Region for around 80 municipalities. Anci Liguria will present the results of PoLaRecCE as a concrete opportunity for other territories with similar condition.

Table 6. Upscaling plan for the concept developed for soils degraded by urban and industrial deposition of PTEs.

6.3. Dissemination plan

June 2024	*Kick-off meeting in Skawina - the pro launched on our website, to inform our c municipalities* about thi innovative project	PP6
October 2024	*Meeting in Genoa and Cairo Montenotte with the project partner and some relevant institution of our region: Province of Savona and Arpal Liguria, to illustrate the project demonstrative activity promoted in Cairo Montenotte*	PP6 and all partners
June 2025	*The PoLaRecCE project has been illustrated to the thematic groups of Anci Liguria (the groups are composed by mayors or other referents from municipalities)*	PP6
January2026	*The project*, together with other ones, *has been illustrated to other Anci belonging to different regions in Italy: Anci Toscana, Anci Umbria, Anci Sicilia)*	PP6
May 2026	*A peony for Europe* - an event to present the results of Interreg Project in Liguria Region.	PP6
June - July 2026	The developed methodology for site assessment of areas polluted by urban and industrial deposition of PTEs will be published in a high-ranking environmental science journal.	All project partners
November 2026	The final toolbox/handbook, providing a set of procedures for quick, inexpensive, and effective environmental site assessment, as well as criteria for selecting the best available solutions for development and management strategies (with a special focus on non-food farming, including analysis of ecological and environmental benefits), will be published	All project partners
December 2026 - 2027	The handbook will be disseminated among local and regional administrations in Poland and other Central European countries.	All project partners
December 2026 - 2027	The final solutions and results of the project will be disseminated via social media in all participating countries.	All project partners

Table 7. Dissemination plan

7. Policy tools instruments

Policy Tools

In order to promote efficient management of the degraded lands PoLaRecCE project developed tools supporting strategic planning initiatives and improving multilevel governance.

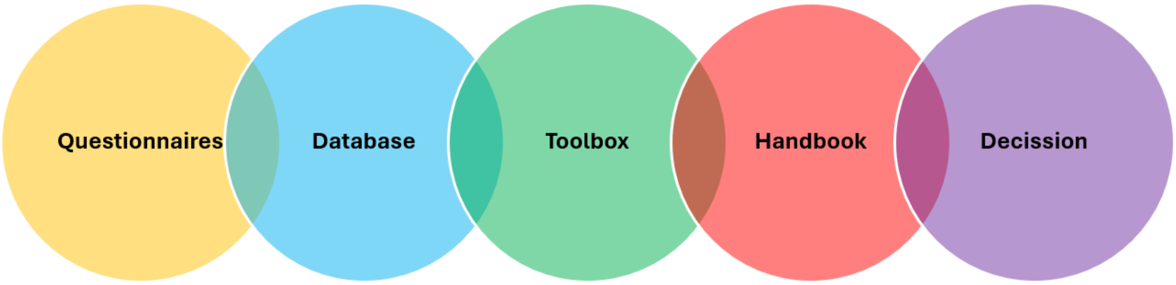

Figure 12. Diagram showing multi-level management of degraded land as a tool developed within the framework of the PoLaRecCE Project

Questionnaires

Within the PoLaRecCE project, a survey was conducted to identify and assess the main risks associated with degraded agricultural soils in the Central European region. The survey covered 18 categories of soil degradation, ranging from contamination caused by industrial emissions and waste disposal to natural processes such as erosion and flooding. The primary target group consisted of municipalities, specifically mayors and technical offices responsible for local planning and land management. Their responses provided valuable insights into how soil degradation issues are perceived and prioritized at the local level. 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 climate change.

Database

This tool has been developed in order to perform cross-regional comparison of the data obtained via survey (questionnaires):

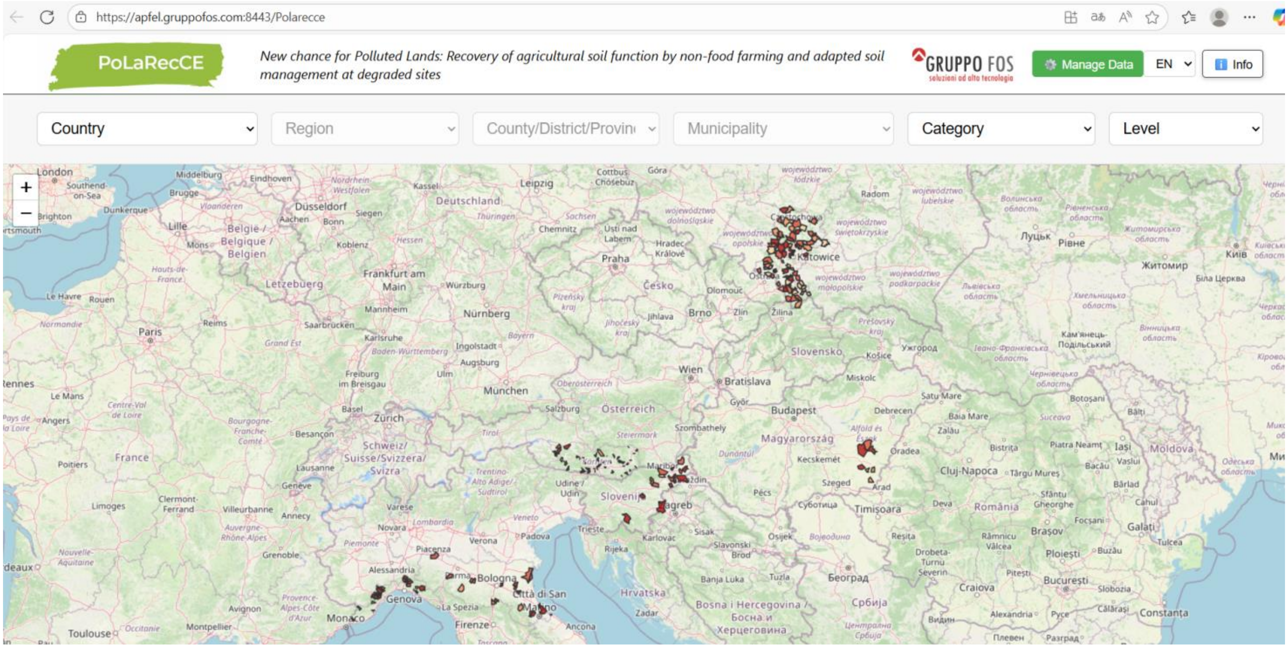

Figure 13. Map of the Central European region, showing municipalities contributing to the database on land degradation

Such an approach enables the identification of both overarching patterns and region-specific issues. While certain forms of soil degradation are consistently observed across Central Europe, others are highly localized, reflecting differences in geography, industrial history, agricultural intensity, and data availability. This provides a comprehensive overview of soil degradation challenges at both local and regional levels. Some of these issues can be addressed directly by local authorities, particularly those of a localized nature, while others—especially those that extend beyond national borders—may require intervention at the EU level. To support the introduction of an open database within Italian institutions, ANCI Liguria plans to organize a workshop involving all relevant stakeholders in order to disseminate the lessons learned.

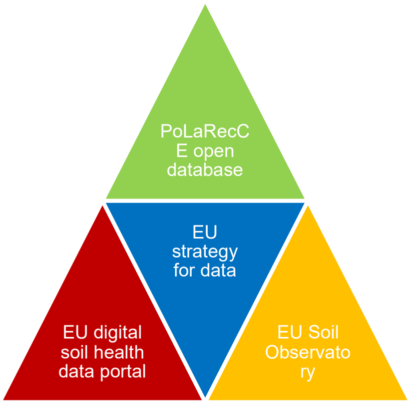

Figure 14. Diagram showing the EU initiatives supporting open access to digital information about the land degradation and soil quality

Toolbox

Soil quality indicators and monitoring techniques are generally focused on agricultural land.

This creates significant challenges in detecting and assessing a wider range of soil contamination issues, such as the deposition of air pollutants or the illegal disposal of waste, as well as in implementing comprehensive monitoring systems that also cover forests, urban areas, and recreational spaces. To address these limitations, the PoLaRecCE project introduces a set of innovative techniques (a toolbox) designed to characterize the physical and chemical properties of degraded soils while accounting for multiple sources of pollution. A key advantage of this toolbox is that it consists mainly of low-cost, easy-to-apply methods that can be used quickly and effectively to detect various soil contaminants across different types of environments.

Handbook

The final tool developed within the PoLaReCE project is a handbook intended primarily for local and regional authorities, including decision-makers responsible for soil management. It provides a comprehensive description of the tools developed during the project, including questionnaires, the database, and the toolbox. In addition, the handbook outlines criteria for selecting the most appropriate revitalization measures and offers detailed guidance on conducting cost-benefit analyses for different investment options. Pilot sites addressing various types of soil degradation serve as practical examples for stakeholders, illustrating how to effectively manage and remediate land affected by different sources of pollution. Two experimental and demonstration fields for the cultivation of peonies and hydrangeas have been set up in Cairo Montenotte, considered the best tool for the regeneration and reclamation of degraded land.

Dissemination

All four tools (questionnaires, database, toolbox and handbook) can support Italian institutions to find answers to three major questions:

- What are the main soil degradation problems to be solved in our municipality?
- Do they affect only our local area or is it a regional problem?
- What measures can be applied to restore the degraded areas?

With the help of PoLaRecCE tools the strategic planning legislation at the municipality, regional and EU-level will be more harmonized, triggering more rapid revitalization of the degraded areas and initiating “healthy soil” procedures more effectively protecting the unique soil environment.