Project ECOREMED

Implementation of eco-compatible protocols for agricultural soil remediation in "Litorale Domizio - Agro Aversano" NIPS

remediation | soil degradation | soil pollution

PROJECT DESCRIPTION

The ECOREMED project had the aim to validate on a pilot scale an assisted bio-phytoremediation protocol for different levels of soil contamination, in order to produce a suitable technical tool for the rehabilitation of degraded and/ or contaminated agricultural soils, with bio-phytoremediation techniques which also include energy recovery from biomass.

The *Agro Aversano* (fields around Aversa), sadly known as the "Land of Fires", is a highly urbanized agricultural area of great importance for the region of Campania as home to more than 1 million people, and in which the 40% of the regional agricultural GDP is produced.

Given that soil rehabilitation by means of physico-chemical techniques is very expensive, most sites remain contaminated, and their high toxicity can cause a strong reduction of soil fertility that makes these soils no longer suitable for agriculture, thus changing their destination to residential, commercial or industrial. This aspect is relevant considering that the assisted phytoremediation is usually tested at laboratory scale or in controlled environments, improving the general knowledge of the rehabilitation process, but without giving any information about its real effectiveness. The idea behind the project was to verify the effectiveness of low-impact eco-compatible reclamation techniques capable of preserving and improving the natural soil fertility, while at the same time finding a synergy between the need to rehabilitate the contaminated land with non-food species and that of producing renewable energy or biomaterials, without entering into competition with traditional food crops.

OBJECTIVES

The objectives of the project were to:

1. study the characteristics of the territory of *Litorale Domizio-Agro Aversano*, classified in past as SNI (Site of National Interest), and reclassified in 2013 as SIR (Site of Regional Interest), highlighting its environmental hotspots;
2. validate on a pilot scale some eco-compatible environmental rehabilitation techniques (bio- and phyto-remediation);
3. verify the opportunity to activate an industry for the energy recovery from biomass produced in the contaminated sites, defining low-impact energy recovery technologies;
4. verify the effectiveness of low environmental impact soil washing techniques to treat the most compromised hot spots;
5. calibrate and validate some environmental monitoring techniques with chemical, biological (moss, microflora, fauna), hydrogeological, landscape-territorial, socio-economic and engineering approaches (related to biomass conversion technologies);
6. create an operational linkage between the technical-scientific protocol produced by the ECOREMED project and the administrative tools for territorial government at different levels (municipal and regional) through information and technical assistance to local authorities;
7. define a set of indicators for environmental quality monitoring that can be used in the environmental regulatory framework;

8. raise public awareness and disseminate project results among the population, students of different educational levels, experts, researchers and local administrators.

PROJECT PHASES

The methodologies proposed by the "ECOREMED protocol" have allowed to obtain a mapping of great spatial detail of the contamination level necessary for a "precision remediation" that combines economic needs (cost reduction) with those of environmental protection (identification of the most suitable techniques in different areas of a site), reserving, for example, the most expensive techniques (such as soil washing) to small, more contaminated surfaces that can not be treated with phytoremediation.

This approach differentiates the "ECOREMED protocol" from the engineering techniques based on the indiscriminate removal of soil volumes, treated on the whole as a special waste to be disposed of in landfill or even on the soil sealing with superficial covering barriers (capping). In the ECOREMED approach, instead, the alterations suffered by the soil as "natural body", expression of long-lasting genetic processes, are dealt with and treated as much as possible respecting the original structure of the pedological coverings with the double benefit of respecting the residual functionality of the resource favoring its regeneration, as well as the aspects of resilience.

Experimental activity on the pilot sites took place in the municipalities of Campania on the territory of *Litorale Domizio - Agro Aversano*: Trentola-Ducenta Fondo Bove (4.500 m^2 of public area contaminated by metals and organic pollutants), Teverola Fondo Comunale (a public land of 3.000 m^2, former temporary storage of municipal waste) and Giugliano Fondo Zacaria (a private property of 3.300 m^2 of agricultural land contaminated by organic pollutants, zinc, copper), Laghetti di Villa Literno (Soglitelle locality, an agricultural land located in a brackish area designated as naturalistic park, subject in the past of extensive poaching that led to an accumulation of lead in the ground). The presence of such a varied range of cases **has made it possible to validate the protocol in different situations of degradation or contamination such as to make it modulated according to the different contexts** in which it operates: physically degraded sites (Trentola-Ducenta and Teverola sites); sites contaminated by non-mobile/ bioavailable potentially toxic elements – PTE (site of Giuliano 1); sites contaminated by PTE and/ or organic contaminants (site of Giuliano 2); sites contaminated by mobile/ bioavailable PTE (Marcianise and Villa Literno sites).

The effectiveness of the "ECOREMED protocol", as well as all the rehabilitation/ safety measures implemented, was monitored by analyzing the effects on the different environmental sectors using different techniques.

In consideration of the high level, also international media attention on the environmental quality of the area (the so-called "Land of Fires") the results of biomonitoring have been disseminated in 11 conferences that have ensured the diffusion of the biomonitoring methodologies proposed by the ECOREMED project also at international level.

PROJECT RESULTS

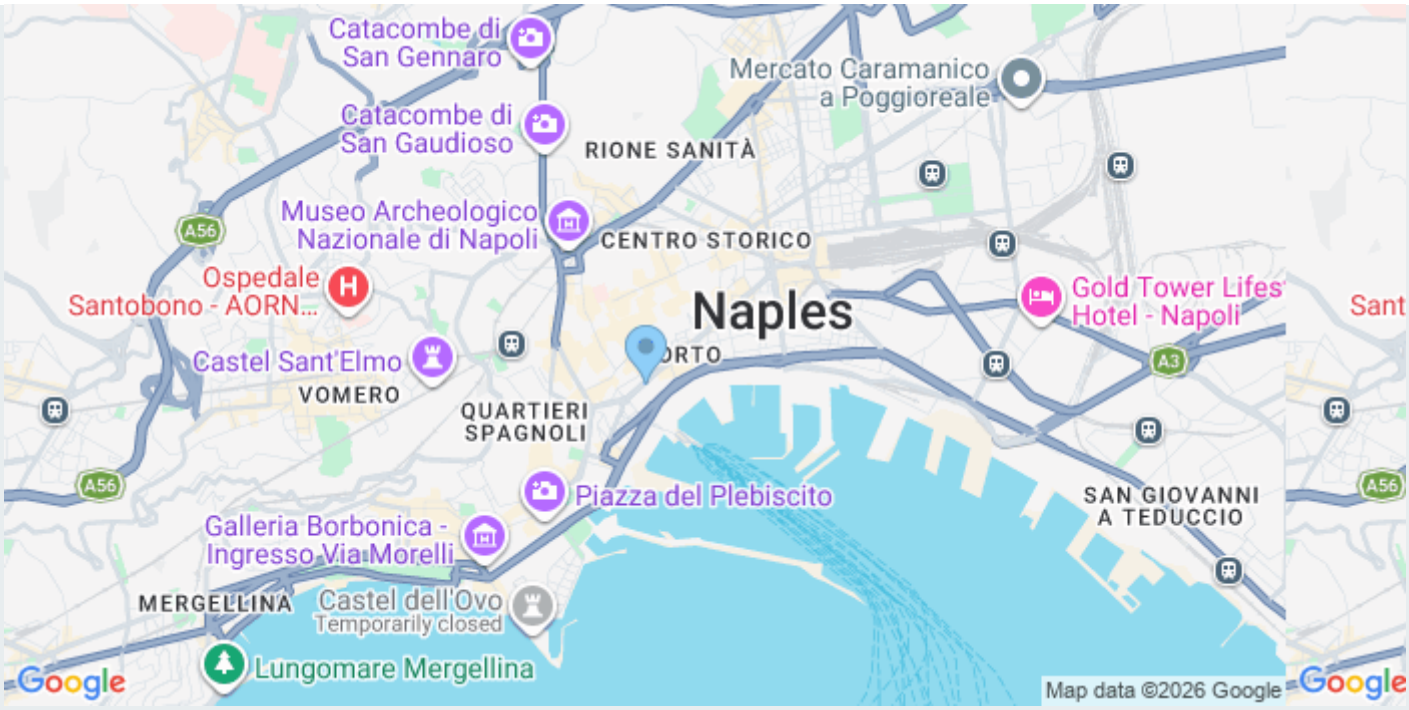
The best strategy, developed thanks to the experience gained during the ECOREMED project, for the management of agricultural sites that present problems of chemical-physical degradation, highlights some of the possible bioremediation and phytoremediation techniques, such as phytoextraction, phytostabilization and rhizodegradation, widely described in the **Operational manual for environmentally friendly rehabilitation of degraded soils**, developed within the project. The Manual illustrates: the techniques for defining in a detailed and scientifically correct way the levels of contamination of soils and the related health risks; the eco-compatible techniques, subject to verification, for the rehabilitation of degraded soils which also restores ecosystem services; the most suitable techniques for monitoring the environmental quality and the effects of rehabilitation; finally the **analysis of the costs of bio-phytoremediation interventions as well as of the economic impacts on farms**. This assessment had to take into account both the classical variables related to direct and indirect costs and benefits of consolidation in a strict sense, as well as the costs and benefits related to intangible elements such as the reputation of the involved area and local agro-food products interested by the pollution problem and thoroughly identified in the recent legislation.

The governmental guidelines drawn up by the National Working Group established pursuant to the Legislative Decree n.ro 153/2014 "Terra dei fuochi (Land of Fires)", have recognized the suitability of the phyto-bio-remediation techniques on which the ECOREMED protocol is based, and which are currently referred to as reference method for the treatment of agricultural soils.

The different forms of active involvement and public participation have created a spirit of cooperation and institutional collaboration between public and private subjects, necessary for the use of the protocol and the implementation of interventions.

The dissemination and public participation experiences carried out in the ECOREMED project and specifically addressed to farmers have shown that in many cases farmers do not have, neither at corporate nor at associative level, the technical-scientific and operational knowledge to deal with these problems. The participatory moments that were organized in ECOREMED turned out to be extremely useful for correctly informing farmers about: actual risk chains that may concern the production processes; strategies that can be deployed, at both company and associative level, to protect the action of the farmers; possibilities of using the ECOREMED protocol for the environmental and landscape redevelopment of degraded rural sites; active role that farmers can play in these processes and in the recovery actions.

Thanks to the highly innovative aspects compared to the approaches traditionally used for the characterization and rehabilitation/ safety of contaminated sites, and to the considerable dissemination and participation activities that accompanied the application of the ECOREMED protocol and which proved to be extremely useful for properly informing all stakeholders - from the farming community to associations, from educational institutions to public administrators – in 2018 ECOREMED was awarded by the European Commission as the **"Best of the Best" LIFE Environment project**.



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Acronym
ECOREMED

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Reference Programme
LIFE

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Centro Interdipartimentale di ricerca Ambiente (CIRAM), Università degli Studi di Napoli Federico II

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2.707.256

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Region
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Description

Litorale Domizio – Agro Aversano NIPS