



**LIFE PROJECT 16
ENV/ES/000159
TECMINE**

**INNOVATIVE
TECHNIQUES FOR
FACIES WEALD AND
UTRILLAS MINE
RESTORATION**



**AFTER LIFE PLAN
2022 – 2025**

DATE: APRIL 2022

THE PROJECT

TECMINE is a demonstrative project that aims to improve the restoration of open pit mines in Mediterranean forestry environments by combining different technics that address both ecological and social issues. These techniques have been applied to 4 areas of a siliceous sands, kaolin and clay quarry, in total 13 hectares.



To date, the restoration techniques employed did not fully address the impacts of mineral extraction such as erosion, biodiversity loss or landscape impact. Prior to this project, the causes of this situation were identified, finding as main barriers the lack of knowledge about other techniques applied in similar environments, the need for tools that accelerate decision-making in projects and their evaluation, as well as awareness and integration of mine restoration as an inherent part of the activity. Finally, and also due to the inadequate quality of the restorations, some social sectors reject this activity because of its high environmental cost, which is a problem given the need for mineral resources supplies so essential today.

The **specific objectives** of this project have been as follow:

- Recommend technical solutions that make mining activities compatible with the preservation of our forests as producers of numerous environmental services.
- Improve knowledge transfer and collaboration between Public Administration, industry and science.
- Provide the mining and Public Administration with tools to design and evaluate the suitability of restorations.
- Raise awareness among the sectors involved and population about the importance of sustainable mining.
- Give new opportunities to enjoy the restored areas.

GENERAL DATA

Reference: LIFE16 ENV/ES/000159 TECMINE

Location: Ademuz (Valencia)

Duration: November 2017-May 2022

CONSORTIUM

COORDINATOR: Conselleria de Agricultura, Desarrollo Rural, Emergencia Climática and Transición Ecológica de la **Generalitat Valenciana** (GVA)

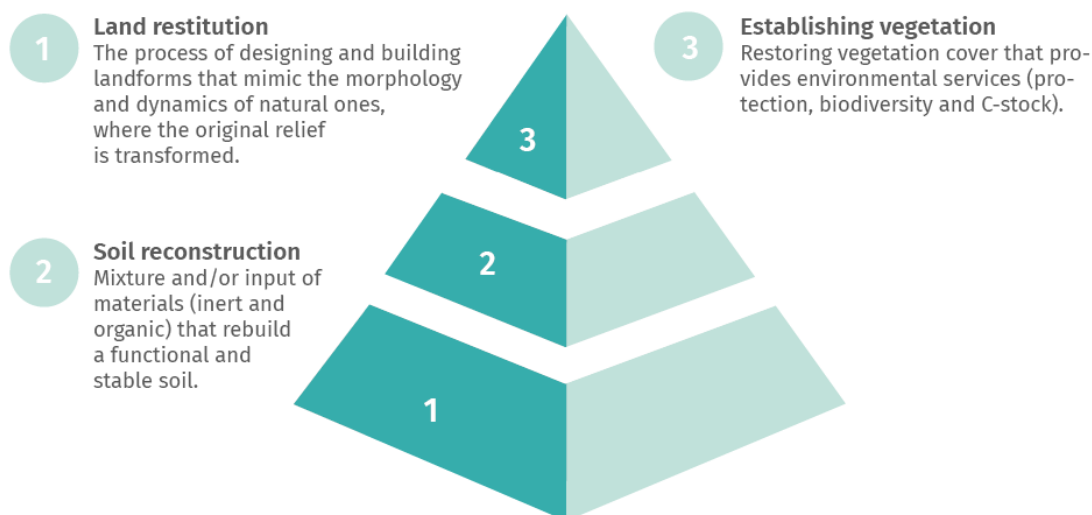
BENEFICIARIES: Fundación **Centro de Estudios Ambientales del Mediterráneo** (CEAM), **SIBELCO Minerales S.A.**, **Universidad Complutense de Madrid** (UCM) and **Valenciana d'Aprofitament Energètic de Residus** (VAERSA).



ACTIONS

Project actions have focused on:

- 1) Preparatory actions** aimed at the elaboration and updating of designs, organisation of a Panel of Experts and the study on the “state of the art” of the restoration techniques in areas affected by open pit mining activities.
- 2) Actions to implement** innovative techniques in morphological restoration, soil reconstruction and vegetation establishment.



3) Monitoring actions structured in the following analyses:

- Morphological evolution and erosion.
- Monitoring of water flows and sedimentation
- Survival and plant growing
- Ecosystem services
- Colonization of wildlife

- 4) **Transfer and communication actions** aimed at different target groups, both professionals from public and private sector, as well as researchers, universities, schools and general public.

RESULTS

As a result of the implemented actions and after 2.5 years of monitoring the restoration indicators, it can be said that TECMINE project has demonstrated that the combination of efficient ecological restoration techniques aimed at hydrological control, substrate improvement and efficient use of resources for restoring a diverse and functional vegetation cover, taking into account the baseline conditions and the requirements of the target species, can be a suitable strategy to achieve a better result in the short term.

The main results obtained are:

ACTION	MAIN RESULTS
<p>Morphological restoration using techniques based on simulating nearby natural areas, called “referents” with the help of software</p>	<ul style="list-style-type: none"> - Better water management reducing its erosive capacity and increasing infiltration compared to the conventional berm and slope model - Greater landscape integration - Increased soil moisture and therefore, greater water availability for plants
<p>Soil input and stabilization using colluvium - type substrates and mixtures of mine wasting with organic matter from activities such as forestry and water waste treatment. In addition, sowing of herbaceous species and organic blankets and strips of wood chips were put down to protect against erosion</p>	<ul style="list-style-type: none"> - Increased protection from colluvium-type substrates - Increased soil fertility from amendments - Herbaceous coverage exceeded 60%, which may be enough to effectively control erosion processes
<p>Establishing vegetation using techniques that optimise the use of rainwater such as “micro-catchment” and planting. In addition, protective devices have been installed and also it has been applied hydrogel, organic amendments and nursery cultivation techniques adapted to the functional characteristics of Mediterranean species</p>	<ul style="list-style-type: none"> - 9,000 plants including 31 different tree and bush species representing up to eight different habitats, of which three are priority habitats - Average survival rates of 75% and growth up to 3 times higher than the original size of the seedlings - Greater water catchment in the holes with an increase in soil moisture levels of around 7%
<p>Transfer and communication through:</p> <p><u>Training actions</u> aimed at professionals from national and international companies and administrations</p> <p>Dissemination in <u>congresses and technical conferences</u></p>	<ul style="list-style-type: none"> - More than 5,000 people reached - Training for more than 120 professionals - 20 technical conferences for more than 2,500 public and private sector professionals and experts. - 17 events where 460 students from Universities and Training Centres received training.

Talks at Universities and Training Centres

Visits to the restoration of the mine by students and professionals in the sector

Awareness-raising and environmental education activities

Publication of technical and scientific documents

Dissemination in the press, television and radio

Dissemination through the web and social networks

Tools and communications materials:

A website <https://agroambient.gva.es/es/web/life-tecmine> available in VAL, SPA and ENG

Social media (Twitter, Facebook, LinkedIn)

6 panels with general information about the project, located at the access to the mine and at the accesses to the nearby villages.

6 posters with general or specific information about the project, actions and results.

Project information leaflet (5.500 copies)

A new interpretative route with 6 panels and specific leaflets of the route (3.500 copies) that provides a new use to the restored area aimed at educational centers, companies and citizens.

2 promotional videos

1 image and video bank on the project, the actions and the evolution of restoration

9 magazines addressed to 301 subscribers

1 itinerant photography exhibition showing the project and its evolution in images (12 panels)

Merchandising: bags, pens, notebooks, children's bag (2,100 pcs.)

Layman report with general information about the project, the actions and the results and lessons learned (500 copies)

- 550 people visited the restoration of the Fortune Mine in Ademuz during the project.
- Participation in more than 20 events for general public, where the importance of mining, the impacts of this activity and the restoration measures, implemented in the TECMINE project have been passed on.
- 4 scientific publications; 2 technical guides on planning and evaluation of mine restoration projects.
- Scientific-technical reports on environmental and socio-economic monitoring campaigns
- 2 reports on television, 2 on radio and 5 articles in the press.
- 3 didactic units for infant, primary and secondary students.
- More than 18,630 visits to the website; and more than 11,340 downloads of content.
- We have more than 715 followers and more than 1,300 publications in social networks
- More than 5,000 virtual visits to the new route through Google and wikiloc.

Replicability. Three replication projects were completed during the project	<ul style="list-style-type: none">- Cabezo-bis Mine (Valencia) by the GVA. Area: 2 ha.- San Luis Mine (Cuenca) by the company SAMCA. Area: 9.7 ha.- Fortuna II Mine (Ademuz) by the company SIBELCO. Area: 3 ha.
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The implementation of the Communication Plan (available at <https://agroambient.gva.es/es/web/life-tecmine/documents-projecte>) has made it possible to achieve the objectives of both transfer and communication and awareness-raising.

ACTIONS AFTER LIFE

The actions planned for the 3 years of the After-LIFE period (May 2022-May 2025) are set out below, with the aim of increasing the scope and giving continuity to the benefits obtained by the project. This Plan contemplates the continuity both restoration monitoring actions, thus obtaining long-term results that will allow confirmation of the current trend, and of the training and dissemination of the results and technical documents elaborated, as well as the environmental awareness and education campaigns.

ACTIONS

ACTION 1: MONITORING OF PLANT SURVIVAL AND GROWTH

Objective

Analyse the evolution of introduced species and obtain results/recommendations on the most suitable species for each environment. A sample of approximately 900 individuals will be taken.

PLANNING:

At least the following actions are planned:

TASKS	FREQUEN- CY/OBJECTIVE	RESPONSIBLE PARTNER
Survival and growth campaign	Twice (1st and 3rd year)	CEAM
Data processing and writing of results	Twice (1st and 3rd year)	CEAM
Final report	Once at the end of the pe- riod	CEAM

RESOURCES

This action will be carried out with CEAM's own staff.

Dedication:

- Field campaign 5 days, 2 people
- Data processing and drafting of results: 4 weeks 1 person

ACTION 2: STREAM EROSION MONITORING

Objective

The slope erosion data obtained in the TECMINE monitoring correspond to the first two years after restoration. This is the most erosive period since erosion subsequently decreases exponentially until it stabilizes in approximately the fourth year.

This action aims to continue erosion monitoring in order to (1) measure the evolution of the network of streams and identify erosion rates once the system is stabilised and (2) monitor the evolution of the abrupt GeoFluv ("fishbone") restoration, in case any treatment is necessary.

PLANNING:

At least the following actions are planned:

TASKS	FREQUENCY/OBJECTIVE	RESPONSIBLE PARTNER
Field sampling of streams	Annual (twice)	UCM/UNIZAR
Data processing and writing of results	Annual (twice)	UCM/UNIZAR
Photographic monitoring of “fishbone” and erosion in GeoFluv Small and GeoFluv Big and report	Annual (twice)	UCM/UNIZAR
Final report	Once at the end of the period	UCM/UNIZAR
Scientific publication (out of budget)	Once at the end of the period	UCM/UNIZAR

RESOURCES

This action will be carried out with UNIZAR's own staff subcontracted by UCM.

Dedication:

- Field sampling: 3 days, 2 people every year (6 days in total)
- Data processing and drafting of results: 4 days of cabinet work every year (8 days in total)
- Photographic monitoring and report: 3 days in total
- Final report: 3 days

ACTION 3: WEB AND SOCIAL MEDIA MAINTENANCE

Objective:

The website and its contents will be kept up to date for 3 years to maintain the dissemination of the results and increase the impact of the project in the medium and long term. On the one hand, public and private sector professionals will be kept informed of news and events related to the project and mine restoration, and they will be able to download technical documents. On the other hand, the general public will be kept informed of activities and results.

Target audience: Aimed at all stakeholders, both experts and professionals from the public and private sector as well as the general public.

PLANNING:

The actions planned are as follows:

TASKS	FREQUENCY/OBJECTIVE	RESPONSIBLE PARTNER
Upload updated documents (technical guides) and new graphic content (photos and videos of the	Annual	GVA-VAERSA

state of the restoration) to the website.		
Publication of news	Quarterly	GVA-VAERSA
Dissemination of the Newsletter	Annual	GVA-VAERSA
New registrations on the newsletter distribution list	Continuous	GVA-VAERSA
Publication of every action and event on social networks	Continuous	GVA-VAERSA
Maintenance and expansion of the network	Continuous	GVA-VAERSA

RESOURCES

This action will require the partial dedication of the technician responsible for updating the website of the GVA Forest Management and Planning Service.

ACTION 4: UPDATING AND DISSEMINATION OF TECHNICAL GUIDES

Objective

This action aims to bring together the latest developments in mine restoration and specially to increase the database of practical cases that constitute the benchmarks in restoration at national level.

To this end, the members of the National Network for Mines and Quarries Restoration will be asked to review the Technical Guides that have been produced and to propose new restoration examples.

Target audience: Mining and engineering companies, and in general, public and private sector professionals in the field of mining and restoration.

PLANNING:

At least the following actions are planned:

TASKS	FREQUEN- CY/OBJECTIVE	RESPONSIBLE PARTNER
Update of Technical Guides and Database of restoration referents	Once at the end of the period	GVA-VAERSA Participating entities: Mines and Quarries Restoration Network
Dissemination through social networks	At least once a year, documents and access will be published on the website	GVA-VAERSA
Presentation of the guides and dissemination through professional associations of nationwide basis	At least 2 events	GVA-VAERSA Participating entities: Professional Association of Mining Engineers Professional Association of Forest Engineers Other professional associations

RESOURCES AND BUDGET

GVA through an assignment to VAERSA, will have one person for 3 years dedicated to the actions included in this plan. The estimated dedication for this action is 5 months.

ACTION 5: TECHNICAL-SCIENTIFIC DISSEMINATION OF RESULTS

Objective

This action aims to continue the technical-scientific dissemination of the project at national and international level based on (1) articles, (2) congresses and conferences presentations and (3) through other programs.

Target audience: Researchers and professionals in mining and restoration sector.

PLANNING:

At least the following actions are planned:

TASKS	FREQUENCY/OBJECTIVE	RESPONSIBLE PARTNER
Publication of articles in specialised journals of national and international scope.	2 articles	UCM/UNIZAR CEAM
Presentation in: Aggregates National Congress 2022 SERE Congress 2022 Quarries alive Congress (not scheduled) Another (not scheduled)	4 presentations	ALL PARTNERS
Participation in the COST Action 2022 (www.cost.eu/actions/CA19128/#tabs[Name:parties]) through a co-organisation of a training activity	July 2022	ALL PARTNERS Entities involved: Polytechnic University of Valencia

RESOURCES

This action will be carried out with each entities own staff, as part of their dissemination functions.

ACTION 6: TRAINING

Objective

This action aims to improve the training in restoration of areas affected by mining activities, both for professionals who are currently facing similar problems to those dealt with in the TECMINE project, and for future generations, university and vocational training students, who can join the labour market with a broader and updated knowledge of the available restoration techniques.

Target audience: Professionals and university and/or vocational training students.

PLANNING:

This action consists of:

TASKS	FREQUENCY/OBJECTIVE	RESPONSIBLE PARTNER
Incorporate the techniques and methodologies in restoration degree and master's degree programmes: - Master in Management and Restoration of the Natural Environment (University of Alicante). - Master in Ecological Restoration (UCM) - Master in Environmental Geology (UCM) - Degree in Forestry and Environmental Engineering (UPV)	Permanent At least 4 programmes	CEAM UCM/UNIZAR VAERSA
Talks and visits from other universities and training centres	2 talks/year 1 visit/year	GVA-VAERSA Entities implied: Polytechnic University of Valencia, Polytechnic University of Madrid, Alcalá de Henares University, Cartagena University, San Blas Vocational Training Centre, among others.
Organisation of the 3rd edition of the course on New Technologies applied to the restoration of mining operations.	1 course at least	VAERSA-GVA

RESOURCES

The incorporation in the study programmes where CEAM, UCM/UNIZAR partners participate does not entail any additional cost. It corresponds to VAERSA staff hired through an order from the GVA to carry out the lectures, visits and organisation of the course.

ACTION 7: SOCIAL AWARENESS AND ENVIRONMENTAL EDUCATION

Objective

In line with the objectives of the Communication Plan of the project, this action is intended to continue with the objective of changing public opinion on mining through informative actions aimed at the general public, explaining the importance and necessity of this activity and how good restoration practices can offset the negative impacts on the environment generated during mineral extraction operations.

PLANNING

This action consists of:

TASKS	FREQUENCY/OBJECTIVE	RESPONSIBLE PARTNER
ENVIRONMENTAL EDUCATION AT SCHOOLS		
Dissemination of the Teaching Units through the Department of Education and the CEFIRE Training Centre. A meeting will be held each year and links to the documents will be sent out again. The links will be available on the web as well.	Once/year	GVA-VAERSA
Translation of the Teaching Units into Valencian.	Once	GVA-VAERSA
Teacher training for teachers in the Valencian Community through CEFIRE	At least 1 course during the period	GVA-VAERSA
Workshops in schools through the GVA's Educabosc programme	At least 1 workshop during the period	GVA-VAERSA
INFORMATION AND SOCIAL AWARENESS		
The photo exhibition will remain on display for the whole period and will be installed in different public spaces (local or regional administrations, universities, other centres).	Permanent	GVA-VAERSA
Participation in the celebration of. <ul style="list-style-type: none"> - Geoloday - Wetlands day - Forests day - Others 	At least twice a year	GVA-VAERSA
Maintenance of the project informative panels in the local area and the route interpretative panels.	Continuous	GVA-VAERSA
Distribution of the Layman, project brochures and interpretative route at events or activities related to mining and restoration. Reprinting the materials that have run out are included.	Continuous	GVA-VAERSA

RESOURCES

This action will be carried out with GVA and VAERSA's own staff. The estimated time for the personnel in charge of post-life actions in VAERSA who will coordinate and carry out the activities required in this action, is 3 months.

ACTION 8: COLLABORATION AND NETWORKING

Objective

With the aim of maintaining and expanding the network created in the TECMINE project, made up of public and private entities, public administrations, research centres, universities, and non-profit organisations mainly local but also national and European, different actions will be developed. These actions will be directly coordinated with the Mines and Quarries Restoration Network, which was created during the project and coordinated by VAERSA.

PLANNING

This action consists of:

TASKS	FREQUENCY/OBJECTIVE	RESPONSIBLE PARTNER
Coordination of the Mines and Quarries National Network together with the Polytechnic University of Madrid (registration of new members, organisation of the annual meetings, etc.)	Continuous	VAERSA
Organisation of technical conferences and visits to exemplary restoration projects	At least once a year	VAERSA Implied entities of the Network
Support to training and restoration initiatives and actions (through dissemination channels)	Continuous	VAERSA
Exchange of documents and experiences of the project and other entities.	Continuous	VAERSA
Promotion of joint activities and collaboration between company-university-administration and especially between partners.	At least 1 replication project	

RESOURCES

The GVA, through an assignment to VAERSA, will have one person for 3 years dedicated to the actions included in this plan. The estimated dedication for this action is 5 months.

ACTION 9: PROMOTION OF THE APPLICATION OF THE TECHNIQUES/PROMOTION OF THE REPLICABILITY/REGULATION

Objective

This action includes actions aimed at promoting the application of techniques and methodologies that have been implemented at TECMINE, in other mines with similar characteristics in Spain and abroad. To this end, some of the dissemination actions outlined above will have a positive effect in this direction. In addition, specific collaboration and implementation actions, such as those indicated below, will be carried out.

Target audience: Mining companies and public administrations.

PLANNING

This action consists of:

TASKS	FREQUEN- CY/OBJECTIVE	RESPONSIBLE PARTNER
Restoration project for a mine in the Valencian Community	At least 1 in the period	GVA-VAERSA
Restoration project of a mine outside the Valencian Community	At least 1 in the period	SIBELCO
Dissemination planned in actions 4, 5 and 6	Permanent	ALL PARTNERS
Support in the design of new projects	Permanent	ALL PARTNERS
Updating of the minimum contents of the General Plan for Mining Operations in the Valencian Community published on the GVA website	Once in the period	GVA-VAERSA
Proposal in the Mining Table and Sustainable Mining Law.	Once in the period	GVA

RESOURCES

This action will be carried out with each entity's own staff.

Regarding the support to other entities in the design or implementation of TECMINE replica restoration actions, a dedication of 5 days/partner is estimated. The updating of the PGAM of the CV will be carried out by GVA staff and support from VAERSA staff assigned to the post-life period (6 months).