



# **Biodiversity Stewardship in Gypsum Quarrying:** Our Best Practices

**EUROXGYPSUM**  
THE VOICE OF THE EUROPEAN GYPSUM INDUSTRY

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# Introduction

Gypsum is a construction mineral eternally recyclable, quarried worldwide and used in an outstanding sustainable way in buildings. Gypsum building materials are used in all construction types (residential, non-residential, new or refurbished), ranging from complex high-tech systems to easy-to-install products adapted for use by the great public.

The European gypsum industry is one of **the few fully integrated industries within the construction products field**. The European gypsum industry covers the whole life cycle of the product. The companies which extract the mineral “gypsum” also process it and manufacture the value-added products and systems mainly used in construction. Gypsum products are eternally and fully recyclable as they always keep their natural properties during use. Therefore, the gypsum companies strive to effectively recycle the products at the end of their life cycle (demolition waste).

Industrial processes, from material extraction through product manufacturing to product disposal, have an adverse impact upon the environment. The European Gypsum Industry aims to reduce environmental stress caused by industry whilst encouraging innovation, resource efficiency and sustained growth. It acknowledges that the industry will continue to operate and expand but it is conscious on its environmental responsibilities to have fewer burdens upon the planet.



## The European gypsum industry strives to avoid pollution – material and energy flows with detrimental environmental impact – by:

### · Increased resource efficiency:

we promote clean production processes without hazardous pollutants; we prevent production waste or recycle it; we recycle construction waste; we implement strict safety policies at the workplace for better process efficiency.

### · Material substitution:

in construction, gypsum products may substitute high resource or energy intensive building products and binders, at comparable or better technical performance. The important market of indoor renovation for gypsum products, creating new surfaces and/or interior design, will give the chance to maintain existing building structures in a material-efficient way, compared to the construction of new buildings.

### · Using gypsum waste as a resource:

Gypsum is furthermore a raw material which can be eternally recycled to manufacture gypsum-based products (closed-loop recycling).

### · Relying on sound environmental management system

to create biodiversity before, during and after quarrying.

In this brochure, the European gypsum industry describes the best practices it implements in its extraction processes to create biodiversity during and after quarrying. The European gypsum industry is also conscious of its responsibility to use natural resources sustainably by:

- Sharply progressing towards the recycling of gypsum construction and demolition waste;
- Relying on synthetic substitutes of natural gypsum, meeting strict quality criteria; and
- Developing construction products and elements made of safe and recyclable components.



# Quarrying Gypsum for Increasing Biodiversity

## Quarrying Gypsum in Line with Nature

The mineral gypsum precipitated around 10-400 million years ago when sea water evaporated. From a chemical point of view, it is calcium sulphate dihydrate ( $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ ) deposited in sedimentary layers on the seabed. Under high pressure and temperature or under high salinity gypsum turns into anhydrite ( $\text{CaSO}_4$ ).

In nature, gypsum and anhydrite occur as beds or nodular masses up to a few metres thick. Gypsum is mostly formed by the hydration of anhydrite. The depth of hydration can range from the surface of the deposit down to three hundred metres, depending on temperature and pressure, topography, and the structure of the deposit. Anhydrite is often mined in conjunction with gypsum but is comparatively limited in its technical applications. The content of gypsum in sedimentary rock varies from 75% to 95%, the rest being clay and limestone.

**Gypsum is extracted from open-cast mines or underground mines** using pillar and stall mining methods, that give extraction rates of up to 75%. Gypsum is normally only screened to remove 'fines' (mainly mudstones), then crushed and finely ground. The extraction process implies an unavoidable impact on the landscape and the environment. However, human activity does not necessarily mean loss of biodiversity and danger for ecosystems.

Indeed, without human activity, Central Europe would nowadays almost be exclusively covered by forests. This type of habitat is not particularly favoring the uptake of many species as many herbaceous plants cannot live under the leafy canopy of the trees due to the lack of light. Those conditions would also have prevailed at gypsum locations with relatively shallow soils. But **as small-scale farming emerged**, numerous plant species were able to migrate to the open habitats and the number of species steadily increased.

**Human activity resulted in a richer biodiversity.** No mineral fertilizers and agrochemicals such as pesticides were available at that time. **With the uptake of large-scale farming and the intensive use of those chemical products**, we observed a dramatic decrease in species and biodiversity. As a result of the large supply of nutrients, tall-growing species displaced low growing plants, and common species, also known as ubiquitous, displaced rare plants. **Human activity in that case meant a loss of biodiversity**<sup>1</sup>.

The quarrying of gypsum rock creates habitats that hardly exist in our intensively used landscapes. The quarrying results in:

- Open, sunny areas;
- Soil conditions poor in nutrients, due to the removal of the eutrophic topsoil; and
- A high level of structural diversity that forms a mosaic of habitats.

Species that need light and warmth, species that are adapted to dry locations, as well as pioneer species that require recurring disturbances for their survival, benefit from quarrying. It is precisely those species that are threatened and appear disproportionately often in the annexes of the EU Habitats Directive: they find their last refuge in the quarries (refuge habitats) and are therefore frequently found there.

<sup>1</sup> Quarry-Environment 1/2002 gypsum habitats and biodiversity – Gypsum extraction and nature conservation are compatible – ScheieskyH/Tränke U./Riemann M.



## Gypsum Habitats

Gypsum soils spread over

**100.000.000 ha**

around the world.

They are confined to arid and semi-arid climates where low precipitation prevents gypsum from being removed by leaching. Together with the arid conditions, gypsum soils have particularly stressful physical and chemical properties for plant life. Among the adverse physical features are the presence of a hard soil surface crust, which can restrict seedling establishment, the mechanical instability of the soil material due to its lack of plasticity, cohesion and aggregation; and, in certain areas, its low porosity, which might limit the penetration of plant roots.

In semi-arid regions, the low water retention of massive gypsum soils leads to a high infiltration of rainwater, which increases water deficit during drought periods, although in some arid regions gypsum soils have been shown to display higher water availability during drought than adjacent soils. Chemically adverse features of gypsum soils are mainly related to the intense nutritional impoverishment of the soil caused by the exchange of calcium for other ions retained in the soil complex, and by the high concentration of sulfate ions, which can be toxic for plants. Such stressful conditions make gypsum soils largely unsuitable for the growth of trees, thus vegetation is composed mainly of stress-tolerant sub-shrubs, some scattered shrubs, herbaceous perennials, and annual plants. Despite gypsum soils constituting extremely adverse habitats for plant life, they give rise to a diversified set of endemic and rare plants in arid and semi-arid regions<sup>2</sup>. Gypsicolous flora, especially the comparatively more restricted endemic taxa, should be saved before starting quarrying.

<sup>2</sup> <http://aob.oxfordjournals.org/cgi/content/full/99/2/333>: annals of botany – Plants living on Gypsum – Beyond the specialist model.



Up to the beginning of the nineties, refilling, soil shaping for prevention of erosion and recultivation of quarries regarding the after-use for agriculture and forestry were the basics of quarry restoration. Since then, the surveys showed that abandoned and even active quarries are adequate habitats for rare and endangered animal and plant species.

**Intensive scientific research provided new elements to enhance biodiversity in gypsum quarries with the results that natural rehabilitation became a standard next to recultivation which is still required by law.**



## The European Gypsum Industry Biodiversity Stewardship

### Stewardship

is both about the conservation status of the land, and about a conviction or “ecological conscience” which guides how companies and individuals respond to that land.

### Biodiversity

means ‘biological diversity’ and relates to “the variability among living organisms from all sources, including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part: this includes diversity within species, between species and of ecosystems.”<sup>3</sup>

The conservation of biodiversity (‘biodiversity conservation’) together with the conservation of valued geological exposures and geomorphological features are the essential building blocks that make up ‘nature conservation’. Conservation involves both the protection and enhancement of existing resources, and the creation of new ones.

<sup>3</sup> UN Convention on Biological Diversity, 1992: <https://www.cbd.int/doc/legal/cbd-en.pdf>.

Biodiversity is of intrinsic value and should be maintained for its own sake as well as for its life supporting functions. Biodiversity is a vital component of well-functioning ecosystems and increases their resilience. It acts as a climate buffer and carbon sink and underpins ecological security. It is a precondition for global economic prosperity and long-term human wellbeing.

Citizens have a moral responsibility to care for

nature and a right to enjoy access to it. This improves mental and physical health and wellbeing. Nature has practical, cultural, emotional, scientific, recreational, and economic significance. These benefits should be better understood and valued.

The European gypsum industry commits daily and on the ground to conservation of nature and preservation of biodiversity by bringing constructive solutions to the environmental impacts of quarrying gypsum.

This biodiversity commitment entails the creation of wildlife habitats on its sites in order to contribute to the conservation of endangered or threatened species, local established species populations, as well as the creation of suitable habitats for previously displaced species. Conservation and biodiversity enhancements also play an important role in promoting net gains and listing of species. In the field of nature conservation and quarrying, we support rational evaluation over preconception by facilitating comprehensive and sound scientific fundamental and applied research combining ecology and business needs.

The European gypsum industry’s biodiversity commitments also include engagement with key local stakeholders to share its strong belief in promoting and restoring biodiversity and habitats at industry operations and/or properties across Europe.





## 1. Ecological Restoration for Biodiversity Enhancement

A common misconception is that active quarries are noisy, dusty and sterile places where native plants and animals are absent. In reality, many quarries provide wildlife havens in areas where biodiversity is otherwise limited by other forms of land-use, such as intensive farming. Through careful management, quarries can significantly enhance the biodiversity of an area and provide much needed habitats and refuges for wildlife.

# Sorbas Almeria

## SPAIN

Company: **Saint-Gobain Placo Ibérica**

### Objective

Ecologic restoration to conserve the original and autochthonous ecosystem with endemisms.

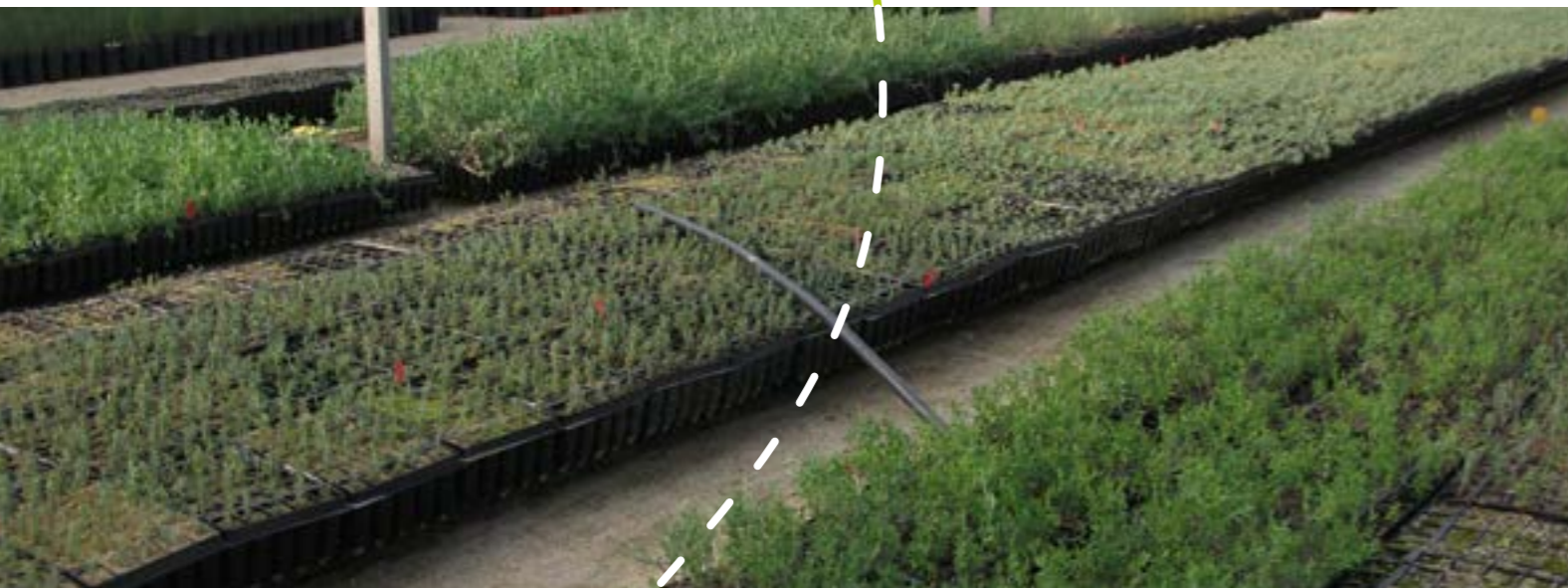
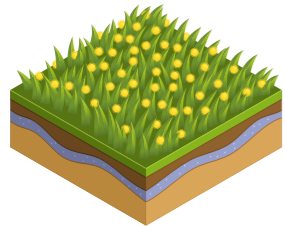
It was a complex project, now a program, of Research and Action (almost all at the same time, as there was no prior knowledge), aimed to recover biodiversity in the areas where quarrying activity was finished, to eliminate the impacts produced for it in the Natural Environment and to enhance environmental and geological values, while developing a strong research activity, by scientists at the highest level, to be used as a basis of the actions carried out "in situ" and exportable anywhere where there are similar conditions, while establishing an important deep knowledge of the Environment, valuable in all aspects, with exceptional results achieved.



## Context

The quarry is located within the LIC (Community Interest Areas) Sierra Cabrera-Bedar and is adjacent to the Natural Reserve "Gypsum Karst in Sorbas", probably the most important worldwide. Given the soil formation, with gypsum in a surface level, and considering the extreme climate, there are many endemics, mainly floristic and more specific gypsum plants.

Preservation and enhancement are absolutely necessary to maintain the natural heritage. Similarly, the action in the use of the mineral resource is important, especially when preserving a karstic area and its evolution over time.



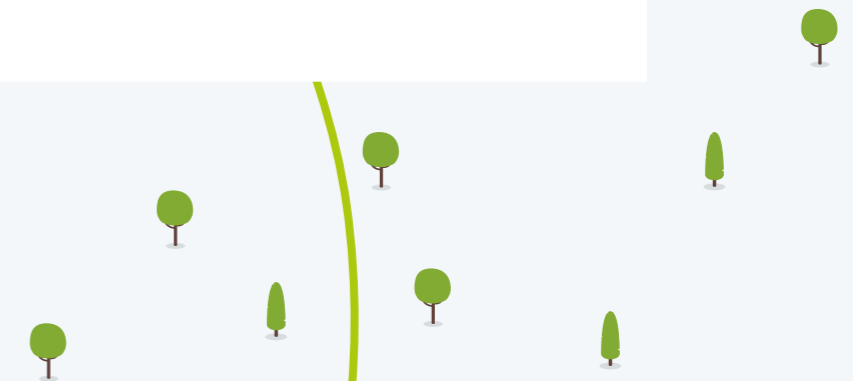
## Solution

- Geological
- Hydro geological
- Climate
- Geomorphologic
- Edaphic

research has been carried out, together with the study of the vegetation of the quarry and Natural Reserve environment, including fauna and flora inventories, percentage coverage in inventories, etc. the physical environment and bioassays in experimental plots aimed to regeneration of plants through the seeds bank gathered in the quarry and its surroundings and incorporation of variable organic material. Following, restoration was conducted (see pictures below for better representation).

## Result

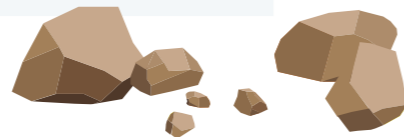
- 47 ha were restored, maintaining the same **biodiversity** levels than the surrounding area.
- Increased environmental **knowledge**, due to a thorough investigation work, considering the place's specificities (80% of the species are endemic, for instance). Current knowledge is now available to the different administrations, so that both Saint-Gobain and local authorities can make full use of the results.
- Saint-Gobain Placo set an environmental **benchmark** for authorities at national and international level, differentiating restoration in arid (deserted) areas from areas with vegetation, mostly endemic, gypsophilous, and determined by the special nature and fragility of the speleothems, part of one of the most and important karst in gypsum around the world.
- Demonstration that mining, that produces wealth and is the main economic drive of the region, is compatible with environmental protection and mineral resources (**sustainability**).
- Besides the symbolic meaning, school and social groups visits have increased, and **investigation** projects at University level, e.g. doctoral thesis, have been conducted.
- Greater knowledge and best practices offered the opportunity to local authorities to rely on this work, releasing areas which were blocked before and allowing extending concessions and extending uptime.
- **Export of this model** to Gelsa Quarry, another similar area to Sorbas, with rapid deployment and immediate results.





## Local Partners

CSIC (Spanish National Organisation of Scientific Investigation)



# Sorbas Almeria

## SPAIN

Company: **Algypsa - ETEX**  
Concession: **Hornos Ibericos III**

## Objective

The restoration of the Etex Sorbas gypsum quarry does not only address the visual impact but also the **biological impact**.

Although the cicatrizing potential of gypsophytes is well known, not all the species are able to recolonize worked out quarries. In Etex Sorbas quarry, an **ecological Restoration based on the knowledge of the species spectrum on site is favoured**, thus avoiding alien species to reach the goal of biodiversity enhancement.

The scientific investigations carried out in this specific Mediterranean environment have been supported by several universities and flora experts.

## Area Sensitivity

The site is located within the LIC "Sierra Cabrera-Bedar" (Natura 2000 Area).





## Context

The gypsum outcrop has a vascular flora with a high variety of exclusive species restricted to this **kind of substrates** (gypsophytes). In addition to vascular plants, there are some rare cryptogams on gypsum soils, like lichens and bryophytes.

The role of cryptogammic crust is almost unrivalled in other world ecosystems and, consequently, it is not surprising that they cover up to 90% of the soil, especially gypsum substrates. This variety of vegetal cover is probably one of the most remarkable features of the Etex Sorbas quarry, which required special attention.

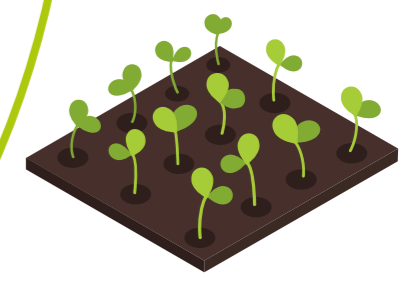


Cryptogammic crust covers **90%** of the soil



**200.000** m<sup>3</sup>

of soil was moved to create slopes



A nursery, able to produce

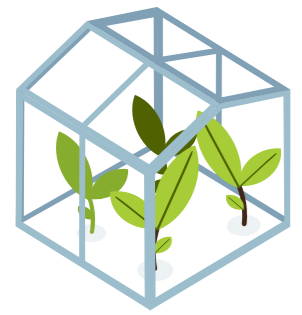
**80.000**

Plants a year

## Solution

Usual artificial rehabilitation results in much altered vegetal communities. This has been avoided in Etex Sorbas quarry rehabilitation programme.

The preservation of the gypsum flora deserves priority protective strategy, so all the seeds, plantations and cuttings come from species originally from the quarry itself to **avoid the risk of introducing alien species** into the outcrop. The restoration of the quarry encompasses the complete system, with all relevant process and components. Thus, we must bear in mind that this quarry is a **mosaic habitat and that all species must be used**, especially those peculiar to the gypsum outcrop and among these, those most vulnerable.



Seeds and plants picked on site and reproduced in a dedicated nursery.



## Result

Works started in 2009. **200,000 m<sup>3</sup> of soil was moved to create slopes from 7.5% to 27%.**

The used material is Gypsum (production sterile and original topsoil from the site). Holes and drains were made, and several hundred plants planted and watered. Seeds and plants picking was organised on the site according to a calendar covering the **seeds ripening from 12 April to December.**

A nursery, able to produce **80,000 plants a year**, was erected in collaboration with Exploitation Rio de Aguas (ERA) and the University of Almeria. This Nursery is located 30 km away from the site to take advantage of quality water in required quantities. Plants production is a process based on three procedures: plants, seeds, propagation by cuttings, again all of them collected in the quarry itself.





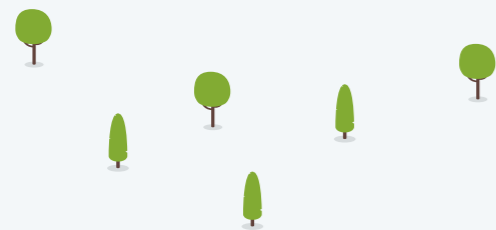
## Local Partner(s)

Exploitation Rio de Aguas (Torralba Group). **Plant Biology and Ecology Department.** University of Almeria – Biointegra



## Area sensitivity

The site is located within the Zona Especial de Conservación “Sierra Cabrera” (Natura 2000 Area).



## 2. Equilibrating the Ecosystem by generating diversified Biotopes in Gypsum Quarries

To evaluate the overall stress of gypsum quarrying on the environment, we need to consider that human activity has influenced the appearance of landscapes fundamentally since farming and settlement began. Even landscapes which appear as untouched nature can often be traced back to cultivation and the conservation of these sites depends on human use.

Although industrial development may cause negative environmental impacts, more often gypsum quarrying creates new and diverse habitats. This is, for example, true in regions where intensive agriculture or population density have put pressure on nature, and where animals and vegetal species seek refuge in former quarries and even in well-managed quarries.

In addition to restoring the original habitats through recultivation or compensating for them elsewhere, quarries themselves offer the opportunity to promote biodiversity by generating diversified biotopes for rare species of amphibians, reptiles, insects, birds, flowers, and plants.





### Context

Quarry covered by **Natura 2000** in course of renaturation.



# Markt Nordheim Bavaria

## GERMANY

Company: **Knauf**

### Solution

- Technical restoration and forming morphology step by step, followed by partly succession or hay sowing.
- Grazing by old cattle breed.
- Hiking trail with six information boards about renaturation and quarries as wildlife habitat.

Along a hiking trail around the quarry

### Six information panels

provide information about the new habitats.

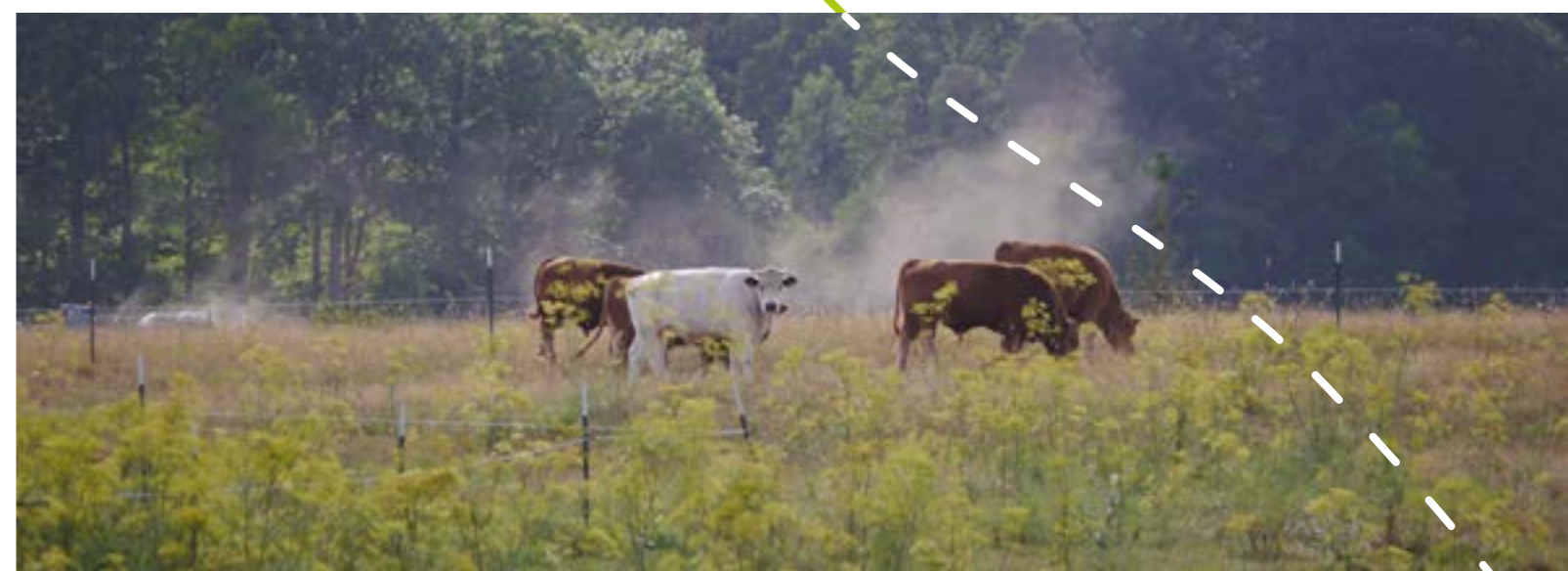


Gelbvieh or "red-yellow Franconian cattle" is an old cattle breed originating in several Franconian districts and now used for grazing in the quarry. It gives excellent beef for local restaurants.

### Objective



Planning and quarrying in an agricultural area to connect different existing biotopes and Natura 2000 areas.







## Local Partner(s)

- Nature conservation association (Landesbund für Vogelschutz in Bayern e.V.);
- Landscape Conservation Organization;
- Regional environmental authorities.



### Thanks to hay sowing,

valuable plant species of xeric grassland have been successfully established, e.g. *Peucedanum officinalis*, *Aster amellus* and *Aster linosyris*

## Result

Different wet and dry biotope types: up to 20 red listed plant and animal species. 10 years monitoring from 2008 to 2018 (assigned each 2 years)



## Area sensitivity

The project takes place between several protected biotopes and Natura 2000 areas. The renatured area of the quarry was designated as a Natura 2000 area and enlarged and connected to the already existing protected areas.





# Markt Bibart Bavaria

## GERMANY

Company: **Knauf**

### Objective

Implementation of different types of biotopes in a 4 ha quarry site: wetlands, rainfall ponds, rocky talus and walls, dry plateaus, etc.



### Context

Quarry covered by Natura 2000 after closure.



More than 15 plant and animal species are now present in the quarry site

### Solution

Technical restoration and forming morphology followed by succession.

### Result

Monitoring after 8 years shows the presence of more than 15 plant and animal species that are red listed. Honored as "Nature Sight" of the Steigerwald Nature Park.





## Local Partner(s)

- Nature conservation association (Landesbund für Vogelschutz in Bayern e.V.);
- Community;
- Forest authorities;
- Landscape Conservation Organization;
- Ecological consultant.



# Ergersheim Bavaria

## GERMANY

Company: **Knauf**

## Area sensitivity

Located inside protected Natura 2000 Forest, the quarry area reaches high biodiversity value and, in the meantime, interaction with forest habitats.

## Objective

Connection of Natura 2000 areas through renaturation and redesign of the land-use by recultivation (creating steppingstone habitats).







### Context

Quarrying in arable land between two parts of Natura 2000 Forest.

### Local Partner(s)

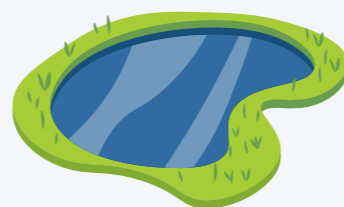
District government, fishing association, forest authorities, landscape conservation organization, ecological consultant.

### Area Sensitivity

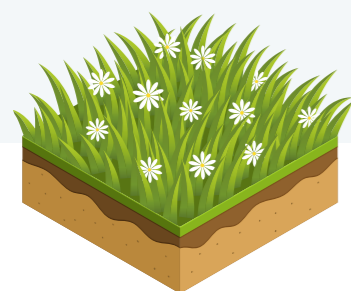
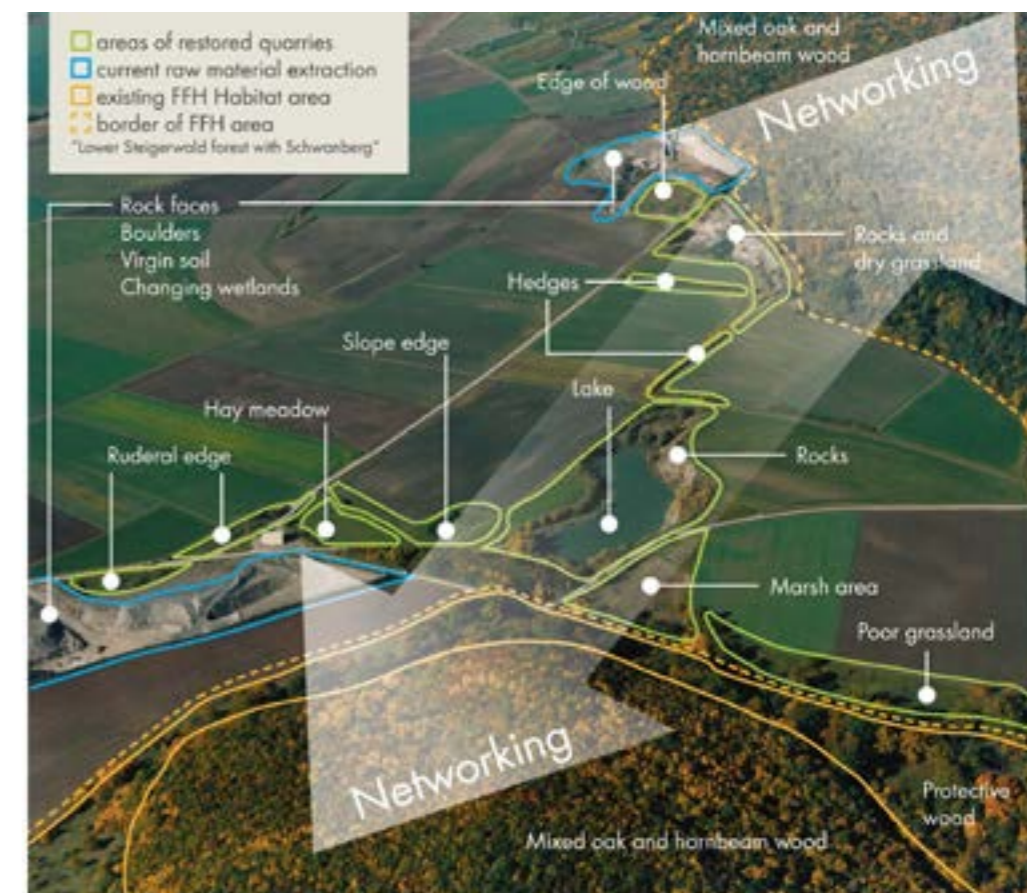
Located next to protected Natura 2000 Forest. Quarry is part of the biotope network (Green Infrastructure) to connect protected areas and increases the biodiversity and ecosystem services of arable land.

### Solution

Technical restoration and recultivation; planting hedges, wildflower meadows, wet meadows, creating of a lake.



**Ideally, as pictured, Knauf renaturation measures lead to linking two different nature reserves.**



### Result

Upgrade of the cultural landscape. Hedges and other near-natural, linear elements enable fauna to be exchanged between the neighbouring forest areas. The lake is used and cherished by the local fishing association.





# Dorste

## Lower Saxony

### GERMANY

Company: Knauf

### Objective

Preservation, stabilization and enlargement of Bufo calamita population (natterjack toad).



### Context

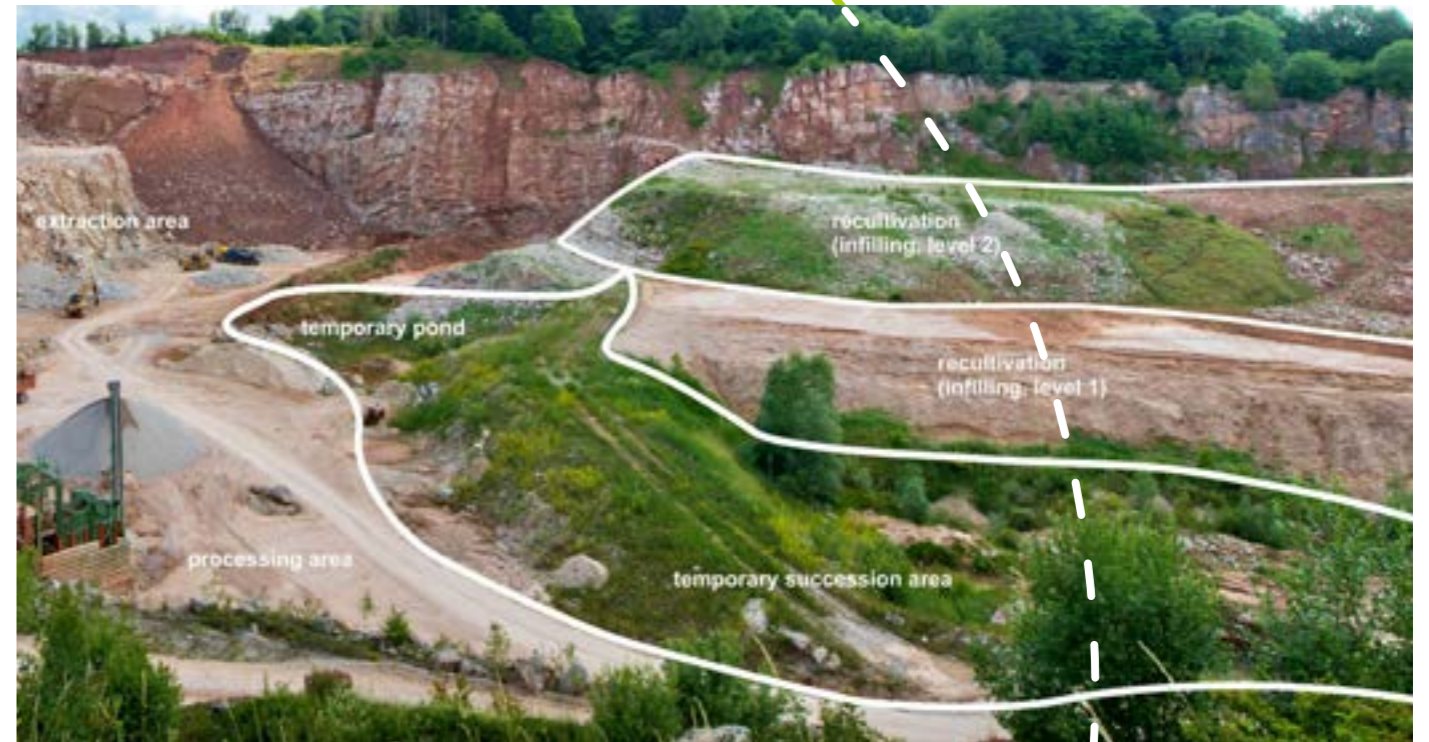
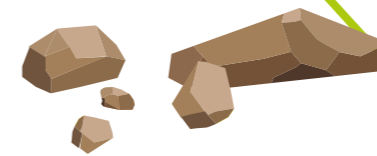
Self-settlement of Bufo calamita inside gypsum quarry, "temporary nature".



### Solution

Quarrying together with biodiversity management, creation of temporary biotopes and construction of 4 new ponds outside extraction area.

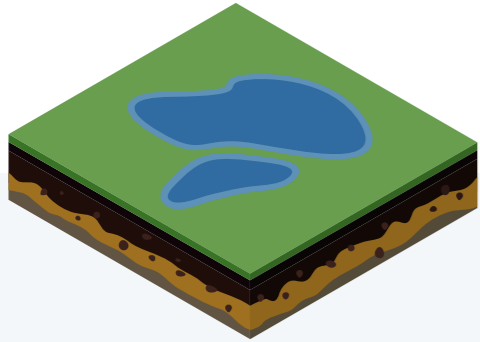
**In the run-up to the recultivation area, temporary ponds and ruderal areas are made possible during the mining process.**





### Result

Immigration of young individuals to new ponds. Establishing of viable population.



### Local Partner(s)

Local NABU group  
(Nature Protection Union Germany)

Sporadically, dry falling pools are perfect spawning habitats for toads and other pioneer amphibians.

The project is adjacent to Nature Protection- and Natura 2000 Area.

### Area Sensitivity



# Bois de Bernouille Seine-Saint-Denis

## FRANCE

Company: Saint-Gobain Placo



### Objective

Preserve and develop the humid environments within the Bernouille forest that are rich in rare batrachians species.

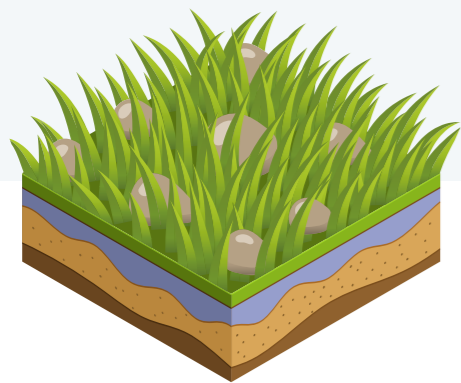


## Context

According to the very rich environmental value, an open cut mining was considered too impacting and underground mining was chosen.

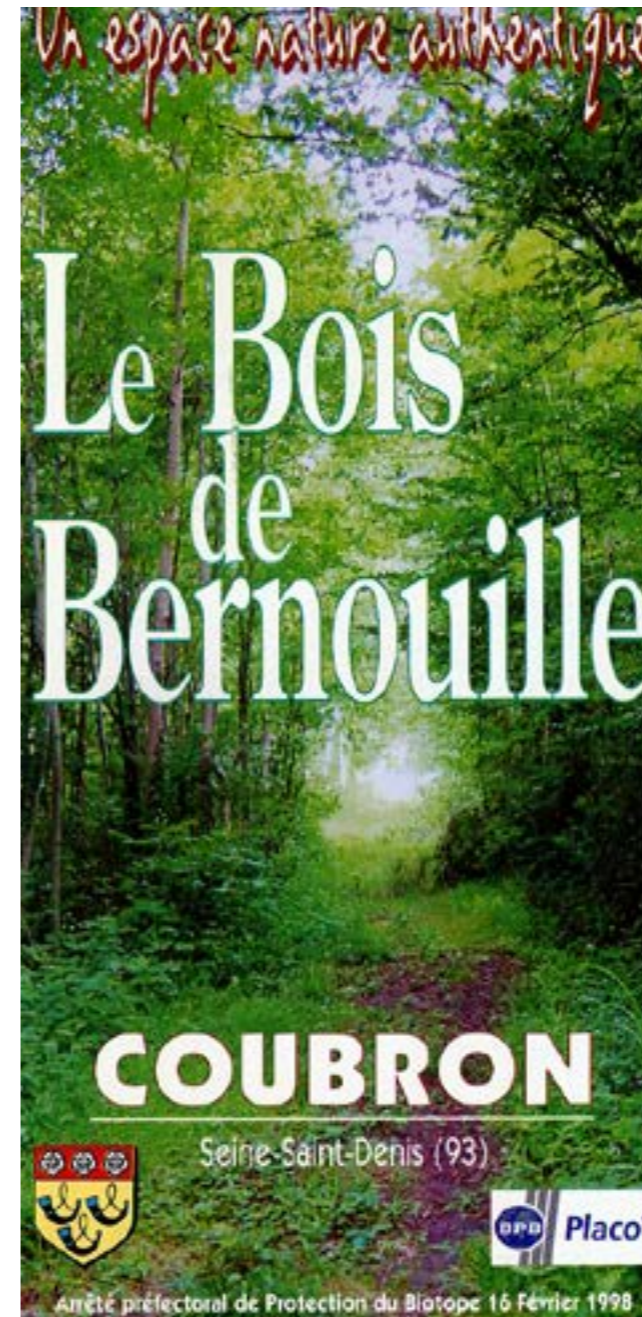
## Solution

An agreement with local communities and environmental associations was signed in 1997. The company funded tracks, observation points and documentation for public visits. Since 1997 the company has provided annual funds to preserve the humid sites.



## Result

The humid environments are preserved while frequently visited.



The forest is valorised by a responsible management plan and the creation of a path for guided tours.



## Local Partners

Local community and environmental associations

## Area Sensitivity

The area is preserved by a biotope protection regulation and it was declared a Natura 2000 site.



### 3. Preserving Natural Assets in Gypsum Quarries during and after Use



## Puchberg am Schneeberg Lower Austria

**AUSTRIA**

Company: **Saint-Gobain Rigips**

Cultural landscape and nature conservation are in many cases compatible. The planning of a new extraction site requires a precise and balanced consideration of environment and economy, thereby building value for society at large. As the extraction process is temporary, the final condition of the site is an essential part of the planning process as shown below.



### Objective

The objective is the protection of red-listed flowers present in the space.



## Context

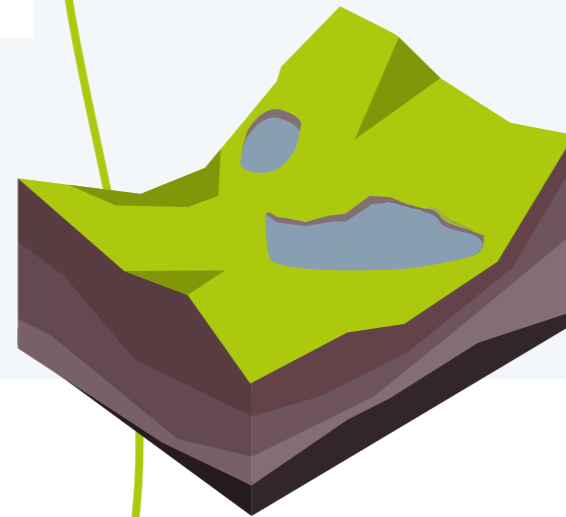
Cultural landscape and nature conservation are often compatible. The planning of a new extraction site requires a precise consideration of environment and economy, building value for society at large.

As the extraction process is temporary, the final condition of the site is an essential part of the planning process. **The Puchberg quarry is in an area with red list flowers within Natura 2000 sites.**



## Result

Annual monitoring of the area shows possibility of protection and preservation of the flora.



## Solution

Transplantation of lawn and the restoration of typical countryside with artificial hills and dips have been performed.

## Area sensitivity

The project occurs in Natura 2000 Area.







# Hartershofen Bavaria

## GERMANY

Company: ETEX GmbH

Many rare and endangered animal plant species depend on secondary habitats as their original habitat has become scarce in the landscape. Anthropogenic habitats, such as quarries, can harbour high biodiversity and provide a substitute for natural habitats. Quarries can show a wide variety of habitat types for specialised species.

### Objective

Protection of the yellow-bellied toad (Gelbbauchunke) and crested newt (Kammolch), protected species.



### Context

The Gipshütte quarry is in a Natura 2000 protected area.



### Solution

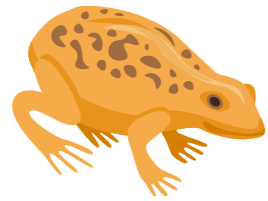
The operation of the quarry is paused during the reproduction period of the frog, as the latter favours this karstic area.





## Result

Best conditions are definitively maintained for the frogs' development and breed.



## Area Sensitivity

The quarry is in a Natura 2000 area.



**The yellow-bellied toad, whose habitat is the pond, is strongly protected in the Gipshütte quarry.**



# Borgo Rivola Emilia-Romagna

## ITALY

Company: **Saint-Gobain Italia SPA**



## Objective

The objective is the protection of the bats' colony.

A quarry represents a mosaic of different habitat types, ranging from open waters with wetland vegetation at floor level to exposed, xeric sites at the steep rocky slopes.

Much of the land needed for quarrying is only borrowed – the quarrying industry works hard to ensure that the loan is repaid with interest.



### Context

Extension area and old mining tunnels under open pit quarry within Natura 2000 areas.

### Result

6 bats species use old mine tunnels as karst environment alternative; reproductions and increase of the bats' population; 3000 specimens' colony.

### Local Partner

Local naturalistic association

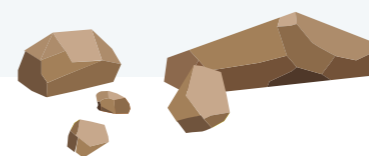
### Area Sensitivity

The quarry is in Natura 2000 areas. Bats species are: Rhinolophus ferrumequinum, Rhinolophus hipposideros, Rhinolophus Euryale, Myotis myotis, Myotis blythii and Miniopterus schreibersii.

### Solution

Partial closure of old tunnel's entrance and bat boards installation in the woods for quarry extension; underground climate habitat assessments, bats survey and periodical monitoring.

- Open pit quarry: 62,000 m<sup>2</sup>
- 13 km (in 4 levels) of mine tunnels
- Bats use of mine tunnels
- 25 bat boards in the woods







# Lantosque

## Alpes-Maritimes

### FRANCE

Company: **ETEX France**

For quarrying businesses, biodiversity work means good business practice. It helps to secure licenses to operate from national and regional authorities as well as the local communities in which quarries are located. There are potential cost savings to be gained by thinking ahead and planning for biodiversity. Biodiversity is also a useful means of engaging these communities in the industry and helping to strike a balance between social, economic and environmental needs of sustainable development.

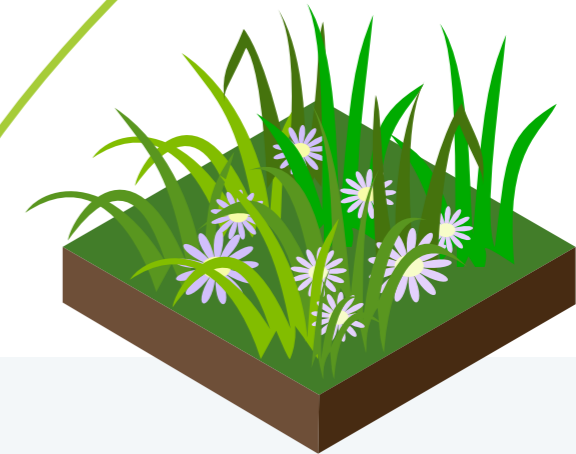


### Objective

Protect the Iberis Linifolia

### Context

Presence of protected species in the quarry.



### Solution

Setting a protection all around the plants; watching on the dust all around the area

### Protection of the Iberis Linifolia in the quarry area

### Result

The species are maintained.







# Gotham Nottinghamshire

## UNITED KINGDOM

Company: Saint-Gobain British Gypsum

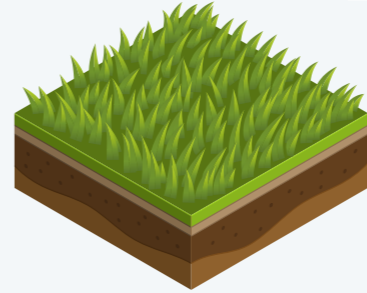
### Objective



Promote wildlife and nature conservation along the road verges of Gypsum Way, Gotham, UK.

### Context

The company was approached by a local wildlife group (Nottinghamshire Wildlife Trust) regarding habitat management and possible assistance. Prior to this, there was no planned management and habitats were lost due to over mowing.

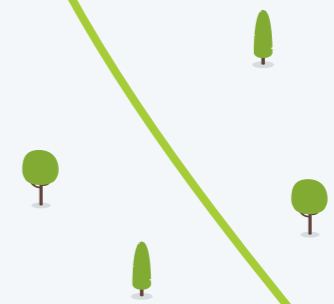


### Solution

A management programme was developed in conjunction with the local wildlife group with approval of "The Wildlife Trust" and local authority (responsible for highway maintenance).

**"The preservation of biodiversity is not just a job for governments. International and non-governmental organisations, the private sector and each and every individual have a role to play in changing entrenched outlooks and ending destructive patterns of behaviour"**

Kofi Annan, UN Secretary General on the 2003 International Day of Biological Diversity





# Result

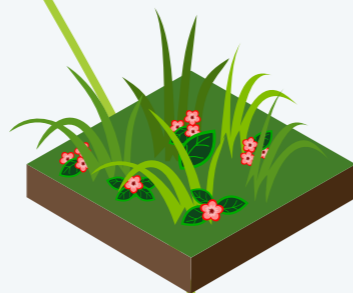
Increased botanical interest adjacent former gypsum sites and next to local primary school. Species promoted include small mammals (such as harvest mice), amphibians, birds, and insects such as butterflies. Blue Butterfly plaques are present showing scheme in place.



**The Blue Butterfly Scheme aims at managing existing wildflower areas, restoring neglected areas and creating new ones.**

## Local Partner(s)

Nottinghamshire Wildlife Trust



Considered local interest. Benefits = promotion using "Blue Butterfly scheme" plaques

## Area Sensitivity



# Castellina Marittima Tuscany

# ITALY

Company: **Knauf**

## Objective

Quarry restoration with local Mediterranean varieties of Maquis shrubland.





## Context

Gypsum mining activities next to a prestigious setting with touristic and religious activities.



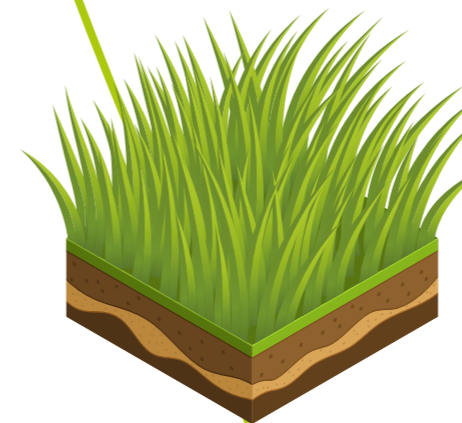
## Solution

- Creating pilot areas for next expansion following proliferation of the Mediterranean forest.
- Use regional seed (hydroseeding), planting of shrubs, hedges, and trees.



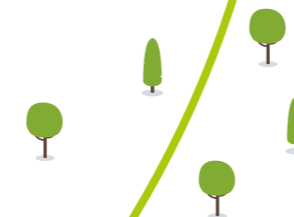
## Results

Successful establishing and expansion of the local vegetation and plant society.



## Local Partner

Department of Environmental Protection



Planting of typical trees and shrubs of the local Maquis plant society



Typical representatives of this plant society are the Yellow Fleabane Gorse and different Genista species, which build large stocks



The establishment of xeric grassland using a hydroseeding process was very successful





## Area Sensitivity

The project is not in or next to a protected area, but some plant species are protected.



## 4. Enhancing Mitigation of Climate Change and Nature Conservation in Gypsum Quarries after Use

Human-induced climate change is a growing concern to society. It already has a perceptible impact on biodiversity and notably on the geographical range, phenology, behaviour, and genetic diversity of organisms. Climate change also exacerbates other threats to biodiversity, such as habitat fragmentation and biological invasions.

Historically, nature conservation practices have mainly relied on traditions. However, the context is changing. Human activities are exerting more and more pressure on the natural environment. In addition to habitat destruction and fragmentation, invasive species, pollution and over-exploitation, climate change now adds to the list of human-induced drivers of biodiversity loss. Climate change already has perceptible impacts on the geographical range, phenology, behaviour, and genetic diversity of organisms. Particularly worrying is the fact that climate change combines and can exacerbate the effects of other threats to biodiversity. For example, species might not be able to adapt their ranges to track changing climatic conditions in a fragmented landscape or invasive alien species might find new opportunities under changing climate.

Quarries can support species in their mechanisms of adaptation to climate change. Either by using active or renatured quarries as steppingstone biotopes and supporting migratory movements as part of a biotope network, or by specifically settling populations of species threatened by climate change in such quarries (“assisted colonisation” or “assisted migration”)<sup>4</sup>.

The establishment of vegetation can be initiated by the planting of native trees and bushes as well as by the seeding of native grasses and wildflowers. The success is already visible after a year, when the soil is covered by a closed vegetation. However, directed restoration techniques are only indispensable if rapid vegetation development is required. The structural diversity can be advanced by aerating or fracturing the surface with overburden for the creation of a physical form that provides favourable conditions for the establishment of a diverse plant community. Another technique, called “diaspore bank”, consists in applying lower levels of topsoil, to retrieve the seeds from past vegetation. Enriching structural elements are rubble, screes, and rocky slopes as well as temporary and permanent waters. These structures are habitats for numerous plant and animal species and underline the importance of quarries for the natural balance of eco-systems.

<sup>4</sup> The following projects illustrate this point: [www.life-bovar.com](http://www.life-bovar.com).





# Cormeilles Val d'Oise

## FRANCE

Company: **Saint-Gobain Placo**

### Objective

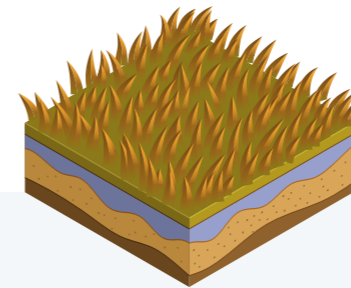
Rehabilitation of 110 hectares by developing various environments and generating biodiversity. The site will be opened to the public after rehabilitation.

Rehabilitated gypsum quarry with a view of Paris city



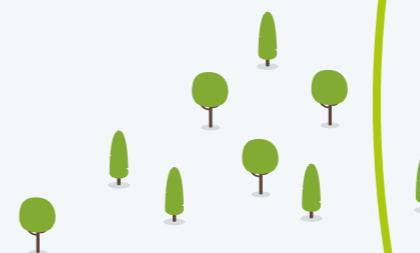
### Context

Gypsum mining has been operating since the 19th century and is still ongoing. According to the high stripping ratio, the moving pit represents 15 million m<sup>3</sup> and is 100m deep.



### Solution

About 8 million m<sup>3</sup> of earth moving materials were brought from outside to get the final profile. More than 70,000 trees were planted. Creeks and ponds were created to manage the water flows and let install humid areas.



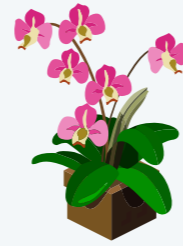


## Result

A very scenic landscape was created including a marvellous view of Paris city. Various environments were generated, biodiversity increased, for instance a dynamic colonisation by rare orchids appeared.



Local community and environmental associations. Through a global agreement, about 50 hectares were already given to the regional community and the remaining surfaces are progressively given.



## Local Partners



A dynamic colonisation of flowers, including the Black locust (*Robinia pseudoacacia*, left) and Sainfoin (*Onobrychis viciifolia*, right).



# Coubron-Vaujours Seine-Saint-Denis

## FRANCE

Company: Saint-Gobain Placo

## Objective

Rehabilitation of 120 hectares of historical open cut mining operation; development of different environments and biodiversity generation.





## Context

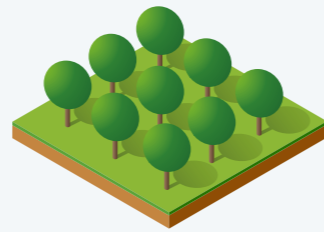
Gypsum mining operated since early 20th century by previous companies had let a wide area of pits and dumps.

About

**70.000**  
trees were  
planted

## Solution

A global rehabilitation plan was designed. About 6 million m3 of earth moving materials were brought from outside to get the final profile. About 70,000 trees were planted within the quarry and a wide area devoted to grass settled. Creeks and ponds were created to manage the water flows and let install humid areas.

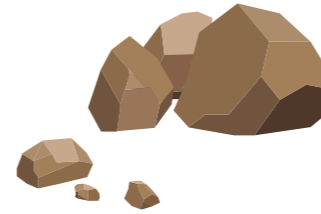


## Result

A very scenic landscape was created, and various environments led to a rich biodiversity development that should now be maintained.

## Local Partners

Local community and environmental associations.



A view of the rehabilitated Coubron Vaujourns quarry



## Area sensitivity

The area is next to a Natura 2000 site.





# Turda Cluj County

## ROMANIA

Company: Saint-Gobain Rigips  
Romania RLR

### Objective 1

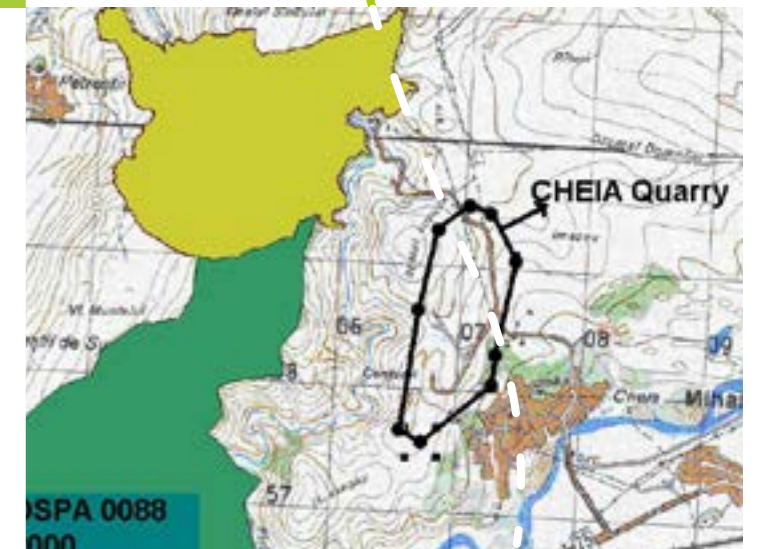
Quarry area	100,09 ha
Actual extraction area	approx. 10 ha
Re-establishing by forestation area	1,3 ha
Bedded species	Robinia pseudacacia, Pinus nigra, Gleditsia triacanthos, Eleagnus angustifolia

### Objective 2

Evaluating the impact on the bird population from Natura 2000 protected area ROSPA0088

1. The objective is a part of the environment re-establishment project for the gypsum **Cheia Quarry**.
2. The evaluation is part of the paperwork needed in the permitting procedure.

### Context



Location of the Quarry and N2000 site

### Objective

1. Reintroducing on the natural circuit of old quarry dumps (start date: November 2008).
2. Evaluating the impact on the birds' population from Natura 2000 protected area ROSPA0088.



### Solution

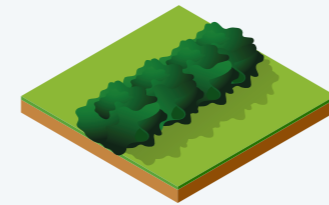
1. Forestation of an area of 1,3 ha
2. Expert study





## Result

The success of the forestation is regularly evaluated to achieve a reduction of the visual impact of the quarry in the protected areas and re-establish the ecological equilibrium of the area. Quarry activities do not significantly affect the bird species from the Natura 2000 protected area.



## Local Partners

1. Silvicultural authorities of Cluj County
2. Biodiversity experts licensed by the Environmental Ministry

## Area Sensitivity

The Natura 2000 site is situated 2 km from the quarry perimeter.



## 5. Promotion of Cultural Heritage within preserved Ecosystems

Some of the most exciting archaeological discoveries of our age have been made as a direct result of quarrying. The industry has contributed in funding to ensure that archaeologists have had every opportunity to uncover the secrets of the past and to make accessible to the great public the cultural heritage of Europe.





# Borgo Rivola Emilia-Romagna

## ITALY

Company: **Saint-Gobain Italia SPA**

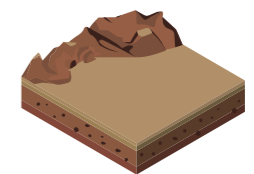


### The "Tana del Re Tiberio" is a natural gypsum cave with bronze age finds and bats habitats.

The karst system is long 4,500 meters and the final karstic part (60 meters) of the caves is famous for archeological aspects.

### Context

Gypsum caves inside quarry pertinence area (quarry shafts, conveyors and crushing chambers) are within Natura 2000 areas and archaeological sites.



### Solution

Caves were put in safety and under monitoring programme; a contract/ agreement with local municipality was signed to develop a museum and tourist visits.

### Objective

"Re Tiberio" cave valorisation



### Result

- Funds for archaeological excavations and museum implementation within the cave;
- Preservation of archaeological and karst habitats;
- Sustainable improvement of quarrying activity with archaeological site;
- Public's and authorities' positive opinion.





## Local Partners

Riolo Terme Municipality, Ravenna Province, Emilia-Romagna Region, Regional Archaeological Supervisor Agency



## Area Sensitivity

The cave is in Natura 2000 areas (bats and karst) and archaeological sites.



Static consolidation work has been carried out under Re Tiberio cave and a monitoring programme is in place to allow archeological excavations and visits in safety.



# Borgo Rivola Emilia-Romagna

# ITALY

Company: Saint-Gobain Italia SPA

## Objective

Gypsum karst systems scientific studies.



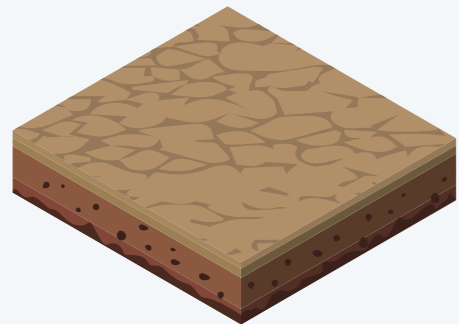


## Context

Gypsum caves are near an open pit quarry and inside quarry pertinence area (quarry shafts, conveyors and crushing chambers) within Natura 2000 areas and archaeological sites.

## Solution

- PhD's;
- Hydrogeology-geological-speleological studies;
- Caves assessments and survey.



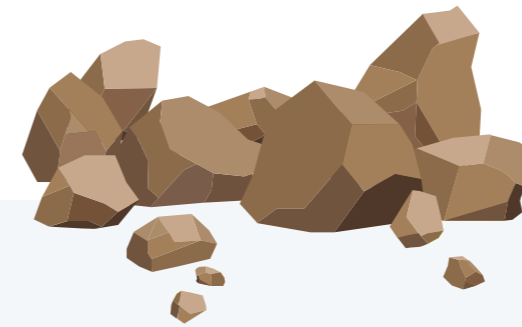
## Result

Mineralogical, regional structural and spelogenesis findings as contribution to scientific research in gypsum deposits.



## Local Partner

University of Pavia Earth Science Department



Due to its touristic interest, the last 60 meters of the caves have been given for free use to the local municipality for 99 years, in order to implement the "Re Tiberio cave museum" and other archaeological excavations with public and private funds, and to manage tourist visits with the intent to valorise and promote the local area.

## Area Sensitivity

It is a Natura 2000 area (bats and karst).







# Robertsbridge East Sussex

**UNITED  
KINGDOM**

Company: **Saint-Gobain British  
Gypsum**



## Objective

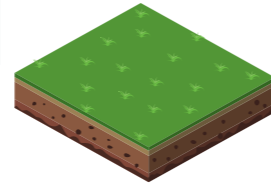
Open up the culverted River Line enhancing habitat for wildlife and preventing possible pollution of the water course from the adjacent landfill.

6. Restoration of quarries in line with Water Protection, a way to mitigate Climate Change



## Context

The River Line was running in a 1 km steel culvert underneath the on-site landfill. The landfill has been closed and capped for a number of years but was historically used for depositing gypsum production waste producing high-sulphate leachate and there were concerns with regards to the integrity of the culvert.



**The river line was diverted to enhance wildlife habitats.**

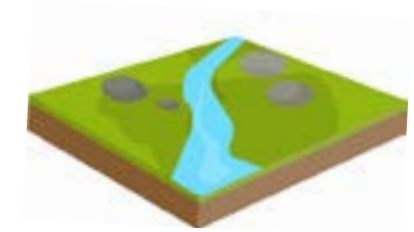


## Solution

Divert the River Line around boundary of landfill opening it up over most of its length.

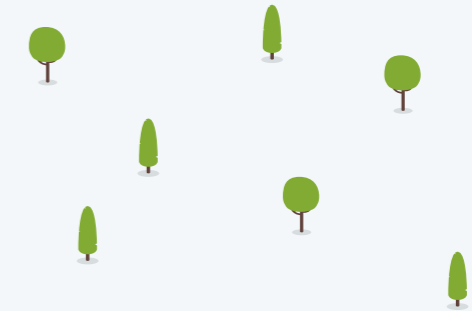
## Result

Significant enhancement of wildlife habitat – notably more birds in the area.



## Local Partner

Environment Agency



## Area Sensitivity

Yes – The site is situated in an area of outstanding natural beauty and there are two sites of special scientific interest in the close vicinity of the project area.





# Carresse

## Pyrénées Atlantiques

### FRANCE

Company: ETEX France

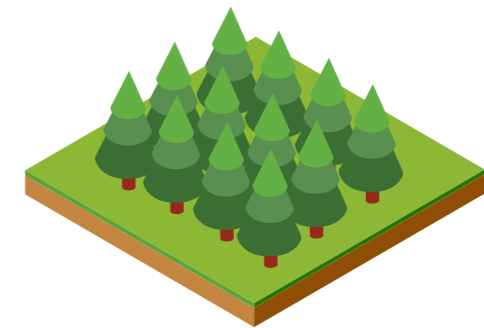
#### Objective



Quarrying enhancing a river classified in Natura 2000.

#### Context

Significant enhancement of wildlife habitat – notably more birds in the area.



#### Solution

A specific impact assessment study has been carried out. A protection band was foreseen before the quarry started. The Saleys river was diverted in the past to surround the mining area. Today, the riparian forest and the river within the authorization perimeter cross the site. The forest constitutes an over 2 km-long corridors, and it allows the free movement of fauna. This continuity is essential for the local ecological functionality conservation, particularly of the fauna dependent on wetlands. In the 2020 ecological diagnosis, this riparian forest was described as belonging to a community habitat called Alder and Ash forest with remote sedge of small streams "(Aulnaie-Frênaie à Laïche espacée des petits ruisseaux).



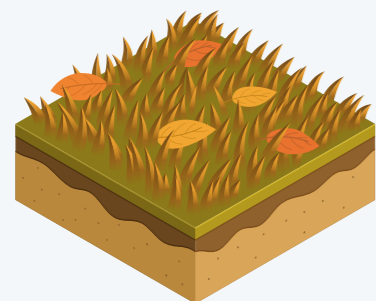
## Local Partner

Direction Régionale de  
l'Environnement



## Area Sensitivity

Natura 2000 N° FR  
7200791



**The river plays an essential role as a corridor to enhance ecological connectivity.**

# Conclusion

The biological variety of life on Earth is commonly referred to as biodiversity. The number of species of plants, animals and microorganisms, the enormous diversity of genes in these species, the different ecosystems on the planet such as deserts, rainforests and coral reefs are all part of a biologically diverse Earth. Appropriate conservation and sustainable development strategies attempt to recognize this as being integral to any approach. Almost all cultures have in some way recognized the importance that nature and biological diversity have had upon them and the need to maintain them.

Greater biodiversity makes species<sup>5</sup> and systems<sup>6</sup> more resilient, while loss of biodiversity weakens them, making them more vulnerable to extinction. If a large proportion of the biosphere is invested in only a small number of species (such as humans and their associated domesticated/cultivated species), this will result in an inherently unstable system.

The biodiversity interactions and functions within ecosystems have developed and evolved over countless years. Changes that have occurred ever so slowly over time have allowed for adaptation of species and ecosystem survival. Nevertheless, catastrophic and rapid changes can have a disastrous effect on ecosystems and biodiversity of species. Among these are natural events such as volcanic eruptions, floods, tsunamis and hurricanes. Other disruptions and destruction of the natural environment and biodiversity occur through rapid and harmful human activities.



<sup>5</sup> A group of related and similar living organisms that can interbreed among their own species and produce fertile offspring.

<sup>6</sup> All the living organisms and all the non-living components of a given area interacting as a whole functional unit.



A rapidly growing concern is the impact of climate change on biodiversity. Indeed, climate change could lead to a shift in ecosystems-poleward and upward. In tropic savannah, a move into former forest areas could occur as well as changes in services provided by ecosystems (provisioning, water regulation, climate regulation).

Biodiversity is connected to climate change mitigation in three ways:

- Biodiversity can contribute to adaptation;
- Each climate change measure does not automatically contribute to biodiversity conservation and ecosystem services maintenance (i.e. biofuel crop production, afforestation of biodiversity habitats);
- The biodiversity conservation sector itself needs to adapt.

We are thus faced with the challenge of finding solutions for both combating climate change and halting biodiversity. The main goal to win this challenge is to preserve ecosystem and ecological integrity by:

- Maintaining numerous and therefore genetically viable populations of native species within large enough, non-contaminated habitats.
- Maintaining life-supporting processes in ecosystems which maintain ecosystems (and which are expressed by the term ecosystems services)<sup>7</sup>.

Acting in this way, biodiversity and climate change will co-benefit bearing in mind that “Biodiversity needs to be an integrated part of the general mitigation and adaptation efforts”<sup>8</sup> and that we cannot halt biodiversity loss without addressing climate change, as it is equally impossible to tackle climate change without addressing biodiversity loss.

The biodiversity’s response to climate change will be revealed through a vast effort of time, talent and knowledge, along with a platform of input, integration, mapping, and integration.

In front of these challenges facing our Society, the European gypsum industry is conscious of its responsibility to go further towards an eco-system approach, thereby contributing to shaping our customers’ overall quality of life – not merely in the products that we supply, but also in ensuring that we do not degrade other aspects of society in the process. Through our products and solutions, we aim to create a world that is aesthetically pleasing, biologically stable and economically productive. However, we also know that we are a small drop in the ocean. We need all economic, societal, and political actors to play their part in taking up this critical challenge for our environment and the welfare of our societies.

<sup>7</sup> Green Week 2009: Slides presentation on the potential of co-benefit approaches: “Contributing to both combating climate change and halting biodiversity loss”. Jan Plesnik, Agency for nature conservation and landscape protection of the Czech Republic, Prague.

<sup>8</sup> Aarhus Conference, Beyond Kyoto, 2009.





# EUROXGYPSUM

THE VOICE OF THE EUROPEAN GYPSUM INDUSTRY

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