Interreg Europe

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INERTWASTE

Transforming inert waste into technosoils for the restoration of mining areas.

Restoration of the mine of Eugi (northern Spain).

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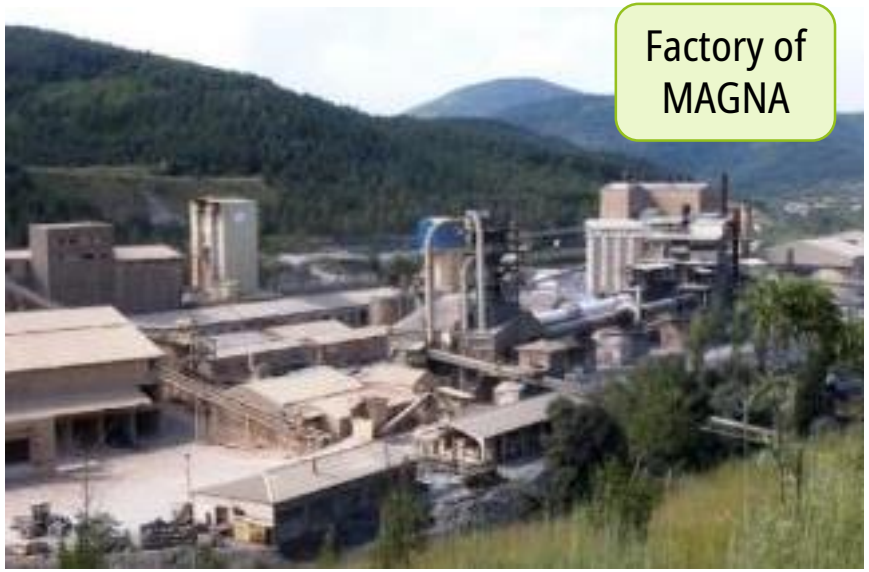
CONTEXT

- MAGNA is a mining company, leader in the production of magnesium oxide based solutions.
- Located in Navarra (northern Spain), it operates in 45 countries.
- MAGNA has the commitment to restore its mine of Eugi (Navarra).



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KEY ISSUES OF THIS PRACTICE

- **WASTE ACCUMULATION:**
  - Lack of space to store inert waste derived from MAGNA's manufacturing process.
  - > 21.707 m^3 sludges/year.

- **SCARCITY OF SOIL FOR RESTORATION:**
  - High demand of topsoil: > 10.000 m^3/season.
  - Lack of extraction sites.
  - High transport costs: 40 km per truck journey.
  - Poor soil quality: cold, from deep layers, debris contamination, crop field seeds, etc.

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SOLUTION FOR THE KEY ISSUES

- **Using the inert waste generated by the factory to create technosoils for the restoration of the mine.**

- *"Technosoil": engineered soil created for land improvement, made using a mix of organic and inorganic materials.*

- A pilot project was conducted in 2019-2024.

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PILOT PROJECT

- Total cost: 667.753€
- Public funding: 12%

Gobierno de Navarra Nafarroako Gobernua

AGENDA 2030

Regional

MINISTERIO DE ECONOMÍA Y COMPETITIVIDAD

CDTI Centro para el Desarrollo Tecnológico Industrial

National

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PILOT PROJECT: DESIGN OF THE TECHNOSOIL MIXTURE

- 5 technosoil mixtures were prepared + control soil.
- Mixtures were designed to achieve a loam soil texture.
- All the inert waste used came from MAGNA.
- Organic matter was introduced for soil fertility enhancement.

MAGNA materials (all inert, without contaminants nor heavy metals)

Nearby organic matter input

Phosphorus supply

% in the mix		Technosoil 1	Technosoil 2	Technosoil 3	Technosoil 4	Technosoil 5	Control soil
Inorganic waste (INERT)	Sand 1-4 mm	20	20	30	20	20	Natural soil of the mine
	Sand 4-12 mm	20	20	0	20	20	
	Sulfamag	0	0	15	0	0	
	Sludge	30	35	30	35	30	
	Flotation tailings	15	15	15	15	15	
Organic waste	Peat	0	0	0	5	0	
	Compost	15	10	10	5	10	
	Manure	0	0	0	0	5	
	Struvite	0,1	0,1	0,1	0,1	0,1	

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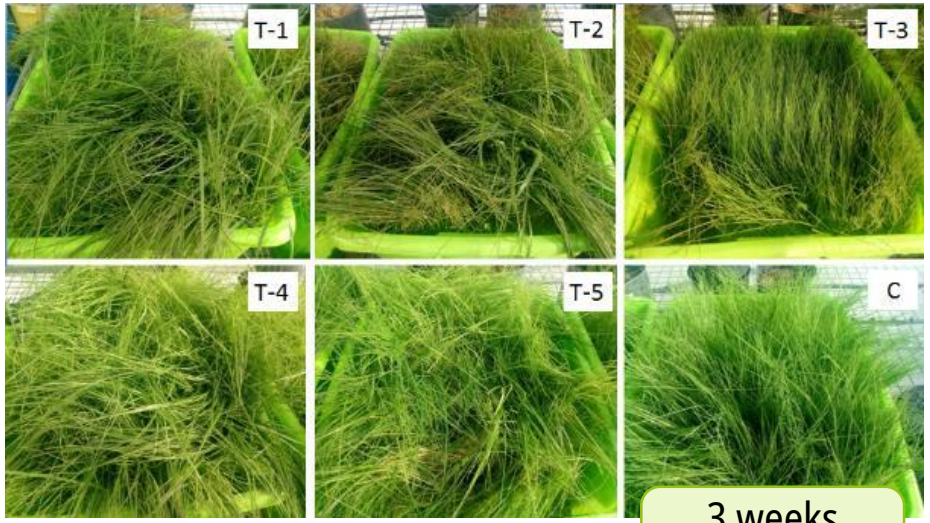
PILOT PROJECT: GREENHOUSE AND LABORATORY TRIALS

- Soil samples taken every 15 days during one year.
- Technosoils #1 and #5 were selected as best options due to high nutrient availability, rapid surface coverage, good height growth, and correct pH/conductivity.

Time of sowing



3 weeks after sowing

Technosoil	Sand	Clay	Silt	Texture	Ph	CE	O.M. %
1	31	9.6	59.4	silty-loam	8.24	446	1.2
2	36.9	17.8	45.3	loam	8.66	171.7	1.05
3	61	25.4	13.6	silty-clay-loam	9.4	2490	0.9
4	30	12.6	57.4	silty-loam	9.11	566.5	1.01
5	38.6	4.8	56.6	silty-loam	8.44	233.9	2.01
Control soil	82	2.4	15.6	sandy	7.31	158.5	3.07

Example of results

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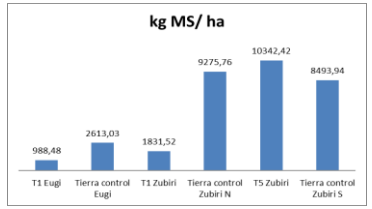
PILOT PROJECT: FIELD TEST

- Field tests were carried out with technosoils #1 and #5.
- The mixture was prepared on a larger scale and spread in various locations.
- Under outdoor conditions, technosoil #5 showed the highest cover and herbaceous growth, due to the manure content. Similar properties or better than natural soil.



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PILOT PROJECT: OTHER TECHNOSOIL APPLICATIONS

- Additional tests were carried out to evaluate the potential of technosoils for recreating natural grassland.
- Technosoils achieved good vegetation cover and similar species diversity compared to other soils.

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CONCLUSIONS AND NEXT STEPS

- Technosoils help to convert waste into a resource, and have shown to be viable for landscape restoration.
- Technosoils created from MAGNA's inert waste address the issues of storage limitations and the scarcity of soil in the market.
- MAGNA plans to scale-up the use of technosoils in the restoration of entire slopes.
- The Government of Navarra will use this practice to improve the ERDF within the INERTWASTE project.

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MAIN CHALLENGES

- **Scalability**: scaling up the production of technosoils to integrate large-scale projects in the production system of MAGNA.
- **Cost and logistics**: producing, transporting, applying technosoils at large scales may require significant investments in infrastructure and equipment.
- **Designing appropriate mixtures**: creating technosoils with the necessary physical, chemical, and biological properties for vegetation growth requires a deep understanding of local soils and vegetation.

Thank you
¡Gracias!
Eskerrik asko!

www.interregeurope.eu/INERTWASTE