

REMEDICATION OF CONTAMINATED MINING SITES TO HALT THE LOSS OF BIODIVERSITY AND ECOSYSTEM SERVICES

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- ✘ Mining has always had a dual role in industrial development, both in scope of scientific and technical innovations as well as a supplier of raw materials needed to develop industries and transport, being a decisive factor in developing of geographical areas.

EUROPEAN LEGISLATION

- ✘ Directive 2006/21/EC of the European Parliament and of the Council of 15 March 2006 on the management of waste from extractive industries and amending Directive 2004/35/EC - Statement by the European Parliament, the Council and the Commission
- ✘ 2009/360/EC: Commission Decision of 30 April 2009 completing the technical requirements for waste characterization laid down by Directive 2006/21/EC of the European Parliament and of the Council on the management of waste from extractive industries (notified under document number C(2009) 3013)
- ✘ 2000/532/EC: Commission Decision of 3 May 2000 replacing Decision 94/3/EC establishing a list of wastes pursuant to Article 1(a) of Council Directive 75/442/EEC on waste and Council Decision 94/904/EC establishing a list of hazardous waste pursuant to Article 1(4) of Council Directive 91/689/EEC on hazardous waste (notified under document number C(2000) 1147) (Text with EEA relevance)

EUROPEAN LEGISLATION

- ✖ 2009/337/EC: Commission Decision of 20 April 2009 on the definition of the criteria for the classification of waste facilities in accordance with Annex III of Directive 2006/21/EC of the European Parliament and of the Council concerning the management of waste from extractive industries (notified under document number C(2009) 2856)
- ✖ 2009/360/EC: Commission Decision of 30 April 2009 completing the technical requirements for waste characterization laid down by Directive 2006/21/EC of the European Parliament and of the Council on the management of waste from extractive industries (notified under document number C(2009) 3013)
- ✖ 2009/335/EC: Commission Decision of 20 April 2009 on technical guidelines for the establishment of the financial guarantee in accordance with Directive 2006/21/EC of the European Parliament and of the Council concerning the management of waste from extractive industries (notified under document number C(2009) 2798)

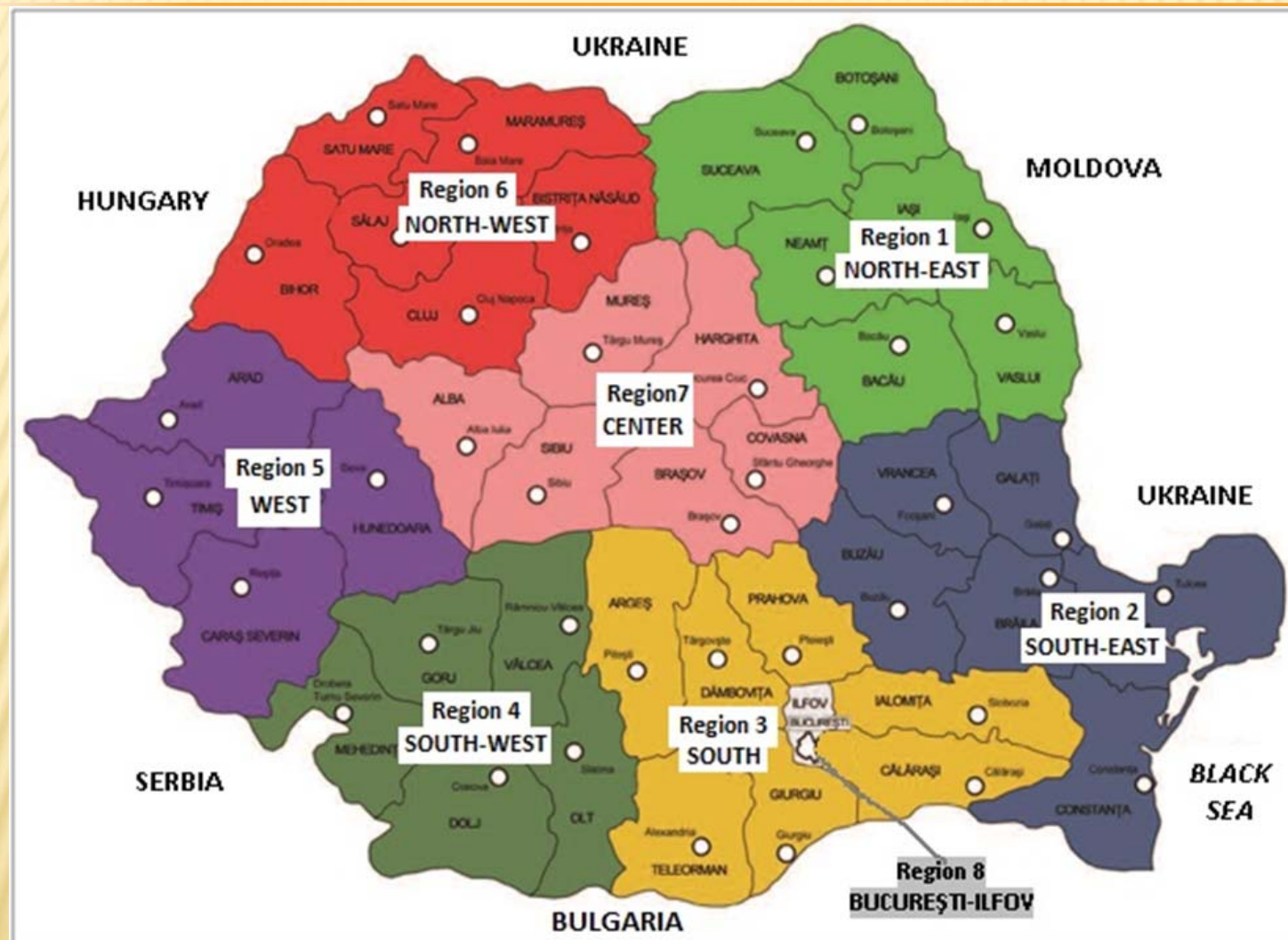
NATIONAL LEGISLATION

- ✗ Mining Law no. 85/2003
- ✗ Government Decision no. 856/2008 on the management of extractive waste
- ✗ Order no. 2042 of 22 November 2010 approving the procedure for the approval of the waste management plan in the extractive industries and its content normative
- ✗ Government Emergency Ordinance 68/2007 on environmental liability with regard to the prevention and repair of environmental damage
- ✗ The Mine Closure Manual, approved by Order 273/2001 of the Ministry of Industry and Resources

The 2016 national inventory identified 984 potentially contaminated sites spread across economic sectors in which 156 potentially contaminated sites in mining and metallurgy industry.

The largest area in the Romanian regions are :

- ✖ West (23.2%),
- ✖ Northeast (20.5%),
- ✖ North West (19.7%),
- ✖ Central (12.3%) and
- ✖ South West Oltenia (12.2 %).



In Suceava County, the North -West Region, there are significant deposits of copper ore, manganese, salt, uranium ore, baritine, sulfur, natural gas, construction rocks, peat and mineral waters.

Of great importance after the First World War was the exploitation and valorization of manganese. At present only the Ulm deposits (Dorna Arini) are exploited.

The distribution of production waste by extractive industry, as reported by the economic operators in the annual statistical questionnaires for 2011-2015, is shown in Table 1.

Table 1. Generation of non-hazardous production waste from extractive industry in Suceava County, 2011-2015

(Source: Annual Statistical Survey on Waste Generation and Management, LEPA Suceava)

Economic activity	Quantity (tonnes)				
	2011	2012	2013	2014	2015
Extractive industry	24,720.28	14,6966.23	13,8848.57	23,2504.94	55,6283.68

One of the major problems of the mining industry is the storage of residues from both extraction and ore preparation.

The impact of this mining waste is on:

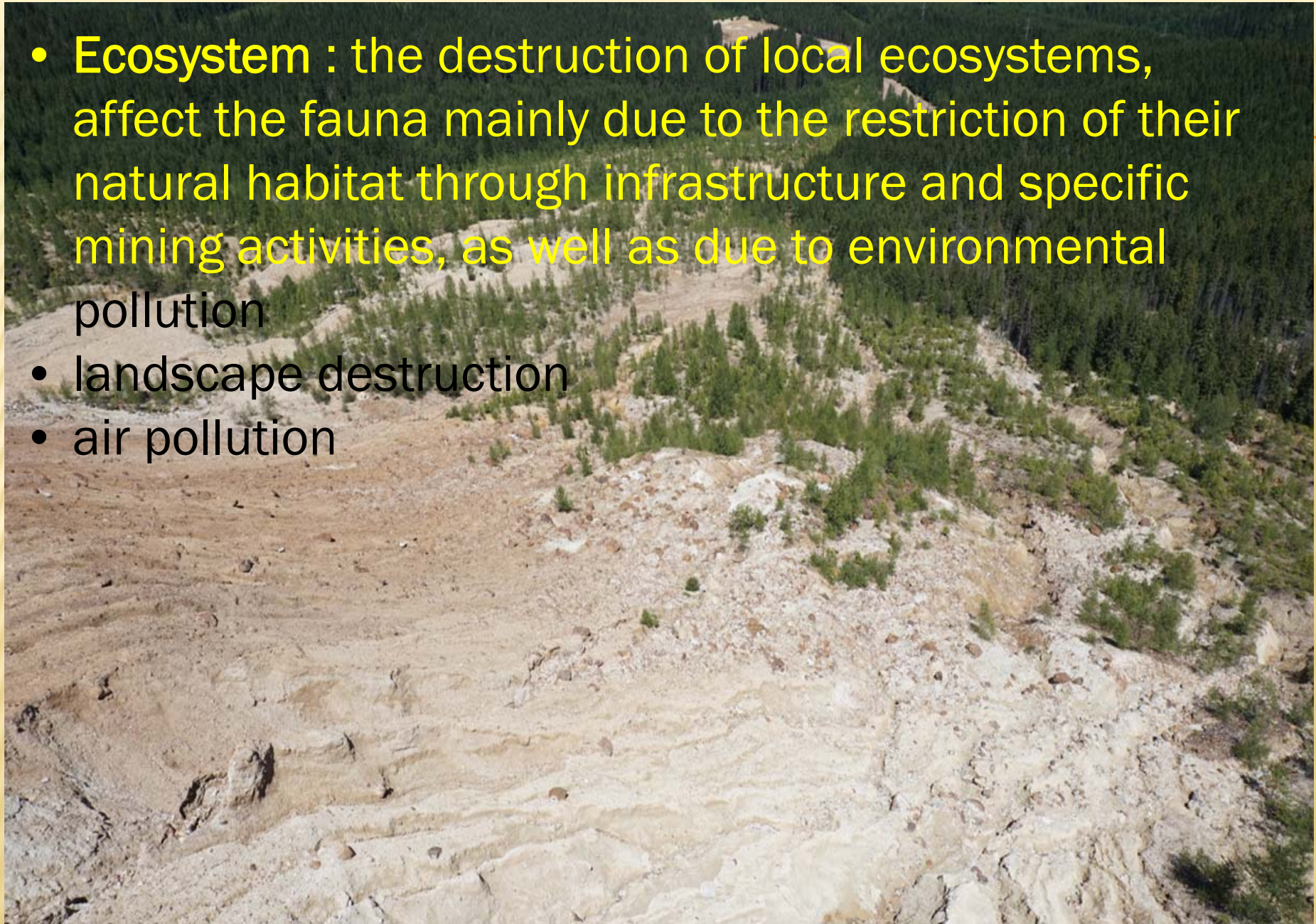
- ✗ **Water** : the chemical and physical pollution of surface and underground waters, changes in watercourses drainage, including the collection and pumping of mine acid waters



- ✘ **Soil:** soil contamination with heavy metal ions, the occupation of large areas of agricultural land and / or forestry, the risk of landslides terrain



- **Ecosystem** : the destruction of local ecosystems, affect the fauna mainly due to the restriction of their natural habitat through infrastructure and specific mining activities, as well as due to environmental pollution
- landscape destruction
- air pollution





✗ risk factor for the safety of residents

SITE DESCRIPTION

The main activity in the Ulm Mining Perimeter is the exploitation of manganese ore by surface-to-quarrying works.

Ulm mining perimeter is located in the northern central part of the Bistrita Mountains.

The relief of the region is mountainous, ranging from 1250 m to 800 m.

The two tailings dumps occupy a land area which was a pasture on which the soil was removed and have a volume of 353.78 thousand m³ and the occupied area is 48.400 m². The tailings dumps are located near two Natura 2000 sites:

- ❖ the Special Protection Area (SPA) Rarău-Giumalău Mountains
- ❖ the Special Area of Conservation (SAC) Rarău-Giumalău Mountains.

Table 3 . Protected natural areas in the vicinity

No.	Name	Category	Surface (ha)
1	Calimani National Park	National Park	10.700
2	Rarău-Giumalău Mountains	SPA	2.157,3
3	Rarău – Giumalău	SCI	2.547

Habitats. Forests are the main habitats, consisting of Norway spruce, beech, and Arrola pine, while upper lands are covered with scrubs like dwarf pine, alpine rose, alpine blueberry and huckleberry.

According Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora the habitats from Calimani National Park are listed in the ANNEX I

- 3220 Herbaceous vegetation on the banks of mountain rivers;
- 4080 Scrubs with species sub arctic of Salix;
- 4070 Scrubs with Pinus mugo and Rhododendron myrtifolium;
- 6230 Mountain meadows of Nardus;
- 9410 ; Acidophile forests of Picea abies in mountain region (Vaccinio-Piceetea)
- 9420; Forests of Larix decidua and/or Pinus cembra in mountain region.

Vulnerable plants



Campanula CarpatICA

Viola dacica



POLLUTION PROBLEMS

There were identified the following pollution problems:

- ✖ drainage, including the collection and pumping of mine acid waters;
- ✖ leakage on the slopes that drives sediments (and sediment quality);
- ✖ effluents of waste water;
- ✖ soil contamination;
- ✖ solubilized pollutants in waste disposal areas;
- ✖ dust emissions from mining areas adjacent;
- ✖ emissions of mine gases.

POLLUTION PROBLEMS

- ✘ The presence of sulphides - the average: 30.72% in the polymetallic ore, 15.04% in the pyrite-copper-ore ore - includes the operating wastes in the category of the potentially acidifying waters, being non-waste according Article 1 (b) of COMMISSION DECISION of 30 April 2009 completing the technical requirements for waste characterization laid down by Directive 2006/21/EC of the European Parliament and of the Council on the management of waste from extractive industries.
- ✘ Drainage that accumulates in the pit and drains the mineral tailings deposit may be contaminated as a result of chemical reactions with the rocks exposed to mining operations. This contamination - known as Acid Rocks Drainage (DAR) - usually involves the oxidation of metallic sulphides under acidic conditions.

POLLUTION PROBLEMS

Soils, found in mining area suffer from a range of physical, chemical, and biological limitations.

These include :

- soil toxicity,
- too high or too low pH,
- lack of sufficient organic matter,
- reduced water-holding capacity,
- reduced microbial communities,
- and compaction.

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- ✖ Removing land from the natural or economic circuit for landfills is a process that can be considered temporary, but which, in terms of the concept of 'sustainable development', extends over at least two generations if the periods of arrangement, exploitation, ecological recovery and post-monitoring are summing.
 - ✖ In terms of biodiversity, a landfill means removing 30-300 species/ha from the area affected by this use without considering the microbiological population of the soil.
 - ✖ Although the effects on flora and fauna are theoretically limited over time, during the exploitation of the deposit, the ecological reconstruction made after the release of the technological zone will not be able to restore the initial biological balance, the evolution of the biosystem being irreversibly modified.

Remediation of the tailings dumps is done in situ.

It is therefore necessary to undertake the following steps, after the clearance of the tailings dumps:

- ✗ reprofiling the tailings dumps,
- ✗ fences coast,
- ✗ laying of the cover layer of vegetal soil, sowing (erosion control),
- ✗ afforestation.

CONCLUSION

There is a need for cost-effective, low energy technologies that can be applied at these sites.

Appropriate soil amendments may be organic (e.g., composts). Soil amendments also can restore appropriate soil conditions for plant growth by :

- ✗ balancing pH,
- ✗ adding organic matter,
- ✗ restoring soil microbial activity,
- ✗ increasing moisture retention,
- ✗ reducing compaction
- ✗ protecting against offsite movement of contaminants by wind and water.

CONCLUSION

- ✖ The objective of in situ treatment of contaminated lands using soil amendments is to establish a self-sustaining system that does not rely on artificial inputs and, ideally, is similar to and provides nearly equal ecological value as the undisturbed adjacent landscape.
- ✖ Revegetation should be ensured by sowing grass to obtain an immediate protection against erosion, and later woody vegetation can be planted to stabilize the dump.

CONCLUSION

- ✖ The reestablishment of native species and plant communities should be emphasized where appropriate and if commensurate with post-revitalization land use. Native plant communities are best in providing the ecological diversity and long-term sustainability of the landscape.
- ✖ This approach is in the line with EU Biodiversity Strategy that aims to halt the loss of biodiversity and ecosystem services in the EU and help stop global biodiversity loss by 2020.



Calimani National Park

Thank you for attention!

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Former mining exploitation