



ENVIRONMENTAL MANAGEMENT - WHAT IS A PRIORITY? LITHIUM MINES OR THE ENVIRONMENT

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Abstract

Environmental management represents the field responsible for managing and solving problems of natural resources to protect the environment. The objective of research is to explain economic development through a circular economy and sustainability, where the modern age needs should not be a priority at any cost if they threaten the environment. Such actions endanger the healthy life quality of future generations. The lithium advantage is that it is used as part of batteries for mobile phones, electric cars, which facilitate the daily life of citizens. The disadvantages of lithium are that it requires large amounts of water and sulfuric acid for processing, which often leads to water contamination that leads to the destruction of ecosystems. The opening of lithium mines in populated areas leads to the displacement of the local population. Environmental management is focusing on renewable resources, preserving soil and biodiversity, protecting water sources, preventing potential pollution and remediating damage. Content analysis, description, and comparative methods were used in the work. The results of the research led to data that no lithium mine in the world meets environmental standards so far, that lithium mines are open for profitability while on the other hand they destroy the environment.

Key words: *Environment protection, management, lithium mines, ecosystems, renewable resources, sulfuric acid.*

Introduction

Environmental management is responsible for organizing, managing and solving the problem of the use of natural resources of the environmental protection. The aim of the research is to explain economic development through the circular economy and sustainability, where the inventions of the modern age should not be a priority at any cost if it threatens the environment, because it would lead to endangering the healthy life of future generations. Such actions threaten the healthy quality of life of present and future generations. Environmental management has the task of focusing on

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renewable resources, preserving soil and biodiversity, protecting sources of drinking water, preventing potential pollution and repairing damage.

Research

In this paper, the author used methods of content analysis, description and comparison are used to get results of the lithium mines investments profitability. The author analyzed the lithium mine financial feasibility, as well as the political, social and, most importantly, environmental analysis. This paper defined the problems that lithium mines bring, the expertise and ethics of the experts involved in lithium projects, cost/benefit analysis, as well as dilemmas related to lithium.

The Problems That Lithium Mines Bring

The arrival of lithium companies in new markets is caused by detailed research into potential lithium reserves. So far, exploration permits have been issued in the Republic of Serbia for 69 locations, while 12 companies have submitted applications for the opening of lithium mines. Lithium mines are planned to open at 40 locations in the triangle Loznica – Vranje – Bor. It is a territory of >22,000 km² with over 2 million people. The lithium mine lifespan is from 40 to 60 years, while mining rent of about 3-5% will be paid for the first 12 years!

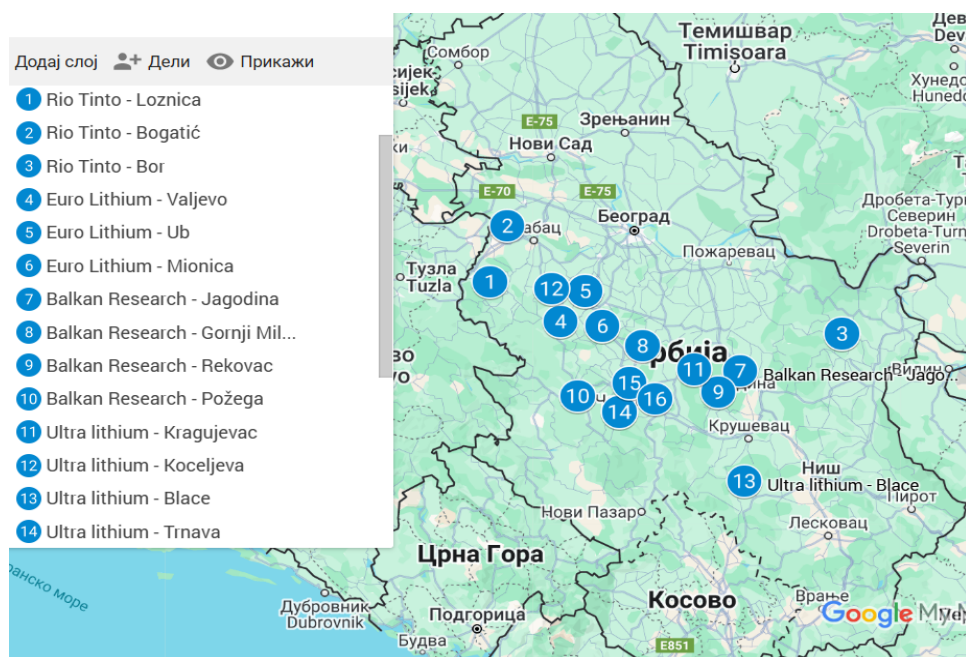


Figure 1: Locations of planned 16 out of 40 lithium mines in Serbia

Known locations for the planned lithium mines:

1. Rio Sava (a subsidiary of Rio Tinto) at the locations of Loznica, Bor, Bogatic.
2. Euro Lithium Balkan on locations Valjevo, Ub i Mionica.



3. Balkan Research at the locations of Jagodina, Gornji Milanovac, Rekovac and Požega.
4. Ultra Lithium at the location of Kragujevac, Koceljeva, Blace, Trnava, Preljina, Lađevci.

The remaining lithium companies: LithiumLi Balkan; Ultra Balkans; Balkan Gold; LithiumLi Exploration; Rare Mineral Resources; GeoMin Consulting; Centurion metals have not yet announced locations.

Experts hired by lithium companies

Rio Tinto's lithium company hired 10 faculties and about 60 university professors and signed NDA (Non - Disclosure Agreement). The question is if there is a conflict of interest because the engaged university professors represent positions in favor of lithium companies, hiding in public appearances in the media that they are paid by lithium companies for their service (example: the Faculty of Mechanical Engineering distanced itself from the appearance of Prof. Aleksandar Jovović, who presents himself in the media as their professor), leaving the public fake impression that his faculty support lithium mines.

The question arises as to why Rio Tinto, as an investor, can finance the preparation of the Environmental Impact Study that should be done by the independent commission? Does this mean that anyone can fund research studies or other related studies? What happens if the results of this or any other study are negative?²⁰² Will lithium companies leave Serbia and abandon the project, or will they continue to operate no matter if they are proven to endanger the environment?²⁰³ It is well known that negative research studies²⁰⁴ already exist, but the question is why are they not open to public and the media, and why the research studies authors are threatened with lawsuits over NDAs if they testify (example: Faculty of Biology²⁰⁵)? Are interests of private lithium companies more important than environmental protection?

²⁰² Avner Vengosh, Gordon Williams, What Are the Effects of Historic Lithium Mining on Water Quality? Duke University, Nicholas School of the Environment, (2024) Nov. https://nicholas.duke.edu/news/what-are-effects-historic-lithium-mining-water-quality?utm_source=chatgpt.com

²⁰³ Ryan Brightwell, In the Mire: Risks to Banks and Investors from Rio Tinto's planned Jadar Mine Project BankTrack (2025) May. https://www.banktrack.org/download/letter_from_banktrack_and_mars_sedrine_to_ubs_on_jadar_project/letter_to_ubs_re_rio_tinto_jadar_project_may_2025.pdf

²⁰⁴ Maria L. Vera, Walter R. Torres, Claudia I. Galli, Alexandre Chanes & Victoria Flexer, Environmental impact of direct lithium extraction from brines, Nature Reviews Earth & Environment 4, 149-164 (2023) Feb https://www.nature.com/articles/s43017-022-00387-5?utm_source=chatgpt.com

²⁰⁵ Ljubiša Stanisavljević, dekan Biološkog fakulteta, Nemamo nameru da lažemo; Rio Tinto pogrešno interpretirao studiju, Prvi na skali, (2024). Septembar. https://prviprvinaskali.com/clanci/dren/ekologija/nemamo-nameru-da-lazemo-rio-tinto-pogresno-interpretirao-studiju-dekan-ljubisa-stanisavljevic-prof-ljiljana-tomovic-bioloski-fakultet.html?utm_source=chatgpt.com



Political pressure

State officials announced the opening of the lithium batteries production factory that would be directly exported to European automotive companies, which would be subsidized by the state of Serbia with 419 million euros. The European Commission recently added the Jadar lithium project to the list of Strategic projects of importance for the EU.²⁰⁶ For comparison, many citizens do not know that in Serbia, near the city of Subotica, already exist a lithium production battery factory, which is a start-up investment worth 1 billion EUR, by importing lithium from abroad and selling the batteries directly to EU countries.²⁰⁷

Lithium is a material of strategic influence for the European Union, trying to reduce its dependence from China, which currently supplies it. Germany has launched a pilot project, in the experimental phase, where lithium is taken from groundwater by direct lithium extraction technology instead of rock ore processing, and the project still did not meet EU environmental standards.²⁰⁸ The questions about lithium mines cause that must be asked are:

- Why is the opening of a lithium mine being forced if it has been proven that none of the existing lithium mines have met the EU environmental standards?
- Where are lithium mines in the EU, which has much larger lithium reserves than Serbia?
- Why is it allowed to open lithium mines near the city with more than 72,000 people when lithium mines around the world are opened in deserts, hundreds of kilometers from populated areas?

Corruption in Europe

In Portugal, the government of Prime Minister Antonio Costa (President of the European Council) fell in 2023 over corruption allegations, among other things, related to mining concessions for lithium projects. Potential corruption allegations can best be seen in the example of Joschka Fischer, a former German foreign minister and deputy prime minister, former leader of the German Greens, whose consulting firm was hired by Rio Tinto for lobbying, although Rio Tinto does not officially operate in Germany.

²⁰⁶ Jadar Project – the most important events that marked the most controversial investment in Serbia's recent history, Balkan Green Energy News, Sept, 2024. <https://balkangreenenergynews.com/rs/projekat-jadar-najvazniji-dogadjaji-koji-su-obelezili-najkontroverzniju-investiciju-u-novijoj-istoriji-srbije/>

²⁰⁷ Latief, Y., Europe's first LFP battery factory opens its doors in Serbia, Smart Energy International, (2023) <https://www.smart-energy.com/industry-sectors/storage/europes-first-lfp-battery-factory-opens-its-doors-in-serbia/>

²⁰⁸ Chris Welch, Vulcan opens pilot Li plant ahead of 2027 production, Markte: Battery materials, Metals, Argus (2024) https://www.argusmedia.com/de/news-and-insights/latest-market-news/2626900-vulcan-opens-pilot-li-plant-ahead-of-2027-production?utm_source=chatgpt.com



Lobby register

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[Joschka Fischer & Company GmbH](#)[Description of the activity and naming of areas of interest and projects](#)[Public grants or subsidies](#)[Donations from third parties](#)[Annual financial statements/annual report](#)[Download register entry \(PDF\)](#)[Download register entry \(JSON\)](#)

Clients (6)

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Figure 2: Bundestag Lobby Register
(Rio Tinto hired Joschka Fischer consulting company)²⁰⁹

Conflicts with the local population

The disadvantages of lithium are that it requires large amounts of water and sulfuric acid for processing, which often leads to a high risk of water contamination leading to the destruction of ecosystems as well as a lack of drinking water for residents. The opening of lithium mines in populated areas leads to the forced displacement of the local population. Lithium companies are often in conflict with the local population over environmental destruction. Thirty years ago, lithium company Rio Tinto was accused of financing the civil war on the island of Bougainville, Papua New Guinea, where about 20,000 people lost their lives. The company left the island, but behind them stayed a permanently destroyed environment with sulfuric acid in its waterways (rivers, lakes and streams).

In Serbia, surveys have shown that over 59,4% of the population (85% are under the age of 45) are against the opening of lithium mines, while only 24.8% (45% pensioners and 53% of people with a primary school diploma) support the opening of lithium mines, while the remaining 15.2% are undecided.

²⁰⁹ Lobby register for the representation of interest before the German Bundestag, Joschka Fisher client - Rio Tinto lithium mines, <https://www.lobbyregister.bundestag.de/suche/R001093>



The positive side of lithium

Lithium has so far been indispensable for the development of new technologies and innovations, as it is used as part of batteries for mobile phones, electric cars, satellites and the military industry, making the daily lives of citizens easier. The EU's strategic objective is to switch to electric vehicles to replace diesel and petrol vehicles to reduce pollution, provided that the electricity needed to power electric vehicles come from renewable energy sources, instead of in some country's electricity is still obtained from fossil fuels (burning coal in power plants). Otherwise, electric vehicles lose all sense of use, because they leave behind exhaust gases only in other locations.

Cost/benefit analysis

Cost/benefit analysis involves dealing specifically with each item that brings costs and benefits from the point of view of environment, economics, politics, and society.

Reasons for opening a lithium mine:

- Economic reasons (jobs, investments, concessions, mineral rent, taxes from which the state will derive financial benefits).

The plans for the opening of lithium mines include the participation of the state, which has committed to provide supporting infrastructure in the form of roads, railways, power stations, water supply and other supporting facilities. For the lithium mine in Loznica alone, state investments through subsidies amount to several hundred million euros.

Table 1: Lithium mine costs

Project	Initial construction cost (Capex)	Operating cost (Opex)	Capacity	Revenue	Profit
Bandeira (spodumen - hard rock)	266.1M\$ + 81.4M\$ for mine maintenance	64,30\$ / t ore processed; 444/t spodumen concentrate	Produces spodumene concentrate	/	
Pastos Grandes (Argentina)	448,2M\$ + 102M for maintenance	3,300-3,400\$ per ton lithium - carbonate	~ 18,000-24,000 t per year of lithium carbonate	/	IRR ~ 24,2% NPV ~ 1,030M\$
Nevada North Lithium	Phase 1 2,95B\$, Phase 2 - 2,35B for mine maintenance	5,097 \$ per t Lithium Carbonate Equivalent	Large projection capacity depending on the phase	/	~ 22-23% after tax

The financial viability of lithium mines is, in addition to the environmental consequences, the most important issue. Local economic experts made cost/benefit analysis where Serbia will achieve 17.4 M EUR per year (2.6 M EUR per capita) from the Rio Tinto lithium mine in Loznica, which will amount to even less when we add several hundred million euros by investing in the accompanying infrastructure (roads, roads, railway, power station...) for only one out of 40 lithium mines planned to be open in the future.



Reasons versus the opening of Lithium Mines

- Environmental reasons – permanent destruction of soil, biodiversity, water sources, use of sulfuric acid, cyanide and arsenic.
- Safety reasons – in the event of an environmental disaster, lithium companies pay symbolic financial compensation, while the state takes on all the risks and consequences of remediation, which amount to billions of euros.
- Health reasons (risk of increased illness of citizens)
- Social reasons – forced relocation of the population, agriculture and livestock extermination by contaminated water.

Consequences of lithium mining

In case of environmental disaster, lithium company will pay a symbolic fine with an apology, while the consequences will be immeasurable, with permanent contamination of soil and water, where the current images of lithium mines show that the soil will look like craters on the moon. Rio Tinto was recently fined only \$2 million on eight counts of discharging harmful substances into waterways off Lake Tio in Canada.²¹⁰

The opening of lithium mines in populated areas leads to the relocation of the local population. Until recently, citizens were not aware of how lithium batteries are made, how much sulfuric acid is consumed with enormously large amounts of water.

The lithium mines consequences so far are enormous and cannot be financially calculated. Lithium processing requires large amounts of water (which often causes problems with the drinking water supply to the local population), which leads to water contamination and endangerment of ecosystems. From lithium processing, waste products, dust, contaminated water with sulfuric acid, heavy metals will remain after the process.

²¹⁰ Rio Tinto Fer et Titane inc. is ordered to pay \$2 million for violating the Fisheries Act and the Metal and Diamond Mining Effluent Regulations, Government of Canada, Quebec – Environment and Climate Change (2025) January. https://www.canada.ca/en/environment-climate-change/services/environmental-enforcement/notifications/rio-tinto-fer-et-titane-inc-ordered-pay-2-million.html?utm_source=chatgpt.com



Table 2: Penalties paid by Rio Tinto for environmental destruction²¹¹²¹²²¹³

Country	Subsidiary	Year	Reason for fine	Amount
Canada (Quebec)	Rio Tinto Fer et Titane	2025	Violation of Fisheries Act and Metal and Diamond Mining Effluent Regulations - discharge of harmful substances and failure to collect samples after unauthorised release	2 M \$
Canada (Quebec)	Rio Tinto Alcan	2023	Violation of Fisheries Act - discharge of harmful substances into the Saguenay River	500,000 \$
Canada (Quebec)	Rio Tinto Fer et Titane	2023	Violation of Fisheries Act - two releases of harmful sub	600,000 \$
Canada (Quebec)	Rio tinto Alcan	2018	Violation of Fisheries Act - release of hydrochloric acid from Arvida plant into Saguenay River	100,000 \$
Mongolia	Rio Tinto / Turquoise Hill Resources	2025	Shareholders lawsuit over delays and cost overruns in the Oyu Tolgoi mine expansion	138,750,000 \$

Research results and potential solutions

The results of the research on the examples of existing global lithium mines concluded that no lithium mine in the world so far meets environmental standards, and that lithium mines are open for profit while destroying the environment trying to compensate damage with symbolic fines. The cost/benefit analyses have shown that lithium mines are not profitable for the countries due to the damage they cause to the environment, which is financially greater than the money invested in opening the mine. Promoting the sale of electric vehicles as "green energy" that do not pollute the environment with exhaust gases, while ignoring the consequences of making lithium batteries whose production methodology destroys the environment by processing lithium production with large amounts of sulfuric acid, is not a solution to the environmental problem. Lithium batteries that are in everyday use today have disadvantages in the form of limited capacity, the possibility of ignition and the problem of processing lithium mining. The development of alternative solutions in the form of sodium-ion batteries, as well as hydrogen batteries, which are already slowly being introduced as a replacement for lithium batteries in mobile phones and

²¹¹ Clara Denina, Jonathan Stempel, Rio Tinto reaches \$138.75 million settlement over Mongolian mine, Reuters, (2025). June. https://www.reuters.com/sustainability/boards-policy-regulation/rio-tinto-reaches-13875-million-settlement-over-mongolian-mine-2025-06-18/?utm_source=chatgpt.com

²¹² Rio Tinto Fer et Titane inc. is ordered to pay \$2 million for violating the Fisheries Act and the Metal and Diamond Mining Effluent Regulations, Government of Canada, Quebec - Environment and Climate Change (2025). January. https://www.canada.ca/en/environment-climate-change/services/environmental-enforcement/notifications/rio-tinto-fer-et-titane-inc-ordered-pay-2-million.html?utm_source=chatgpt.com

²¹³ Rio Tinto Fer et Titane Inc. ordered to pay \$600,000 for violating the Fisheries Act, Government of Canada, Quebec - Environment and Climate Change Canada (2023) June. https://www.canada.ca/en/environment-climate-change/news/2023/06/rio-tinto-fer-et-titane-inc-ordered-to-pay-600000-for-violating-the-fisheries-act.html?utm_source=chatgpt.com



electric vehicles, may make lithium, in addition to destroying the environment, financially unprofitable and outdated.

Table 3: Environmentally friendly lithium battery replacements

No	Technology	Energy Density	Lifetime	Cost / Materials	Advantages	Drawbacks	Development Status
1	Solid-state batteries	High (2–3× Li-ion potential)	10–20 years (longer cycle life)	Expensive, complex manufacturing	Safe, fast charging, compact	Still difficult to mass-produce	Toyota, Samsung, QuantumScape → expected late 2020s
2	Sodium-ion batteries	Medium (lower than Li-ion)	5–10 years	Very cheap, sodium widely available	Low cost, less resource dependency	Lower energy density than Li-ion	CATL & BYD launched first EVs with Na-ion (2023–2025)
3	Magnesium/Aluminum/Zinc	Potentially high	(Still lab tests)	Cheap and abundant materials	Eco-friendly, safer	Technical barriers: dendrites, stability	Early research phase
4	Lithium-sulfur (Li-S)	Very high (up to 5× Li-ion)	Currently short (hundreds of cycles)	Sulfur is cheap & abundant	Lightweight, huge capacity potential	Fast degradation	NASA & startups developing prototypes
5	Hydrogen fuel cells	High (very energy-dense fuel)	10–15 years	Hydrogen production & storage costly	Zero emissions (water only), fast refueling	Lack of infrastructure	Toyota Mirai, Hyundai Nexo, buses, trains
6	Nuclear microbatteries	Low (μ W–mW range for now)	Up to 50 years	Expensive isotopes	Extremely long lifespan, no recharging needed	Low output power, regulatory issues	Betavolt BV100 (China), Zhulong C-14 (prototype)
7	Supercapacitors	Very low (much less than batteries)	Millions of cycles	Relatively cheap	Ultra-fast charging, very durable	Cannot store much energy	Used for buses, regenerative braking

Much better solutions that don't destroy the environment are:

- **Nuclear batteries** - The Chinese have already introduced the BV100 battery, which operates on nuclear power, the size of a coin, which develops 100 μ W (microwatts), voltage 3V, which uses nickel-63 technology (radio isotope) with a service life of 50 years.²¹⁴ Compared to the lithium batteries used in phones and electric vehicles, we can see that their lifespan is about 5 years, while the battery creation procedure leaves behind irreparable damage to the environment.
- **Sodium-ion batteries**, where companies invest a lot of money in the development of alternative technologies to replace lithium batteries in the future with sodium-ion batteries (Na-ion), which bring with it cheap production costs, have a lower energy density than lithium, and is not dependent on rare materials. Chinese electric vehicles from BYD and CATL have switched to using sodium batteries from 2025.
- **Batteries based on zinc**, aluminum and magnesium that use more accessible and cheaper metals, which are more environmentally friendly and safer, but are still in the research phase.
- **Hydrogen batteries** where energy is obtained from the reaction of hydrogen and water, which are fast-charging and have a long range.

²¹⁴ Hale, T., China Unveils Coin-Sized Nuclear Battery That Lasts For 50 Year, IFL Science, Jan, 2024 https://www.iflscience.com/china-unveils-coin-sized-nuclear-battery-that-lasts-for-50-years-72448/?utm_source=chatgpt.com



Conclusion

By analyzing environmental management, we can see that the consequences of the opening of lithium mines are enormous, that so far, no lithium mine meets environmental standards that behind lithium mines remain destroyed land that cannot be recovered or ever used for any other use. There is a huge risk of contamination of watercourses, as well as pressure and corruption, no environmental, social, safety and health reasons have been met, while cost/benefit analysis has proven the unprofitability of investments. From the point of view of environmental management, the priority is not lithium mines, but environmental protection. It is not excluded that in the future new technologies will meet environmental standards by processing lithium, but now this is impossible and unattainable, which is why the opening of lithium mines should not be allowed. So far, there are numerous examples of fines paid by Rio Tinto for environmental destruction. The question is, why do we believe that this scenario will not happen in Serbia? Should we take their word for it, as other countries have done, and risk environmental disaster?

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