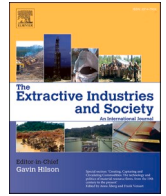


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The calm before the storm? The making of a lithium frontier in transitioning Portugal

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ABSTRACT

A nation undergoing accelerating energy transitions with ambitious climate targets discovers lithium. In recent years, Portugal has made headlines inter alia for running on renewable electricity for over a month, setting world records at solar auctions, closing its last two coal-fired power plants, and investing majorly in green hydrogen for regional public transport fleets. Lithium extraction for battery manufacture can give it leverage in a sector where it has lagged: manufacturing for energy transitions. Bureaucratic machinery has begun whirring in this direction. Yet, extraction carries risks of environmental destruction, community displacement, and populist backlash. Hence, mapping extraction sites has evoked public opposition and triggered debate. Drawing on civil society publications, policy papers and reports, media coverage, field observations, and interviews with social movement representatives, we interrogate the emergence of a lithium frontier in this greening country. We analyse the human geography and social anthropology of mapped extraction sites, to discuss what social movements have emerged and how they are reflected in official political frames. We do not take a position based on technical assessment, but rather analyse available facts as energy social scientists familiar with the sociotechnical geographies of the Portuguese energy system. We conceptually engage literature on the making of resource frontiers and moments of transition, to foreground the sort of meaning being made and performed in this rapidly unfolding national low-carbon energy future. While unpacking exploration and licensing processes reveals tensions with social justice issues, how hybrid governance navigates these issues will define emergent extractive proclivities.

1. Introduction

A nation undergoing accelerating energy transitions with ambitious climate targets discovers lithium. Since the late 2010s, Portugal has made headlines inter alia for running on renewable electricity for over a month (in 2018), setting world records at solar auctions (in 2019 and 2020), closing its last two coal-fired power plants (in 2021), and investing majorly in green hydrogen for regional public transport fleets (in 2022). Lithium extraction for battery manufacture can give it leverage in a sector where it has lagged: manufacturing for energy transitions. Accordingly, bureaucratic machinery has been whirring in this direction since the mid-2010s, with a working group (2016), strategic guidelines (2018), extraction contracts (2019–2021), and public

tenders for research and prospecting (2022). Nevertheless, extraction carries risks of environmental destruction, community displacement, and populist backlash. Therefore, the mapping of extraction sites has evoked public opposition reactions by environmental and cultural civil society organisations, local populations, and social movements in most cases. By contrast, some mayors have played up its local livelihood and revenue prospects.

The only operational (small-scale) lithium mines in Portugal feed the glass and ceramics industry. At this crucial juncture, we interrogate the emergence of a lithium frontier in this greening country: What is the human geography and social anthropology of mapped extraction sites? What social movements have come about at this incipient moment and how are they reflected in and encountered by official political frames?

Towards a Special Issue of *The Extractive Industries and Society* on 'Lithium dynamics: Global trends and local spatializations'

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We do not take a position based on technical assessment. Rather, we analyse simple (and in 2023 still somewhat limited) available facts based on familiarity with the country's energy system and its socio-technical geographies, grounded in our competence as energy social scientists. We draw on civil society publications, policy papers and reports, media coverage, and interviews with social movement representatives.

This analysis is conceptually underpinned by literature on resource frontier-making and moments of transition, to foreground what is at stake and the sort of meaning being made and performed in this latest chapter of Portugal's rapidly unfolding low-carbon energy future. The concept of "commodity frontier", or resource frontier, describes the processes through which new reservoirs of cheap labour, food, energy, and raw materials – that is, "cheap natures" – are being incorporated into the dynamics of global capitalist expansion, reflecting a "capitalism-in-nature" paradigm (Moore, 2015). The framing of a particular area as an empty space is crucial for the expansion of these frontiers (e.g. Peluso and Lund, 2011; Tsing, 2005), in which processes of extraction and exchange are linked to dispossession, displacement, the depletion of environmental resources, and resistance in most cases (Beckert et al., 2021; Verbrugge and Geenen, 2019). Discursive erasure thus opens up for socio-material erasure. Moreover, the expansion of resource frontiers often creates ecological distribution conflicts (Martinez-Alier, 2009), in which respect so-called "green commodities" are no exception (Fairhead et al., 2012). Lithium extraction is a good example of this trend, with high-quality reserves sought-after by the powerful automotive manufacturing industry (Narins, 2017). It has also been framed as "green extractivism" (Voskoboynik and Andreucci, 2021). Hence our mobilisation of the term lithium frontier.

Here, we shed light on the attempts made by the Portuguese government (and mining companies) to create a new lithium frontier in the Portuguese countryside and the subsequent opposition by social movements. We argue that while the exploration and licensing process reveals tensions with issues of social justice, it is the manner in which hybrid governance navigates them that will define the extractive proclivities of a country without a fossil extractive past. What is at stake, then, is whether energy transitions bring extractivism to a country spared this fate during "carbon democracy" (Mitchell, 2011) – which is based on two "cheap natures", namely coal and oil – or whether energy politics can co-produce a pathway that keeps people as close to decision-making as the corporate behemoths who are turbocharging Portugal's energy transition wish to be.

Our analysis shows that the most major shift with deepening interest in pursuing the lithium frontier is taking place amongst Portugal's major environmental civil society organisations. Rather than focusing on the foundational question of land use change from a wide range of existing practices, critique of lithium extractivism in emergent national discourse has primarily centred on protected areas with nature conservation priorities at stake. This marks an emerging consensus on – or at least the absence of an overt challenge to – expansion of extractive activities in themselves when they are ostensibly at the service of so-called "green transitions". We share concerns articulated by many political ecologists, human geographers, and scholars of degrowth and environmental politics on the legitimacy of such claims of "green", "renewable", and "energy transition". To avoid redundant repetition, we acknowledge these concerns while examining this case for its insights on resource frontier-making and its policy relevance, given that many powerful actors and authorities are pursuing green deals through strategies where lithium extraction plays a prominent role. Notably, whether extracted lithium reserves will contribute to energy storage for specific purposes to enable energy flexibility in line with wider public interests or not is not an explicit concern raised by social movement representatives; rather, we find that they are keen to protect the most vulnerable categories of land related to environmental conservation and local livelihoods.

This is a significantly reductive approach to extractivism, compared to broader debates on socio-environmental justice linked with other

contexts of lithium extraction, e.g. virtual water exports, local livelihoods, displaced ways of life and landscapes of meaning in the Lithium Triangle of Latin America. Notably, some local and regional civil movements do contest lithium mining due to the expected negative impacts on local economic activities, especially agriculture and tourism. In particular, the Grupo pela Preservação da Serra da Argemela sees mining as a threat to traditional ways of living in Barco and other villages. Yet overall, the Portuguese case provides a national policy context that merges extractivism and energy transition in a manner that appears to make societal consensus a distinct possibility. This merits attention, not as a perfect instance of just transitions, but as compelling evidence of pragmatic, moderate green transition pathways that countries may be able to enrol wider publics to pursue with low conflict. While critically informed, as energy social scientists we are empirically and conceptually interested in this pragmatism and its implications for transition pathways.

The rest of this article is structured in five sections. A literature review unpacks trends in scholarship on lithium extraction, land use change and social movements, showing that current debates feature a gap in terms of green transition cases that can bring these oft-conflicting priorities together. The next section presents our research design and methods. This is followed by a section with detailed case background based on secondary research, which consolidates the rationale for case selection of lithium extraction in Portugal and provides the basis for a clear understanding of the subsequent empirical analysis. In the section that offers this analysis, we draw on five key expert interviews with representatives of social movements that provide novel insight into emergent societal understanding and efforts to shape lithium extraction in Portugal. Following this, a final section discusses the implications for the research gap targeted by our argument, and by way of conclusion offers the implications of our argument for national policies as well as our main reflections for future research. We submit that our case analysis identifies a pragmatic, moderate pathway for green transitions that many countries may begin to pursue during the 2020s. Driven by ambitious energy transition targets, decision-makers squeeze the meaning of just transitions to tighter categories of implementation in order to open up space for rapid sociotechnical change to unfold.

2. Literature review

This section presents brief forays into literature on lithium extraction, land use change and social movements, ending with a synthesis that identifies a key research gap at the confluence of these strands that merits empirical investigation.

2.1. Lithium extraction

As countries, cities and companies have embraced ambitious net-zero emission targets (Höhne et al., 2021), and low-carbon energy transitions have begun to make major advances in various places globally (Way et al., 2022), energy flexibility technologies have risen in importance, with an emphasis on energy storage (De Sisternes et al., 2016). Increasing global demand for high-capacity, fast-charge battery storage for rapidly decarbonising sectors such as electricity and transport has led to growth in extraction of lithium, a major component of the most popular batteries (Ambrose and Kendall, 2020). Scholarship has identified problems, e.g. lithium reserves being geographically concentrated (Narins, 2017), lifecycle assessments being environmentally problematic (Bae and Kim, 2021; Miao et al., 2022), and the unequal justice implications of extraction in Global South geographies such as the Lithium Triangle of Latin America whereas major end-use is in richer contexts of the Global North (Bos and Forget, 2021), e.g. Europe and USA, but increasingly also China. Despite the relatively nascent nature of this research, some trends are clear: lithium extraction requires responsive regulation that anticipates and proactively steers development away from unjust impacts on vulnerable geographies and

populations in extractive zones for the benefit of privileged elites located elsewhere (Zografos and Robbins, 2020).

A focus on contexts outside the Lithium Triangle, while rare, is emerging, e.g. a study on a Portuguese extractive region that emphasises its local socio-ecological impacts as well as the lack of adequate knowledge given growth prospects of this sector (Chaves et al., 2021); and an analysis of the attempts made by a mining company to mitigate the growing opposition to a prospective lithium mining project in a site located in the North region of Portugal (Dunlap and Riquito, 2023). Global scale analyses point out that lithium demand is driven by strong lobbies such as electric automobility majors at a pace and scale that sustainability policies are not effectively enforced at to steer the nature of extractive development (Crawford et al., 2021). An important early review points to the need to secure goals that are not aligned with top priorities of stakeholders, to address knowledge asymmetries, and to address conflicts that arise in relation to emerging extractive activities (Agusdinata et al., 2018). In sum, there is a need for an improved understanding of local dynamics and scope to advance sustainability imperatives in a booming sector with limited regulation.

2.2. Land use change

Knowledge on land use change with the onset of lithium extraction has increased in recent years due to sectoral development and increased attention to local impacts. In one of the hotspots, Chile, studies show moderate to severe degradation of salt flats as well as impacted areas with human settlements and national nature reserves (Liu et al., 2019). Researchers have long pointed out how questions of valuation matter for branding electrification shifts in the automobility sector as sustainable, as such claims are contingent on upstream value chain activities that impact local ecosystems (Stamp et al., 2012). This focus on land use change due to lithium extraction intersects with and draws from a highly established area of enquiry into multidimensional impacts of extractive activities on land use (Worlanyo and Jiangfeng, 2021). Yet, heightened attention to the Lithium Triangle in Latin America in the early growth of lithium extraction research has driven attention primarily to high elevation Andean wetlands, where persistent drying tendencies are already a concern in predictive climate models (Izquierdo et al., 2015). This means that literature on land use change related to lithium extraction in more varied geographies is relatively lacking, which slants consideration of socio-ecological impacts that such activities can have as these mining activities proliferate globally.

An especially instructive aspect of extant scholarship is the use of multiple scenarios to deal with uncertainties of mining development and its impact, and consideration of both proximal and distal impacts in both spatial and temporal terms (Liu and Agusdinata, 2021). The impact on water reservoirs can impact not only local communities but also inhabitants further away whose lives and livelihoods are impacted by groundwater levels. Contexts where lithium mining has not yet taken hold in a major way require the state to play a role in safeguarding against such impacts (Ortiz, 2021), another instance where diverse national contexts may have quite distinct experiences to the early ones of Chile, Argentina and Bolivia due to contrasting governance characteristics. This bears investigation, especially in Europe, where member states of the European Union collaborate more closely on evolving national regulations for energy transitions than Latin American countries do.

2.3. Social movements

A striking aspect of research on lithium extractivism is that coverage of social movements mobilised in relation to it is rather spartan. Two prominent researchers on this theme do point out the increasing scale and intensity of social activism against lithium mining practices in Chile's Atacama desert, where corporate social responsibility investments have done little to assuage public concerns (Liu and

Agusdinata, 2020). A major contribution across the Lithium Triangle contexts points to a converging sociotechnical imaginary of lithium as a strategic resource to which these countries can add value through technological refinement to lead global export (Barandiarán, 2019); this imaginary accords primacy to science and technology over local needs of marginalised groups located in close relationships with geographically remote nature near national extractive sites. This disjuncture between emerging national imaginaries in Global South contexts of extraction compared with Global North contexts of green transition that drive lithium demand is becoming quite apparent. A study characterises the Global North imaginary as one that combines both energy security and sustainability, through an idea of lithium regulation as both securing adequate reserves for national priorities and establishing ethical procurement measures to address negative impacts elsewhere, a vision based in hegemonic and problematic narratives of unmitigated growth and green capitalism (Riofrancos, 2022). Nevertheless, the latter is easier said than done in light of scholarly insights on the intractable socio-ecological injustices and impacts bound up with existing lithium mining practices in fragile contexts.

Tellingly, scholarship on opposition to lithium mining in Portugal identifies a conflict over who owns the future, local residents or an overreaching state exercising control over territory at the cost of local self-determination (Araújo et al., 2022). This highlights the salient need for greater attention to mobilisation amongst the multiple publics impacted by lithium extraction both in and around extractive zones, at a point when change is still contingent rather than at an advanced stage when impacts become harder to shape. There is thus a clear need for research on emergent social movements that resist lithium mining, not necessarily in opposition to the idea of extraction itself, but rather to understand the context-specific nature of multiple contested local interests.

2.4. Research gap

At the confluence of these strands of scholarship, we address a combined research gap. This includes attention to emerging lithium mining activities and debates in under-studied contexts beyond Latin America with distinct policies and political concerns, and to diverse lithium extraction geographies and how these inflect concerns related to impending lithium mining and land use change. Finally, we identify a need to engage with social movements that resist particular emergent trajectories of lithium extraction, in order to understand local contestation and multiple visions of how such extractivism can be governed to secure interests of multiple actors. To combine these interests, we propose a specific research design in the next section, with a rationale for selecting the advent of lithium mining in Portugal and focusing on the narratives of social movement actors, who have had little mention in research. Our ambition is to problematise the role of the state as a governance actor, and indicate the empirically hybrid nature of governance through which pathways of lithium extraction are shaped. While there are signs in recent scholarship that these pathways are contingent upon a number of socio-political and geographical conditions, there is a dearth of studies that probe these contingencies in distinct contexts of emergent extractivism. Through our empirical analysis, we aim to constitute the basis to advance discussion about how lithium frontiers are constituted and whose interests they serve.

3. Research design and methods

This article is based on different sources of information. First, there is material from a wider investigation on low-carbon energy transitions conducted by the authors on both national and local scales in Portugal through various research projects on energy transitions governance over the past decade. This includes research on the local impacts of and responses to wind and solar plants and on the governance and accountability of solar energy and smart grid rollouts (e.g. Sareen and Wolf,

2021; Silva and Delicado, 2017; Silva and Sareen, 2021). This was complemented by field observations in November 2022 in the parish of Gonçalo (1167 inhabitants in 2011, 960 inhabitants in 2021), in the municipality of Guarda, which hosts a concession contract to upscale the long established open pit extraction of lithium concentrates. Hence we bring a seasoned understanding of Portugal's energy system to an analysis of this controversial and crucial recent development, with one author based in Portugal and closely following evolving media coverage and debates as well.

This basis was bolstered by five interviews conducted with representatives of the following anti-mining social movements and associations during October–November 2022: the Association United in Defence of Covas do Barroso (established in 2018), the Association Montalegre with Life (2019), the association Corema (1988), the Movement Against Mining Beira Serra (2019), and the Group for the Preservation of the Serra da Argemela (2017). These representatives responded affirmatively to interview requests issued by email or telephone. They occupy prominent positions in their movements/associations, and represent groups based in different parts of the country (three in the North and two in the Centre regions) that were established at distinct times, in most cases in response to applications or contracts for lithium research and prospecting. The exception to this trend is Corema, founded in 1988 due to the absence of non-governmental environmentally-concerned associations in the Upper Minho region. The interviews focused on the organisational mission and motivation for participation in lithium-related social mobilisation; perspectives on the need and the strategy for decarbonisation; reflections on the Portuguese lithium programme; reasons for opposition to lithium exploration or extraction; and actions undertaken to prevent lithium mining in their areas of operation.

We also draw upon several secondary information sources, including Portugal's lithium programme and lithium-related legislation; the public consultation report of the Strategic Environmental Impact Assessment (SEIA) of the national lithium programme conducted by the Directorate General of Geology and Energy (DGEG); news published in regional and national newspapers; and civil society publications. Given the emergent and evolving nature of the case study, we acknowledge that our data sources are limited, and duly qualify our analytical insights. Yet given the rapid nature of this important societal development, such insights are urgently required and provide a good basis for future research to extend through more comprehensive empirical studies.

4. Case background: the national lithium extraction policy mix

According to the U.S. Geological Survey (2022), identified lithium resources have increasing greatly in Portugal and globally in recent years, having reached 270,000 tonnes in Portugal. While this is well below the amount of lithium resources in Bolivia (21 million tonnes), Argentina (19 million tonnes), Chile (9.8 million tonnes), the USA (9.1 million tonnes), Australia (7.3 million tonnes), China (5.1 million tonnes), Germany (2.7 million tonnes), the Czech Republic (1.3 million tonnes) and Serbia (1.2 million tonnes), it is comparable to the 300,000 tonnes in Spain, and well above the 50,000 tonnes each in Austria and Finland.

Accordingly, since the mid-2010s, lithium has gained a prominent place in Portuguese raw materials policy, which foresees the creation of a new resource frontier. In December 2016, the government set up a working group to study the potential of Portuguese lithium for electric vehicle batteries manufacture (Administrative Order No. 15,040/2016). The report, released in March 2017, concluded that the country has considerable lithium deposits in nine areas located in the North and Centre regions.¹ Then, in January 2018, the government approved

strategic guidelines to explore lithium (Resolution of the Council of Ministers No. 11/2018). Next, the government signed exploration contracts for lithium and other minerals for two areas in the North region during 2018–2019. The first covered an area of 593 hectares in the parish of Covas do Barroso (261 inhabitants in 2011, 191 inhabitants in 2021), in the municipality of Boticas, and was signed with the British company Savannah Resources. The second extended over an area of 825 hectares in the parish of Morgade (228 inhabitants in 2011, 195 inhabitants in 2021), in the municipality of Montalegre, and was signed with the Portuguese company Lusorecursos.

Subsequently, in February 2021, DGEG requested an SEIA of the Lithium Research and Prospecting Programme in eight potential areas of lithium mining. Concluded in January 2022, this assessment served as the basis for approval of lithium research and prospecting in six areas, one in the North and five in the Centre regions, while rejecting research and prospecting rights in two areas, one in each of the same regions (see Table 1).² Activities in the areas of Arga and Segura were rejected due to their prospective classification as protected areas. Several approved activities were spatially delimited in scope in light of high population density.

Rapidly, in February 2022, Portugal's government announced international public tenders for lithium research and prospecting rights in the six areas identified in Table 1, which are currently being drafted. A little earlier, in October 2021, the government signed an exploration contract of lithium and other minerals (e.g. tin, tantalum, niobium, wolfram, rubidium, copper, lead, zinc, gold, and silver) in the Serra da Argemela with the Portuguese company PANN – Consultores de Geociências. The process related to exploration in this area dates back to 2011, and the application for a concession to explore an area of 404 hectares was submitted in 2017 and granted in 2020. The concession area covers three parishes – Barco and Coutada (879 inhabitants in 2011, 723 in 2021), Lavacolhos (236 inhabitants in 2011, 180 inhabitants in 2021) and Silvares (968 habitantes in 2011 and 2021) – in the municipalities of Covilhã and Fundão in Central Portugal.

Yet, as of May 2023, there are no relevant lithium mines operating in Portugal. Lithium is only extracted in association with quartz and feldspar in some small-scale open pit operations in Northern and Central Portugal – such as the Lousas Mines in the municipality of Boticas, the Gondiaes Mine in the municipality of Cabeceiras de Basto, and the Alvarrões Mine in the municipality of Guarda – to feed the glass and ceramics industry. Fig. 1 presents an overview of the areas requested, attributed and forecasted for lithium exploration or extraction during 2016–2021.

It is noteworthy that planning decisions on the mining extraction sites are taken at the national level. Permissions for exploration and extraction of raw materials are given by DGEG. Environmental Impact Assessments (EIA) of mining projects come under the jurisdiction of the Portuguese Environment Agency. Municipal councils also give opinions, but these are not binding when there is no protected area at stake. Likewise, the statements made in the public consultation processes of lithium exploration or extraction projects are not binding either.

Except in part for Serra d'Arga, which is close to the coastal city of Viana do Castelo, the areas mapped for lithium (and other raw material) exploration or extraction are peripheral and scarcely populated rural areas that have been witnessing continuous population declines since the mid-20th century. This is contemporaneous with a shift from an economic model based on primary sector activities to one based on production and consumption activities – in which agri-environmental schemes, nature conservation and tourism play important roles – since the 1980s; a trend paralleled in many other rural areas in Southern

¹ Accessed on 29.10.2022 at <https://www.dgeg.gov.pt/media/ngzjpc5z/res-umo-executivo-relatorio-grupo-litio.pdf>.

² Accessed on 03.11.2022 at https://www.dgeg.gov.pt/media/svdjw2kn/2_r013-22_21-06-15_rnt.pdf. The areas of Covas do Barroso, Morgade and Serra da Argemela were not subject to this assessment due to the existence of contracts signed in earlier years.

Table 1

Overview of the key characteristics of the eight areas proposed for lithium research and prospecting subject to the Strategic Environmental Impact Assessment.

Designation	Initial area Km ²	Final area Km ²	District(s)	Municipalities	Decision
Arga	247.7	0	Viana do Castelo	Caminha, Vila Nova de Cerveira, Viana do Castelo, Ponte de Lima, Paredes de Coura	Disapproved
Seixoso – Vieiros	247.3	144.215	Braga, Porto, Vila Real	Fafe, Celorico de Basto, Guimarães, Felgueiras, Amarante, Mondim de Basto	Approved
Massueime	499.7	438.651	Guarda	Almeida, Figueira de Castelo Rodrigo, Pinhel, Trancoso, Mêda	Approved
Guarda – Mangualde C	421.5	162.872	Castelo Branco, Guarda	Belmonte, Covilhã, Fundão, Guarda	Approved
Guarda – Mangualde E	497.0	420.576	Guarda	Almeida, Belmonte, Guarda, Sabugal	Approved
Guarda – Mangualde W	376.6	173.899	Guarda, Viseu	Mangualde, Gouveia, Seia, Penalva do Castelo, Fornos de Algodres, Celorico da Beira	Approved
Guarda – Mangualde NW	444.9	155.244	Viseu, Coimbra	Viseu, Satão, Penalva do Castelo, Mangualde, Nelas, Oliveira do Hospital	Approved
Segura	311.3	0	Castelo Branco	Castelo Branco, Idanha-a-Nova	Disapproved

Europe (Silva and Figueiredo, 2013).

Nevertheless, agriculture remains an important economic activity in most of these areas. For example, the agri-silvi-pastoral system of the Barroso area, which encompasses the municipalities of Boticas and Montalegre, was included in the United Nations Food and Agriculture Organisation's list of Globally Important Agriculture Heritage Systems in 2018, and features several protected geographical indication agricultural products. Another concession, Guarda – Mangualde C, impinges on the irrigation of Cova da Beira, which feeds over 3500 farms across 6000 hectares of land, including national ecological reserve and national agricultural reserve zones spread across five municipalities in Central Portugal.

Furthermore, some of the areas at stake have an important mining past, mainly associated with wolfram and tin but also with small-scale and artisanal uranium mining. This is the case with the Covas Mine in the municipality of Vila Nova da Cerveira, the Bessa Mining Field and the Borralha Mines in the municipality of Montalegre, the Panasqueira Mines in the municipalities of Covilhã and Fundão, the Malha Pão Mining Field in the municipality of Seia, and the Urgeiriça Mine in the municipality of Nelas. Most of these were shut down in the 1950s-1960s, leaving several open pit mines and galleries, and a variety of environmental problems that have persisted in their wake.

5. Controversies around lithium exploration and extraction

Since the beginning, the Portuguese government has regarded lithium mining as a great contribution to the national economy that can attract investment and create jobs, as well as to the European Union's objective of achieving carbon neutrality by 2050, by enabling the manufacture of electric vehicle batteries and digitalisation for decarbonisation of sectors such as transport. Accordingly, in February 2022, government representatives met with the mayors of the municipalities where lithium research and prospecting is foreseen, to explain “the relevance of lithium, the economic gains that can result from its exploration, the environmental impacts that it can cause and how to minimize them” based on media reports cited below. They guaranteed that municipalities would receive about “€100,000 per year” per mine.

This is both an illustration of the centralised nature of the Portuguese territorial organisation, in which negotiation takes place between national and local political elites (often in a non-transparent manner), and a consequence of the anti-mining positions assumed by several municipal (and parish) mayors and councils based on pressure from social movements and populations directly affected by the lithium programme. Such positions were expressed by approving motions against the inclusion of their territories in the lithium programme, by participating in demonstration protests organised by social movements, and/or by submitting unfavourable opinions in the public consultation process of the SEIA report of the lithium programme. These inputs were grounded in the claim that mining comes into conflict with current local

development strategies that are based on the protection of the environment and heritage, agriculture and tourism.

Indeed, considering the statements made by some of the mayors of several municipalities located in the Centre region of the country to a regional and a national newspaper (*O Interior* and *Expresso*, respectively) after one of the aforementioned meetings with government representatives, concerns about the adverse environmental and socio-economic impacts of lithium exploration or extraction persist, even as the promise of local job creation is not guaranteed, and the anticipated revenue for the municipalities is considered rather insignificant.³

Notably, some mayors in the municipalities mapped for lithium mining emphasised its link to local job creation, depopulation reversal and revenue prospects from the outset. For example, in 2017, the erstwhile mayor of the municipal council of Montalegre considered lithium mining “a unique opportunity to fight regional depopulation and [...] to enhance the public finances of our country”, and highlighted the prospective attraction of “skilled workers”.⁴ Likewise, in 2017, the then-mayor of the municipal council of Guarda responded with satisfaction to the interest in lithium exploration in its territory and the municipal government gave a favourable opinion to three mineral explorations requests, including lithium.⁵ Similarly, in 2022, the municipal assembly of Seia rejected a motion presented against lithium mining in the municipality.⁶ Additionally, some residents in the areas mapped for lithium exploration or extraction are in favour of lithium mining as a driver of job creation, depopulation reversal and revenue prospects, according to data collected in the parish of Gonçalo and information provided by anti-mining movement/association representatives in 2022.

Nevertheless, as also applicable to numerous other resources, lithium extraction carries risks of environmental destruction, community displacement, and populist backlash. Hence, requests for lithium exploration, the signing of contracts and the mapping of lithium prospecting or extraction areas has evoked public opposition reactions by environmental and cultural civil society organisations, local populations, and social movements. In fact, anti-mining movements, associations and platforms have burgeoned in the North and Centre regions

³ See <https://ointerior.pt/regiao/ministro-matos-fernandes-garantiu-que-rendimento-das-minas-de-litio-sera-partilhado-com-as-autarquias/> and <https://expresso.pt/sociedade/2022-02-10-litio-autarcas-saem-incredulos-de-reuniao-com-o-ministro-do-ambiente>, accessed on 10.11.2022.

⁴ See <https://www.jornaldenegocios.pt/empresas/detalhe/montalegre-ve-na-exploracao-de-litio-oportunidade-unica-de-combater-despovoamento>, accessed on 10.11.2022.

⁵ See <https://www.jornaldenegocios.pt/mercados/materias-primas/detalhe/camara-da-guarda-da-parecer-positivo-a-exploracoes-de-litio-na-zona-sul-do-concelho>, accessed on 10.11.2022.

⁶ See <https://letras-do-alva.webnode.pt/1/assembleia-municipal-de-seia-rejeita-mocao-apresentada-contra-a-exploracao-de-litio-no-concelho/>, accessed on 11.11.2022.

Lithium mining in the municipalities of the Northern and Central regions of Portugal: Areas requested, attributed, and foreseen for exploration or extraction between 2016 and 2021.

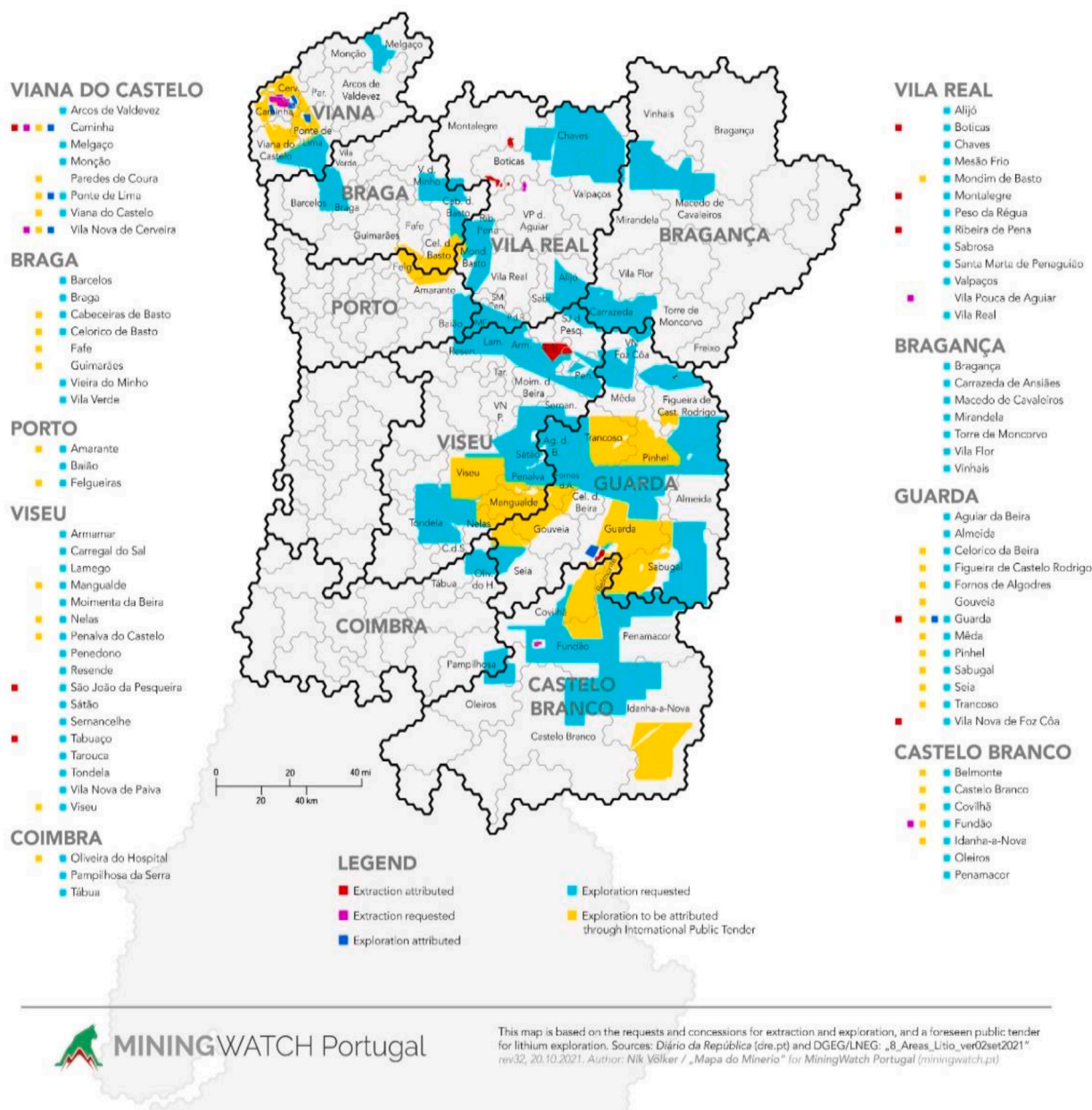


Fig. 1. Lithium in Portugal (Source: https://miningwatch.pt/assets/img/Lithium_Mining_in_Northern_Central_Portugal-Municipalities-Districts-rev32-2021-En.jpg).

of Portugal. Some have evolved from spontaneous social movements to associations “to act jointly in a more organised and formal way”, as several interviewees put it.

Some actions have taken place on the ground, such as collecting signatures, writing letters of complaint to DGEGL, prohibiting the companies’ workers to enter private and common lands, and organising sessions to make the population aware of the risks of lithium mining and

demonstration protests in the villages and towns near where lithium mining is foreseen, as well as two joint demonstration protests in Lisbon (in 2019 and 2021) under the banner “No to mines, yes to life”. Others have unfolded on electronic platforms, such as by creating Facebook accounts and online public petitions and delivering two national manifestos. In both these ways, movements, associations, and platforms have sought to prevent lithium and other raw material mining locally.⁷

⁷ The association Montalegre with Life has also filed a complaint in the administrative court of Mirandela to annul the contract signed between the DGEGL and the company, and promoted three electoral boycotts, two in 2019 and one in 2021, while the association Corema convinced priests to read notices and make appeals at masses for people to participate in protests against lithium mining in the Serra d’Arga.

In part, as elsewhere (Escosteguy et al., 2022), the opposition is due to a lack of transparency and consultation of populations by national and municipal governments. For instance, movement representatives ubiquitously complained that citizens are not duly informed about public consultations on mining projects, their participation in such consultations is only possible through the Participate online portal, and that many people, especially the elderly, do not have access to the internet, particularly amongst rural dwellers. This is not a new phenomenon in Portugal, where public consultations of EIA have a “typically centralized, hierarchical and secretive” (Gonçalves, 2002) nature and do not effectively involve local populations in planning and decision-making processes. Respondents also claimed that some contracts were signed without an EIA of the projects. Some further stated that the national government and DGEG does not respond to complaint letters and emails, and that municipal councils have failed to promote awareness sessions for local populations. In some cases, resistance is also due to the lack of trust in the competence of the companies that requested and obtained concession areas for lithium mining.

More than this, however, the size of exploration or extraction areas, the proximity to habitation in several cases and, above all, the undesirable impacts of open pit mining are regarded as endangering local environmental conditions and economic activities by changing land use patterns. The supporting quotes from multiple sources in Table 2 illustrate this point.

These concerns are also shared by other anti-mining movements and associations of local and regional scope. In January 2020, 12 social movements delivered and signed a national manifesto against plans for lithium and associated minerals exploration or extraction in Portugal, highlighting the “lack of transparency” in the national policy at different levels and defending “the self-determination of local communities to protect life as such, the communities’ vitality, public health, plant and animal well-being, the quality of water, soils and air, as well as the right to tranquillity”. They also listed the potential negative impact of mining on natural and food resources, public health, population’s quality of life, “social relations and the livelihoods of local communities”, landscape, the “quality and economic potential of regional products and nature tourism”, as well as the risks of increased rural depopulation. They further complained that the areas mapped for exploration or extraction impinge on protected areas and endanger “archaeological, cultural, and religious heritage”.⁸

More recently, in May 2021, 14 anti-mining movements and associations promoted the second demonstration protest in Lisbon and delivered a national manifesto rejecting the Green Mining narrative that served as the motto for the European Conference on Green Mining.⁹ Environmental civil societies of national scope, such as Quercus and Zero, have shown similar opposed reactions and concerns, but limited to prospecting and extraction in protected areas, based on greater primacy to the consideration that lithium plays a critical role in the low-carbon energy transition.¹⁰

Accordingly, the public consultation period for the aforementioned SEIA report of the eight potential areas of lithium research and prospecting, which ran from 28 September until 10 December 2021 in the Participate online portal, received 1430 statements. Of these, 1361 were signed by citizens; 11 by 973 citizens; eight by private companies linked to viticulture, electricity generation from renewable sources and tourist accommodation establishments; 38 by a category of actors that included

⁸ Accessed on 10.11.2022 at <https://drive.google.com/file/d/11o7xZVDSnwwGsYbifrWXQtORck49lk7/view>.

⁹ Accessed on 10.11.2022 at <https://minanao.noblogs.org/post/2021/04/29/manifesto-de-repudio-a-narrativa-green-mining/>.

¹⁰ See, for example, <https://alertalito.quercus.pt/posicao-da-quercus-ancn-em-relacao-a-exploracao-de-litio-em-portugal/> and <https://zero.org/litio-pedidos-para-prospecao-e-pesquisa-abrangem-mais-de-86-mil-hectares-em-area-s-com-interesse-para-conservacao-da-natureza/>, accessed on 11.11.2022.

Table 2

Quotes from representatives of lithium extraction resistance movements.

Source	Quote
Representative of the Association United in Defence of Covas do Barroso	“It’s a business that will destroy our way of life [and] [...] our village [...]. We are talking about a project and exploration rights in an area of over one-third of our parish’s territory. We are talking about a project located 200 m from the houses. We are talking about a mostly agricultural community. [...] And we cannot go along with a State that does not defend our interests and closes its eyes to private interests. Because our river is within the concession area, the various mines are a few meters from the river, the washing plant too and there’s another thing: they have designed a heap up to 190 m at the exit of the washing plant. [...] Then, on days like today when it rains heavily, everything ends up in the river.”
Representative of the Association Montalegre with Life	“It’s a large-sized open pit mine and people are afraid of having mines near their houses. [...] Then, an area of dense forest [...] would be destroyed. It is an area very rich in water [...] and that water would disappear. [...] The Rabagão [...] and the Bessa rivers [...] will also be affected and disappear. Afterwards, they also told us that an industrial area with about 200 hectares was going to be built [...] close to the village of Morgade. And all these 200 hectares are currently an agricultural area. [...] This agricultural land would be transformed into industrial land [...]. They also wanted to build a refinery and a ceramics industry in that industrial zone, something that would have a strong environmental impact. amongst other things, our agriculture would disappear.”
Representative of the association Corema	“We had mining activities in the Serra d’Arga until 1984, namely in Covas, Vila Nova de Cerveira. The extraction was done in galleries and caused environmental damage that continues to be irreparable, namely the pollution of water courses such as the Coura river. And we realised that the proposed open pit extraction was a very serious attack on biodiversity, the rural world, spatial planning, the population’s quality of life and human activities that are still practiced in the Serra d’Arga, such as grazing, tourism and agriculture.”
Representative of the Movement Against Mining Beira Serra	“We all know what happened with the previous mining phases [...] [and] [...] the truth is that where there are mines, the soil resource disappears right at the head. [...] There is also the issue of pollution, the disruption of groundwater... [...] And we are in a country and regions [...] with almost systematic extreme or severe droughts. It is unaffordable to have activities that consume thousands of hectolitres of water per day. [...] Additionally, [...] the entire lithium separation process will generate a lot of dust that will spread around. With leaves full of dust, trees and plants will not photosynthesise. So, wine, blueberries, apples, just to mention the large areas of agricultural production here in the area, all this [will disappear].”
Representative of the Group for the Preservation of the Serra da Argemela	“This project is to annihilate us and not to bring some kind of development to the region. (In what sense?) The project is about 500 m from the village [of Barco] and at a higher elevation... Even if there is no wind,

(continued on next page)

Table 2 (continued)

Source	Quote
	and that is a windy region, the dust falls on top of us daily. We won't be able to open windows or dry clothes in the sun. It's going to be impossible to eat a lettuce or a cabbage or whatever because the dust won't let people do that. Life here in Barco will be impossible. [...] With open pit mining here, there will be destruction of heritage [houses], lives and ecosystems. We cannot forget that the Zêzere river passes here. Who will save three million inhabitants in the Lisbon region who drink water from the Zêzere river? [...] Here at Barco but also at Lavacinhos and Silvaes, there are two options: either mining is not carried out or the villages are displaced. Because leaving villages there with open pit mining is killing people."

associations (16), non-governmental organisations, movements (4) and political parties; 60 by local governments; and four by central/regional administration entities.

Most, that is 95.7% of such statements, were against the lithium programme, 1.3% were in favour of it, 1.1% were complaints, 0.7% were suggestions, and the remainder mentioned other issues. About 45.5% of the unfavourable statements refer to all sites of lithium prospecting at stake, the entire lithium programme, or do not mention any specific sites. The prospective impacts of the projects on local populations, biodiversity, geological resources, and water stand out as the main reasons for opposition (between 15% and 19%), though a significant percentage of objectors highlight other potential negative effects, notably on heritage, air quality, landscape, governance (of common lands) and tranquility (between 11% and 14%).¹¹

Furthermore, following the government's decision to issue the public tender for granting lithium research and prospecting rights in the six areas identified above, several social movements have publicly expressed that they will continue their efforts to prevent lithium mining in their territories. This includes most of the movements whose representatives we interviewed, whereas other movements have been newly minted, such as the Movement Seixoso – Vieiros Against Mining (2022) and the SOS Platform Between Douro and Minho (2022). One interviewee pointed out this wellspring of collective agency, despite members' recognition that "the inequality of weapons between us, citizens, and the so-called pressure groups is enormous, as they have access to the corridors of the Assembly of the Republic and the European institutions, and there is a whole propaganda about lithium going on that crushes us every day".

Anti-mining movements and associations recognise that global warming requires urgent action. However, they question the idea that massive extraction-based electrification of the global economy is the solution, given the sheer amount of raw material resources required to do so, and the existence of sources of greenhouse gas emissions other than carbon dioxide. Additionally, they are not only against lithium mining, but against all mining activities on their territories, on the grounds that there is no "green mining", especially considering that the projects at stake are open pit mines, which entail harmful environmental and socio-economic consequences and the destruction of natural carbon sinks, notably forests.

Regarding the main driver of differences in perspective amongst actors related to lithium mining in Portugal, interviewees held that its advocates want to make a business out of climate change, whereas opponents are keen to preserve local environmental conditions and

livelihoods, as captured in the two telling quotes below:

"The main factor is economic, who is in favour, for me, the reason is economic. (And who is against?) Those who value the quality of life, value the environment and value what has been left to us" (Representative of the Association Montalegre with Life).

"There are two logics here: there are people with a profoundly materialist thought who see technology as the solution for all problems and there is another part of the world's population [...] that has already realised that we only have this planet and we must preserve it" (Representative of the Movement Against Mining Beira Serra).

6. Conclusion

Our study sheds light on the controversies associated with the latest chapter of the Portuguese transition to a low-carbon economy, the constitution of a new commodity/resource frontier. While the Portuguese government has been promoting the extraction of identified lithium reserves in the country since 2016, social movements and associations of local and regional scope affected by the lithium programme have emerged in protest against mining in their territories. The reasons for this opposition include the environmental justice issue of "fairness of process" and, above all, the environmental and socio-economic problems that open pit mining of lithium and other raw materials are expected to create or exacerbate by changing land use patterns.

Like large-scale "renewable" energy projects – such as wind and solar power plants – in Portugal (Silva and Sareen, 2021) and elsewhere worldwide (O'Sullivan et al., 2020), prospective lithium mining reinforces centre/periphery asymmetries. Local populations remain excluded from substantive decision-making processes, but must be effectively involved in deciding about lithium mining in order to pursue and deliver more just low-carbon energy transitions in Portugal in ways that enjoy greater popular legitimacy. Despite Portugal's relatively small reserve, there are parallels with controversies related to lithium mining in the much-studied Lithium Triangle of Latin America. Yet, there are also differences in terms of the social process, related to how power manifests. Portugal has shown state leadership in structuring corporate lithium mining expansion, with national civil society organisations largely towing the line drawn in the formal process, aiming to block the worst excesses in terms of socio-ecological impact. Local and regional voices have mobilised to make diverse claims about a wider range of place-specific impacts, but without much influence on the unfolding push towards extraction.

This attention to diverse lithium extraction geographies is a key contribution to growing thematic research and an avenue for future investigation. The Portuguese case reminds us that extraction is shaped through complex, culturally intertwined structures, which themselves undergo institutional evolution as energy sectors and policies move towards low-carbon transitions. The land use changes underway in this case displace marginalised ways of life related to agrarian livelihoods and rural habitation, with impacted residents poorly integrated in the modalities of centrally-led participatory processes. The national socio-technical imaginary of a future green Portugal thus worryingly holds less space for these diverse ways of being and places that have long been quintessentially Portuguese.

Finally, our preliminary foray into the emergent social movements that resist lithium frontier-making and are being rapidly firmed up provides room for pause. We see limited social contestation, and in its stead a disquieting discontent amongst citizens who feel their worldview is shunned by a modernistic vision of progress that drives extraction in strategic discursive constructions of "empty space" without ensuring continuity in a detailed and deliberative manner. A pragmatism embodies Portugal's green transition in its enablement of lithium extraction, one whose success may well inspire other countries to learn from its centrally-led approach, while containing the unrest caused by

¹¹ See https://participa.pt/contents/finalreport/R012.22.21.06.15_Relatorio_consulta_6769.pdf, accessed on 10.11.2022.

dispossession. Our foregrounding of multiple counter-hegemonic visions of place-specific energy futures points to the need to secure interests of multiple actors to avoid societal splits over time, and raises troubling questions about what the future holds if this pragmatic approach proves successful and is widely emulated worldwide. With the widening advent of lithium extraction, what will we gain and what do we lose?

Declaration of Competing Interest

No potential conflict of interest was reported by the authors.

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References

- Agusdinata, D.B., Liu, W., Eakin, H., Romero, H., 2018. Socio-environmental impacts of lithium mineral extraction: towards a research agenda. *Environ. Res. Lett.* 13 (12), 123001 <https://doi.org/10.1088/1748-9326/aae9b1>.
- Ambrose, H., Kendall, A., 2020. Understanding the future of lithium: part 1, resource model. *J. Ind. Ecol.* 24 (1), 80–89. <https://doi.org/10.1111/jiec.12949>.
- Araújo, E., Bento, S., Silva, M., 2022. Politicizing the future: on lithium exploration in Portugal. *Eur. J. Futures Res.* 10 (1), 1–11. <https://doi.org/10.1186/s40309-022-00209-3>.
- Bae, H., Kim, Y., 2021. Technologies of lithium recycling from waste lithium ion batteries: a review. *Materials Advances* 2 (10), 3234–3250. <https://doi.org/10.1039/D1MA000216C>.
- Barandiarán, J., 2019. Lithium and development imaginaries in Chile, Argentina and Bolivia. *World Dev.* 113, 381–391. <https://doi.org/10.1016/j.worlddev.2018.09.019>.
- Beckert, S., Bosma, U., Schneider, M., Vanhaute, E., 2021. Commodity frontiers and the transformation of the global countryside: a research agenda. *J. Glob. Hist.* 16 (3), 435–450. <https://doi.org/10.1017/S1740022820000455>.
- Bos, V., Forget, M., 2021. Global Production Networks and the lithium industry: a Bolivian perspective. *Geoforum* 125, 168–180. <https://doi.org/10.1016/j.geoforum.2021.06.001>.
- Chaves, C., Pereira, E., Ferreira, P., Dias, A.G., 2021. Concerns about lithium extraction: a review and application for Portugal. *Extr. Ind. Soc.* 8 (3), 100928 <https://doi.org/10.1016/j.exis.2021.100928>.
- Crawford, A., Seefeldt, J.L., Kent, R., Helbert, M., Guzmán, G.P., González, A., Chen, Z., Abbott, A., 2021. Lithium: the big picture. *One Earth* 4 (3), 323–326. <https://doi.org/10.1016/j.oneear.2021.02.021>.
- De Sitermes, F.J., Jenkins, J.D., Botterud, A., 2016. The value of energy storage in decarbonizing the electricity sector. *Appl. Energy* 175, 368–379. <https://doi.org/10.1016/j.apenergy.2016.05.014>.
- Dunlap, A., Riquito, M., 2023. Social warfare for lithium extraction? Open-pit lithium mining, counterinsurgency tactics and enforcing green extractivism in northern Portugal. *Energy Res. Soc. Sci.* 95, 102912 <https://doi.org/10.1016/j.erss.2022.102912>.
- Escosteguy, M., Clavijo, A., Paz, W., Hufty, M., Seghezze, L., 2022. We are not allowed to speak: some thoughts about a consultation process around lithium mining in Northern Argentina. *Extr. Ind. Soc.* 11, 101134 <https://doi.org/10.1016/j.exis.2022.101134>.
- Fairhead, J., Leach, M., Scoones, I., 2012. Green grabbing: a new appropriation of nature? *J. Peasant Stud.* 39 (2), 237–261. <https://doi.org/10.1080/03066150.2012.671770>.
- Gonçalves, M.E., 2002. Implementation of EIA directives in Portugal. How changes in civic culture are challenging political and administrative practice. *Environ. Impact Assess. Rev.* 22 (3), 249–269. [https://doi.org/10.1016/S0195-9255\(02\)00005-7](https://doi.org/10.1016/S0195-9255(02)00005-7).
- Höhne, N., Gidden, M.J., den Elzen, M., Hans, F., Fyson, C., Geiges, A., Jeffery, M.L., Gonzales-Zuñiga, S., Mooldijk, S., Hare, W., Rogelj, J., 2021. Wave of net zero emission targets opens window to meeting the Paris Agreement. *Nat. Clim. Chang.* 11 (10), 820–822. <https://doi.org/10.1038/s41558-021-01142-2>.
- Izquierdo, A.E., Grau, H.R., Carilla, J., Casagrande, E., 2015. Side effects of green technologies: the potential environmental costs of lithium mining on high elevation Andean wetlands in the context of climate change. *Glob. Land Project: GLP News* 12, 53–56, 11-2015.
- Liu, W., Agusdinata, D.B., Myint, S.W., 2019. Spatiotemporal patterns of lithium mining and environmental degradation in the Atacama Salt Flat, Chile. *Int. J. Appl. Earth Obs. Geoinf.* 80, 145–156. <https://doi.org/10.1016/j.jag.2019.04.016>.
- Liu, W., Agusdinata, D.B., 2020. Interdependencies of lithium mining and communities sustainability in Salar de Atacama, Chile. *J. Clean. Prod.* 260, 120838 <https://doi.org/10.1016/j.jclepro.2020.120838>.
- Liu, W., Agusdinata, D.B., 2021. Dynamics of local impacts in low-carbon transition: agent-based modeling of lithium mining-community-aquifer interactions in Salar de Atacama, Chile. *Extr. Ind. Soc.* 8 (3), 100927 <https://doi.org/10.1016/j.exis.2021.100927>.
- Martinez-Alier, J., 2009. Social metabolism, ecological distribution conflicts, and languages of valuation. *Capital. Nat. Social.* 20 (1), 58–87. <https://doi.org/10.1080/10455750902727378>.
- Miao, Y., Liu, L., Zhang, Y., Tan, Q., Li, J., 2022. An overview of global power lithium-ion batteries and associated critical metal recycling. *J. Hazard. Mater.* 425, 127900 <https://doi.org/10.1016/j.jhazmat.2021.127900>.
- Mitchell, T., 2011. *Carbon Democracy: Political Power in the Age of Oil*. Verso, London and New York.
- Moore, J.W., 2015. *Capitalism in the Web of Life: Ecology and the Accumulation of Capital*. Verso, London.
- Narins, T.P., 2017. The battery business: lithium availability and the growth of the global electric car industry. *Extr. Ind. Soc.* 4 (2), 321–328. <https://doi.org/10.1016/j.exis.2017.01.013>.
- Ortiz, E.M., 2021. *The role of the state and the environmental impacts of lithium mining in Jujuy, Argentina*. Master thesis. UCLA, Los Angeles.
- O'Sullivan, K., Golubchikov, O., Mehmood, A., 2020. Uneven energy transitions: understanding continued energy peripheralization in rural communities. *Energy Policy* 138, 111288. <https://doi.org/10.1016/j.enpol.2020.111288>.
- Peluso, N.L., Lund, C., 2011. New frontiers of land control: introduction. *J. Peasant Stud.* 38 (4), 667–681. <https://doi.org/10.1080/03066150.2011.607692>.
- Riofrancos, T., 2022. The security-sustainability nexus: lithium onshoring in the Global North. *Global Environ. Polit.* 1–22. https://doi.org/10.1162/glep_a_00668.
- Sareen, S., Wolf, S.A., 2021. Accountability and sustainability transitions. *Ecol. Econ.* 185, 107056. <https://doi.org/10.1016/j.ecolecon.2021.107056>.
- Silva, L., Delicado, A., 2017. Wind farms and rural tourism: A Portuguese case study of residents' and visitors' perceptions and attitudes. *Morav. Geogr. Rep.* 25 (4), 248–256. <https://doi.org/10.1515/mgr-2017-0021>.
- Silva, L., Figueiredo, E. (Eds.), 2013. *Shaping Rural Areas in Europe. Perceptions and Outcomes on the Present and the Future*. Springer.
- Silva, L., Sareen, S., 2021. Solar photovoltaic energy infrastructures, land use and sociocultural context in Portugal. *Local Environ.* 26 (3), 347–363. <https://doi.org/10.1080/13549839.2020.1837091>.
- Stamp, A., Lang, D.J., Wäger, P.A., 2012. Environmental impacts of a transition toward e-mobility: the present and future role of lithium carbonate production. *J. Clean. Prod.* 23 (1), 104–112. <https://doi.org/10.1016/j.jclepro.2011.10.026>.
- Tsing, A., 2005. *Friction: An ethnography of Global Connection*. Princeton University Press, Princeton, NJ.
- U.S. Geological Survey, 2022. Mineral Commodity Summaries. Retrieved from. <https://pubs.usgs.gov/periodicals/mcs2022/mcs2022-lithium.pdf#8.11.2022>.
- Verbrugge, B., Geenen, S., 2019. The gold commodity frontier: a fresh perspective on change and diversity in the global gold mining economy. *Extr. Ind. Soc.* 6 (2), 413–423. <https://doi.org/10.1016/j.exis.2018.10.014>.
- Voskoboynik, D.M., Andreucci, D., 2021. Greening extractivism: environmental discourses and resource governance in the 'Lithium Triangle'. *Environ. plan. E Nat. Space* 5 (2), 787–809. <https://doi.org/10.1177/25148486211006>.
- Way, R., Ives, M.C., Mealy, P., Farmer, J.D., 2022. Empirically grounded technology forecasts and the energy transition. *Joule* 6 (9), 2057–2082. <https://doi.org/10.1016/j.joule.2022.08.009>.
- Worlanyo, A.S., Jiangfeng, L., 2021. Evaluating the environmental and economic impact of mining for post-mined land restoration and land-use: a review. *J. Environ. Manage.* 279, 111623 <https://doi.org/10.1016/j.jenvman.2020.111623>.
- Zografos, C., Robbins, P., 2020. Green sacrifice zones, or why a green new deal cannot ignore the cost shifts of just transitions. *One Earth* 3 (5), 543–546. <https://doi.org/10.1016/j.oneear.2020.10.012>.