Reindeer herders in the green sacrifice zone: The cumulative impacts of past extractivist dispossessions and recent mining expansion in Sodankylä, Finland

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Abstract

The European Union is pushing for critical mineral self-sufficiency to meet its goal of transitioning to a low-carbon society, and also supporting strategic defense objectives. The raw materials needed for this transition are creating so-called 'green sacrifice zones.' The people living in resource extraction areas suffer from environmental degradation, pollution, food insecurity, and loss of livelihoods and land. They also experience some of the worst climate change impacts. The article examines the impact of mining expansion on reindeer herders in Sodankylä, Arctic Finland. The herders' territories are transformed into a sacrificial zone, legitimated by the green transition. The article links historical changes, like those brought on by hydropower and forestry, to the current rapid transformations within the green transition. The green sacrifice zone has continuities with past socio-environmental damage. The sacrifice zone is (re)enforced over time by the power asymmetries between the reindeer herders and their intergenerational territorial relations, and the authorities and corporations that promote extractivism.

Key Words: green extractivism, mining, reindeer husbandry, Arctic, sacrifice zone

Résumé

L'Union européenne s'efforce de parvenir à une autosuffisance minérale critique afin d'atteindre son objectif de transition vers une société à faible émission de carbone et de soutenir les objectifs stratégiques de défense. Les matières premières nécessaires à cette transition créent ce que l'on appelle des 'zones de sacrifice vertes.' Les populations vivant dans les zones d'extraction des ressources souffrent de la dégradation de l'environnement, de la pollution, de l'insécurité alimentaire et de la perte de leurs moyens de subsistance et de leurs terres. Elles subissent également certains des pires impacts du changement climatique. L'article examine l'impact de l'expansion minière sur les éleveurs de rennes à Sodankylä, dans l'Arctique finlandais. Les territoires des éleveurs sont transformés en une zone sacrifiée, légitimée par la transition verte. L'article établit un lien entre les changements historiques, tels que ceux provoqués par l'hydroélectricité et la sylviculture, et les transformations rapides actuelles dans le cadre de la transition verte. La zone de sacrifice verte présente des continuités avec les dommages socio-environnementaux du passé. La zone de sacrifice est (ré)imposée au fil du temps par les asymétries de pouvoir entre les éleveurs de rennes et leurs relations territoriales intergénérationnelles, d'une part, et les autorités et les entreprises qui promeuvent l'extractivisme.

Mots clés: extractivisme vert, exploitation minière, élevage de rennes, Arctique, zone de sacrifice

Resumen

La Unión Europea está impulsando la autosuficiencia mineral crítica para cumplir su objetivo de transición a una sociedad con bajas emisiones de carbono, y también para apoyar objetivos estratégicos de defensa. Las materias primas necesarias para esta transición están creando las llamadas zonas verdes de sacrificio. Las personas que viven en las zonas de extracción de recursos sufren degradación medioambiental, contaminación, inseguridad alimentaria y pérdida de medios de vida y tierras. También sufren algunas de las peores consecuencias del cambio climático. El artículo examina el impacto de la expansión minera en los pastores de

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renos de Sodankylä, en el Ártico finlandés. Los territorios de los pastores se transforman en una zona de sacrificio, legitimada por la transición verde. El artículo relaciona cambios históricos, como los provocados por la energía hidroeléctrica y la silvicultura, con las rápidas transformaciones actuales dentro de la transición verde. La zona de sacrificio verde tiene continuidades con los daños socioambientales del pasado. La zona de sacrificio se (re)impone a lo largo del tiempo por las asimetrías de poder entre los pastores de renos y sus relaciones territoriales intergeneracionales, y las autoridades y empresas que promueven el extractivismo.

Palabras clave: extractivismo verde, minería, cría de renos, Ártico, zona de sacrificio

1. Introduction

In the twenty-first century, Arctic Finland (hereafter Lapland) has become a crucial area in the global search for untapped mineral resources. The production of minerals such as copper, lithium, and cobalt that are needed for renewable energy technologies (i.e. wind power, solar panels, batteries, and electric cars) and for defense purposes and space technologies is expected to increase worldwide (European Council 2023; World Bank, 2020). The Arctic, which is warming four times faster than the rest of the globe, is becoming more open at a regional level to mining, wind energy, and hydrocarbon development as determined by the Arctic nation-states and transnational organizations like the Arctic Economic Council (AEC, 2023; Dodds & Nuttall, 2019; Finger & Heininen, 2019).

Recent academic discussions have conceptualized the Arctic as a commodity extraction frontier, where historical patterns of colonization and resource extraction are reemerging as 'green' extractivism, which is legitimized by references to the climate crisis (see Dunlap *et al*., 2024; Hanaček *et al*., 2022). Globally, excavating so-called transition minerals has resulted in widespread environmental destruction and human rights abuses (Andreucci *et al*., 2023; Barbesgaard & Whitmore, 2022; Bennett, 2016). In response to the large-scale environmental damage and destruction resulting from resource extraction, there has been an increase in cases of resistance to green extractivism and the colonial legacies they embody (Hanaček *et al*., 2024; Kuokkanen, 2019; Shearer, 2012). The discussions about the adverse effects of increasing raw material exploitation highlight how the people living in areas of extraction for decarbonization purposes are living in so-called 'green' sacrifice zones (Dunlap and Laratte, 2022; EEB, 2023; Zografos and Robbins, 2020). In these zones, people experience increasing health effects, contamination, diminishing food security, and losses of livelihoods and lived environments while also experiencing the worst effects of climate change (Dunlap and Riquito, 2023; Jerez *et al*., 2021; Lerner, 2010). While the Arctic is becoming a central site of contestation over the raw materials needed for the green transition, there has been little discussion of the resulting sacrifice zones (Dale *et al*., 2018; Skorstad 2023).

This article contributes to the study of socio-environmental harms to local communities in the Arctic caused by increased large-scale extraction of resources in support of the green energy transition. The article asks whether a green sacrifice zone is developing in Sodankylä, a municipality of 8,300 inhabitants affected by the recent expansion of mining in the northernmost parts of Finland. In general, the emerging discussion on green sacrifice zones has focused on the most recent developments and policies that illustrate the burdens and cost shifts of extractivist and market-driven transitions (Zografos & Robbins, 2020). The article shows how the concept of the green sacrifice zone gains analytical power when it is linked to the political ecology perspective, which explains the historical and material dimensions of socio-environmental grievances and power asymmetries (e.g. Stott & Sullivan, 2000). By deepening the discussion of these newly created sacrifice zones, I suggest that green sacrifice zones not only occur through the current rapid transformations, but also develop over time and contain the histories of the cumulative impacts of industrial land use, resource extraction, and marginalization. By focusing on the lived experiences of reindeer herders with overlapping extractive industries in Sodankylä, I demonstrate that the history of cumulative impacts plays a central role in such a situation where herders are experiencing deteriorating conditions of their land-based livelihoods, and their territories are being transformed into a sacrificial zone for the latest green mining expansion. The herders' livelihoods have already been significantly impacted by hydropower and forestry through the loss or inextricable alteration of entire living environments, including the widespread reduction of reindeer pastures and their food sources. More

recently, herders have witnessed increased dust and water pollution from mining operations and the reservation of most of their traditional territories for mineral exploration. Herders are vulnerable to patterns of extraction and dispossession when the negative impacts limit their opportunities for reindeer herding in their traditional territories.

In this article, I will first explain the materials and methods employed, then unpack the theoretical and contextual aspects of the study. I then proceed with a description of the herders' experiences about the historical changes caused by national modernization through hydropower and forestry and their relationship to the recent mining expansion by multinational corporations. Finally, I will analyze the power asymmetries at play when herders interact with state authorities and companies and how these asymmetries affect the production of the sacrifice zone.

Materials and methods

This article is based on long-term research conducted between 2016 and 2024, where I followed the mining industry and its socio-environmental impacts in Sodankylä, Finland. The overarching research included 52 interviews and discussions with research participants. The analysis presented in this article is based on 18 interviews, the majority of which were conducted in spring 2023, but some also in 2016, 2020, and 2024. Participants are anonymized using initials. Twelve of the interviews were with Finnish reindeer herders from the Sattasniemi and Oraniemi districts, while two interviews were with herders from the Sámi Lappi district. Interviews with two villagers and two municipality representatives are also included. It must be noted that the herders I interviewed in Sodankylä, from the Sattasniemi and Oraniemi districts, may identify as partly Sámi or as having Sámi ancestors, despite not speaking the Sámi language. Due to ancestral reindeer-herding and other nature-related subsistence practices in the area, they have a unique cultural identity that differs from the majority population. This situation can be described as a hybrid ethnic identity in a region with a rich history of mixed ethnicities and movements, making it difficult to distinguish between indigeneity and non-indigeneity (Valkonen, 2009).

The interviews were semi-structured, open-ended, and conversational. The reindeer herders responded to questions concerning their pasture lands and the changes caused by different industrial land uses. The questions posed to municipal representatives concerned the municipality's position on the mining industry. The reindeer herders I interviewed were men and women, aged 20 and older. The interviews were mostly conducted by voice or video call. Some of the research participants I had previously met in Sodankylä, and most of the people I had interviewed remotely I later met in person in Sodankylä during fieldwork in May 2024 (Image 1). Thus, the interviews are part of a longer continuum, where the connections with the research participants have not ended and are an ongoing research process. The interviews discussed in the article are indicated by letters and years. The interviews were analyzed by finding common themes and concerns in the reindeer herders' accounts of industrial land use in this specific area. These were then supported by historical and region-specific literature and other secondary materials, such as environmental reports and news articles. In the analysis, particular attention was paid to the power asymmetries that the herders experience with the authorities and companies seeking to justify their mining activities. Typically with ethnographic analysis, the data collection, analysis, and writing phases were intertwined throughout the research process (Kramer & Adams, 2017).

Given the long history of extractive and colonial knowledge production within academia in relation to Indigenous and minority communities, it was important to consider how the interviews were conducted and the research findings presented (Drugge, 2016). The autonomy and informed consent of the research participants were respected. Within the interview space, they were able to talk freely and steer the course of the interview in the directions that they felt were most important. The knowledge produced through this process responds to the herders' desire to make their experiences with extractivism better known.

Image 1: Reindeer calf marking, Sattasniemi district, Sodankylä, May 2024. Kirsi Mäkitalo, Sami Pulju and Ante Pulju. Photo: Author

3. The sacrifice zone, extractivist expansion, and cumulative impacts

The concept of sacrifice zones emerged in the United States as early as the 1970s[2] in relation to the oil crisis and the resulting demand for energy self-sufficiency, which led to a rapid expansion of uranium and coal mining and oil extraction in the American West (Juskus, 2023). This land had already been targeted for its oil in the 1920s, and the Navajo people have been exploited since the 1950s as uranium mines were built and nuclear tests were conducted in their territories (Juskus, 2023; Redfern, 2023). In the 1980s and 1990s, Indigenous activists drew attention to the devastating health effects of uranium mining and nuclear testing, citing the sacrifice of their lands (Means 1983; Ortiz, 1992). In the 1990s and 2000s, environmental justice activists and scholars expanded the concept of a sacrifice zone to include a broader perspective of communities around the world, usually low-income or minority, with no decision-making power, who bear the burden of capitalist accumulation and industrialization in the form of health and environmental impacts near extraction sites, military bases, hazardous waste sites, or chemical factories (Lerner, 2010).

Studies of sacrifice zones and environmental justice point to how marginalized communities living near extraction sites bear the environmental damage resulting from capitalist development. At its core, the sacrifice zone can be seen as an inherent part of spatial inequality in the modern political economy since it intertwines extractivism, coloniality, and racism (see Bullard, 1990; Massey, 2005; Quijano, 2000). The wealth and

[2] Earlier, the concept had been connected to livestock grazing, where certain areas, such as pastures near water sources, were 'sacrificed' so that other pastures remained green (Juskus, 2023).

prosperity of the few are made possible through the exploitation of Indigenous peasant, pastoral lands, and the systematic externalization of the negative impacts (Chagnon *et al.*, 2022; Willow & Orr, 2019; Ye *et al*., 2019). More recently, the political ecology discussion of green extractivism has been linked to the emerging discussion of green sacrifice zones and the capitalist "minerals and renewable energy nexus" (Andreucci *et al*., 2023). Scholars have conceptualized green extractivism as capitalism's latest socio-environmental 'fix' in which the global environmental crisis provides opportunities for corporations and states to continue capitalist accumulation and drive increased consumption by expanding extractive operations into areas that were previously considered off-limits, by claiming that such extraction is sustainable and mitigates climate change (Andreucci *et al*., 2023; Bruna, 2023; Harvey, 2001; Le Billon, 2021; McCarthy, 2015; Enns *et al*., 2019). The low-carbon transition through green policy initiatives, such as the Green New Deal in the United States of America or the European Green Deal, has significant negative impacts for the people living where the raw materials and energy are or will be extracted, such as Sodankylä (Andreucci *et al*., 2023; EEB, 2023; Zografos & Robbins, 2020).

Globally, decarbonization has been associated with increased vulnerability in communities and reduced opportunities for political action against the negative impacts of green policies (Sovacool *et al.*, 2021). The consequences of sacrificing certain areas for the green transition have been documented, for example, in the context of lithium mining in Chile and Argentina, where large power asymmetries are exhibited between the state, mining companies, and local communities (Dorn & Gundermann, 2022; Jerez *et al*., 2021). With respect to hydropower aimed at climate mitigation, state-funded mega dams in Southeast Asia promote overlapping extractivist activities, fostering exclusion and violence (Käkönen & Thuon, 2019). The European Union's (EU) recent decarbonization policy, the changing geopolitical situations (i.e. the Russian invasion of Ukraine), and the post-pandemic period all call for an increase in the mining of 'critical' and 'strategic' minerals in member states in the form of the Critical Raw Materials Act (European Council, 2023). A direct consequence is the demand that member states shorten the permitting process to two years for mines containing critical minerals (European Council, 2023). Growing conflicts have been documented in Portugal, Spain, France, and in Fennoscandia in Norway and Finland, where rural and Indigenous communities are threatened by large-scale lithium or copper mining and wind power (Dale *et al*., 2018; Dunlap and Riquito, 2023; Franquesa 2022; Lassila 2023).

Political ecology has a tradition of analyzing the material dimensions of socio-environmental conflicts, the interconnectedness of different processes of accumulation and dispossession (i.e. the accumulation of land by mining companies), and the simultaneous accumulation of toxicity in peoples' environments (Perreault, 2012). While sacrifice zones have not been extensively conceptualized in the Arctic, the loss of reindeer grazing lands due to the cumulative impacts of different land uses, such as forestry, hydropower, and mining, and the power asymmetries associated with their decision-making processes are well-documented, along with the increasing challenges posed by climate change (Gallardo *et al*., 2017; Larsen *et al*., 2022; Mustonen & Mustonen, 2010; Mustonen & Syrjämäki 2013; Turunen *et al*., 2020).

In the context of mining in Arctic communities, Dale and others (2018, 5) highlight how the "social license to sacrifice" is usually achieved in communities that already have a history of mining and through technoscientific knowledge strategies such as environmental impact assessments (EIAs) that influence the perceptions of acceptable environmental damage. However, these technical planning processes can be undemocratic or suppress the real power asymmetries in how decisions about potentially polluting projects are made (Dale & Dannevig, 2023; Heikkinen *et al*., 2023; Li, 2015; Perreault, 2015). In relation to these perspectives, I emphasize the development of the green sacrifice zone through multiple processes of dispossession and asymmetrical power relations between the affected communities, the state, and the involved corporations. The green sacrifice zone does not emerge suddenly; rather, it develops gradually, with a so-called greater good achieved through extractivist profit-making, whether in the name of national modernization in the past or climate change mitigation in the present. The narratives developed in support of this greater good serve to repeatedly overshadow the local socio-environment and culture. Moreover, the sacrifice zone implies an existential dimension (Juskus, 2023). Therefore, in the case of this article, the question is not only about access and distribution of resources or land but also about how reindeer herders, who are in a minority position to the majority population and decision-makers, experience threats to their way of life and are thus sacrificed for the

benefit of others—for employment or in support of an abstract notion of progress. The accounts of lived experiences in the following sections show how the continuity of the reindeer herding way of life in Sodankylä is at stake within the intensifying, historically and unequally produced extractive expansion.

The mining industry in Finland

In Finland multi-metal ore bodies are common, and while only some of the minerals are considered critical, even the more common ones, like nickel, are important for renewable energy technologies (Andreucci *et al*., 2023). Following the closure of state-owned mining operations and the decline in mineral prices in the 1990s, Finland attracted global mining companies through free trade agreements, a commodity boom, and state funding (Mononen & Suopajärvi, 2016). From 2011-2016, the Finnish government's Green Mining program further focused on optimizing the growth of the mining industry through international relations and building the social acceptability of mining (Kivinen & Aumo, 2015). The Finnish system is based on claims, meaning whoever finds the minerals has the right to exploit them. The Mining Act, which was updated in 2023, gives municipalities more power to decide which areas can be mined through zoning measures,[3] and the updated Environmental Act bans mineral exploration in national parks and in nature reserves (Valtioneuvosto, 2023). Based on geological information that Finland freely provides, companies on the other side of the world regularly make land reservations, which gives them the preliminary right to apply for an exploration permit. While municipalities can say no, this is difficult to do, especially where mines are seen as the answer to the structural problems of unemployment, an aging population, and youth outmigration (N, 2023; A 2016). A royalty tax was introduced in 2024, the first of its kind in Finland, which allocates 60 percent of the total mining revenues to municipalities with mining operations. The royalty tax has been criticized because the proposed tax for metal ores will be 0.6 percent of the value of the metal delivered as a concentrate; in other countries with a similar tax model, the tax is usually 2–5 percent of the value of the metal (Kaivosmineraaliverolaki, 2023; Finnwatch, 2022).

In contrast to other parts of Fennoscandia, where there is large-scale mining in the Indigenous Sámi homeland of Sápmi, companies in Finland have established large-scale mining operations just outside the borders of the Sámi homeland (Image 2). This is largely due to lengthy permitting processes and expected opposition, which often makes companies in Finland avoid Sámi lands (Koivurova *et al*., 2015; Tukes, 2023). With new preliminary reservations and exploration permit applications, the pressure on the Finnish Sámi homeland is constantly increasing.[4] Mining and wind power developments are seen as the latest extension of state colonialism against the Sámi, preventing full Sámi self-determination in a context where the state owns more than 90 percent of Sámi land, has not ratified the ILO 169 Convention on Indigenous Peoples' Rights, and does not respect the free, prior, and informed consent process for industrial projects on Sámi land (Kuokkanen, 2020; Lawrence, 2014). In this article, I focus on Sodankylä's districts of Sattasniemi and Oraniemi, where Finnish-speaking reindeer-herding is dominant. These districts are located in the mineral-rich 'Central Lapland Greenstone Belt', which has attracted most of the recent exploration and speculation for minerals.

[3] Previously, zoning was decided at the provincial level.

[4] The Sámi Parliament in Finland has unanimously opposed recent preliminary reservations and mineral exploration applications in the Sámi homeland, including the Sámi Lappi district in Sodankylä municipality (The Sámi Parliament, 2021).

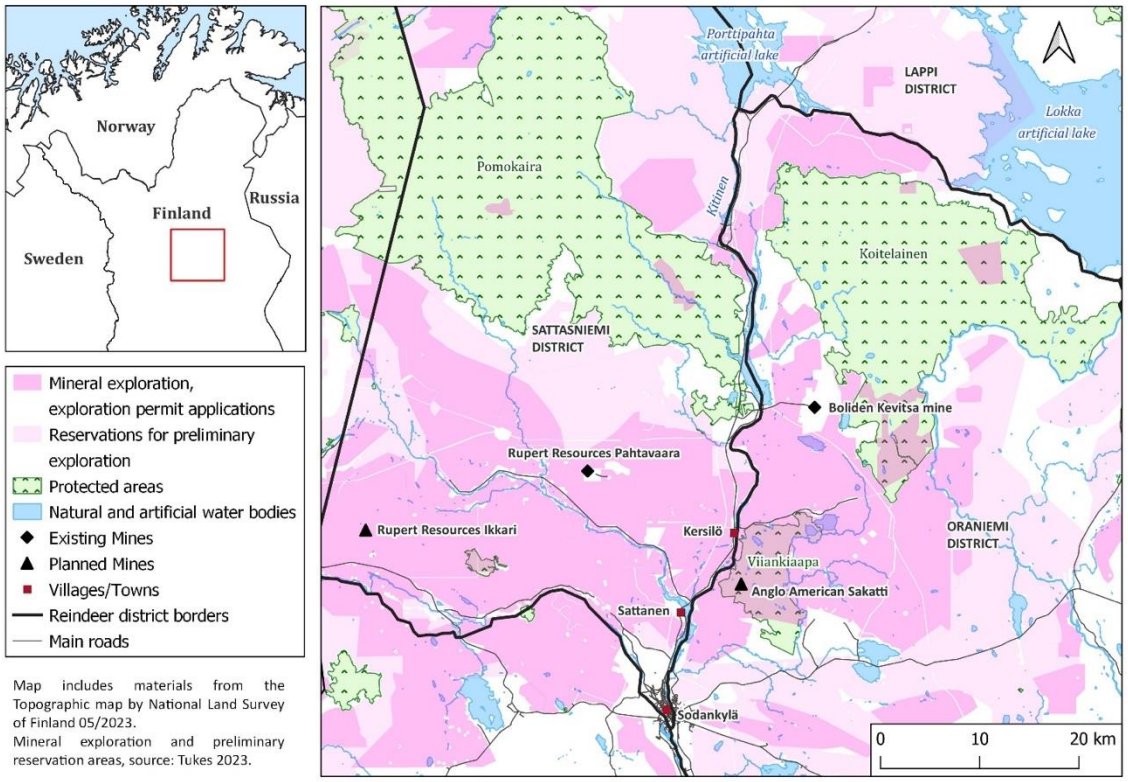

Image 2: The study area, showing the overlap of reindeer husbandry, environmental protection, land reservations for preliminary exploration, mineral exploration, and existing and planned mining projects. Reservoirs appear in the upright corner of the map and the Kitinen River flows from north to south between the Sattasniemi and Oraniemi districts. Map: Noora Rämö, 2023, UEF

4. Herders' lifeworlds in the sacrifice zone of large-scale resource extraction

Sodankylä consists of four districts: the Sattasniemi and Oraniemi districts in the central parts of the municipality and on the Finnish Lapland side, and the northern Lappi district in the Sámi homeland[5]; the fourth district Syväjärvi is in the southernmost part of the municipality (Image 2). Sodankylä's districts have over 20,000 reindeer, which require extensive pastures for rotation. All the districts in Sodankylä, except for Syväjärvi are part of the Special Reindeer Husbandry Area, which means that the role of reindeer husbandry is given particular importance. Both Sámi and non-Sámi people practice reindeer husbandry in Finland. Reindeer herders have a strong pastoral and collective identity to the area, which consists of collectively used common lands owned by the state (Nystén-Haarala *et al*., 2021). An integral part of the organization of reindeer husbandry is the seasonal cycle, where reindeer traditionally follow a pasture rotation from northern summer pastures to southern winter pastures, since different environmental niches provide edible plants for the reindeer throughout the seasons (G, 2016; Valkonen, 2023). According to the Reindeer Husbandry Act (1990), in the Special Reindeer Husbandry Area, state authorities and companies are obliged to negotiate industrial land use and consult reindeer herding communities, and projects should not jeopardize herders' livelihoods. Nevertheless, herders live in a situation where they feel they must constantly defend their way of life against competing land uses. Next, I analyze the specific circumstances affecting herders in Sodankylä.

[5] Kemin-Sompio district in Savukoski is partly on the side of the Sodankylä municipality.

The beginning of cumulative effects: The sacrifice of herders' territories for national modernization

In this section, I provide a historical analysis of how hydropower and forestry have reduced reindeer herders' territories in Sodankylä. I then analyze how the expanding mining industry adds to the previous transformations, focusing mainly on the experiences of reindeer herders in Sattasniemi and Oraniemi, with some views from the northern district of Lappi. Both the historical perspective and the herders' personal accounts support the observation that the reindeer herders' territories in Sodankylä are becoming a sacrifice zone due to a historical expectation of resource extraction and in the context of state land ownership in Lapland (see Valkonen, 2003).

In the post-World War II era, hydropower and timber production were seen by politicians, such as President Urho Kekkonen, as crucial to the modernization of the state, with little regard for the required local environmental sacrifices (Itkonen, 2018; Massa, 1994). The postwar energy shortage and the ethos of rebuilding and industrializing Lapland led the state-owned company Kemijoki Oy to exploit the wild salmon rivers and rapids in the north, resulting in widespread ecological destruction and losses to local livelihoods (Massa, 1994; Kinnunen, 2018). The interview material from Sodankylä highlights how the construction of the Lokka and Porttipahta reservoirs (Image 2) in the 1960s and 1970s and the hydropower plants along the Kitinen River in the 1980s are collectively remembered as a profound loss. The reservoirs caused the forced migration of more than 560 people from an area called Sompio where the water flooded entire villages, standing trees, fields, meadows, and reindeer and cattle pastures (Pyhäjärvi, 2011).

The Lokka and Porttipahta reservoirs were a socio-environmental disaster for local communities and forced a major transformation of reindeer husbandry in the area, particularly in the Sámi Lappi district (Mustonen & Mustonen, 2010). The extensive clear-cutting for the construction of the reservoirs and the final flooding of nearby areas destroyed important grazing lands (Turunen *et al*., 2020; R, 2024). Herders in the Lappi district had to abandon their Indigenous *siida* reindeer herding system and instead manage two large northern and southern herds (J, 2023). Sattasniemi lost important winter pastures to the Porttipahta reservoir, and reindeer pasture areas along the riverbank were flooded (R, 2024; C, 2023). In the Oraniemi and Sattasniemi districts, the construction of the power plants on Kitinen River is remembered as a time when reindeer herding became unbalanced, and fish disappeared. For some, the construction of the hydroelectric power plants severed their relationship with a meaningful dimension of the living environment, a loss some experienced as early as their childhood. Fishing, along with hunting and cattle and reindeer herding, was important for households along the river to maintain a subsistence way of life. People discussed the river as a part of their understanding of life in the region, which is "many hundreds of years old," where the damming of the river meant its "lost value" (D, 2016). The stocking of the river with farmed fish does not compensate for the overall loss of local peoples' agency over the river (C, 2023).

The research participants in Sodankylä mentioned that the state's industrial forestry had already started to reduce reindeer grazing areas with the construction of the reservoirs, as forests were cleared to make way for new roads (C, 2023; F, 2023; E, 2023; R, 2024). Forests in Lapland have multiple uses, ranging from everyman's rights, which allow the use of forests for berry picking, mushroom gathering, or hunting, to reindeer herding, industrial logging, and nature-based tourism (Jokinen, 2014). The state's *Metsähallitus* (translated in English as Forest Government) is a state organization that oversees forest management and owns most of the forests in Lapland, including Sodankylä. Despite various social obligations, such as maintaining national parks and preserving biodiversity, and obligations to negotiate logging operations in the Sámi homeland and the Special Reindeer Husbandry Area, *Metsähallitus* has emphasized profit-making and has continued the historical expectation that all publicly owned forests should be available for timber extraction (Raitio, 2013). Broader forest conflicts began in Lapland after the 1970s, as herders were feeling the effects of the heavy clear-cutting that began post-World War II and accelerated in the 1950s (Turunen *et al*., 2020). *Metsähallitus* was involved in disputes with Sámi and non-Sámi reindeer herding communities in Lapland—particularly Inari and Muonio—between the 1980s and 2000s. In the 2010s, they even signed some agreements with the herders to exclude important old-growth forests from logging (Jokinen, 2014). Deforestation is detrimental to reindeer winter pastures because Lapland's old-growth forests contain arboreal *luppo* lichens, which are an important source of nutrition for reindeer in early spring (Jokinen, 2014). In Finland and more broadly in Fennoscandia, the negative effects of forestry practices compounded with climate change have been observed on fungi and tree and ground lichens (Gallardo *et al*., 2017; Mustonen & Syrjämäki, 2013). As a result of clear-cutting, winter

grazing is mainly concentrated in the remaining industrial forest areas, where arboreal lichens are scarce (R, 2024), which has greatly reduced the natural food supply for reindeer. Starting in the mid-1990s, districts have given supplementary feed to reindeer during the winter, due to the destruction of old-growth forest winter pasture lands from hydropower development and forestry policies[6] (R, 2024; F, 2023). An exception is the Lappi district, where the pastures located in the protected Urho Kekkonen National Park provide nutrition (J, 2023).

In addition, every year, the herders are experiencing more unpredictable weather patterns due to climate change, making their livelihoods even more fragile in the face of the reduction of grazing land due to industrial developments. The usual dry and sub-zero conditions in late fall have changed to wet snow coming early, making it difficult for reindeer to get their nutrition from the ground. Winters can be unusually long and windy, and summers are unusually hot or wet, which directly affects the health of the reindeer, their reproductive capacity, and the number of calves born in the spring.

Forestry and hydropower have certainly been central industries in Finland's national modernization, but they have drastically reduced reindeer grazing in Sodankylä and elsewhere in Lapland and Fennoscandia, and their adverse effect on reindeer pastures is increasing as climate change intensifies. It is noteworthy that the discourses associated with these earlier industries have been transformed for environmental purposes, with mining now also being reframed by the state and companies as a clean industry contributing to the green transition, with wind power playing an important role (Regional Council of Lapland, 2022). The difference with previous definitions is that the expectation of resource extraction comes not only from national visions, but also from the EU level through initiatives such as the Critical Raw Materials Act, which pushes for shorter permitting processes to facilitate mining. Lawrence (2014) has highlighted that the current discourse on the green transition in the Arctic sacrifices Indigenous interests for false environmental goals, while the underlining value is profit-making. Scholars emphasize how the marketing of green growth through the 'bioeconomy' is accelerating forestry activities in Finland and the expansion of Finnish forestry in the Global South, with its multi-scalar involvement of flex trees, the pulp industry, sawmills, paper mills, biorefineries, and power plants (Kröger, 2016; Vezzoni & Ramcilovik-Suominen, 2023).

The development of the sacrifice zone through 'green' mining in Sodankylä

I will now analyze the effects of the expanding mining industry in Sodankylä on the reindeer herders' already reduced territories, as well as its cumulative environmental impacts. The growing impact of mining points to a future in which the herders' adaptability will be limited by the lack of space for reindeer grazing, and the environmental damage caused by mining will become unmanageable.

Large-scale mining takes place in the Sattasniemi and Oraniemi districts of the municipality, with two existing mines: the Boliden-Kevitsa open pit mine, Finland's second largest mine, and the Rupert Resources Pahtavaara underground mine (currently not in operation, but it may be restarted), plus two planned mines: the Rupert Resources Ikkari open pit and underground gold mine and the Anglo American Sakatti (hereafter AASM) multi-metal underground mine (Table 1). With no major mining projects yet, the Lappi district has instead suffered from an increase in gold panning permits in recent years and preliminary reservations by companies. The AASM mine in the Oraniemi district is being developed in the EU Natura 2000 protected Viiankiaapa mire, which is also a part of the National Peatland Protection Program. Both AASM and Boliden-Kevitsa promote the mines as producing "green transition metals" and the "metals of the future" (AASM, n.d.; Boliden-Kevitsa, n.d.). The municipality may have three or four mines in operation in the next decade, in addition to several ongoing exploration projects (Tukes, 2023; Kotilainen *et al*., 2022). The districts of Oraniemi and Sattasniemi are completely reserved for large-scale mining activities, other preliminary reservations, and mineral exploration, leaving herders feeling disadvantaged because they have no rights to the area. Exploration has caused considerable concern for the future, as some sites, such as the Ikkari exploration area, have already been transformed, with trees cut down and roads cleared, making herd control more difficult and signaling what may lie ahead if explorers one day make a large enough ore discovery or if mining starts (E, 2023; S 2024).

[6] Unpredictable weather conditions have also been an influencing factor, such as the harsh winter of 1996–1997, when many reindeer starved to death. (R, 2024; L, 2023)

Industry	Owner	Commodity	Expected main effects on herders' lands	Where the resources are consumed
Hydropower constructed 1967–1980	The state-owned Kemijoki company	hydro energy	Forced migration of 560 people in the Sompio area. Reservoirs destroyed Lappi and Sattasniemi pastures. Destruction of riverbank pastures. End of subsistence fishing in the Kitinen River. Intensified industrial forestry.	The national level energy grid
Forestry 1950s	The state-owned Metsähallitus	pulp, wood	Erosion and loss of winter pastures and lichen led to winter feeding of reindeer. Climate change contributes to the erosion of winter pastures.	Wood sold for domestic and international markets; in Finland: pulp mills, sawmills, and heat and energy plants; pulp is one of Finland's most important export items, as well as sawn wood and paper products
Rupert Resources Pahtavaara underground mine 2008 (closed but may reopen for remaining gold)	Rupert Resources, Canada	gold concentrate	Destruction of Sattasniemi's pastures. Fears of health effects to reindeer from unfenced tailings ponds (some have drowned). High levels of asbestos in the ore with possible cumulative effects. Wastewater spills while the mine was in operation.	Sold globally, e.g. Switzerland and Sweden
Boliden-Kevitsa open pit mine 2012	Boliden, Sweden	nickel, copper, gold, platinum, palladium concentrates	Destruction and disruption of Oraniemi pastures. Increasing metals in ground water, and dust. Reindeer avoid the mine area within 10 kilometers.	Sold globally, e.g. China (nickel), Sweden (copper), and Switzerland (gold and platinum).
Kuolavaara-Keulakkopää wind turbines 2016 (17 turbines with 6 in Sodankylä)	Allianz Capital Partners, global investors e.g. Germany, UK, Singapore	wind energy	Disruption of Sattasniemi pastures (reindeer avoid wind turbine areas).	The national level energy grid
Rajala wind turbines (6 planned)	TuuliAlfa, Finland	wind energy	Disruption of Sattasniemi winter pastures.	The national level energy grid
Rupert Resources Ikkari open pit mine (planned)	Rupert Resources, Canada	gold concentrate	Destruction of winter pasture lands for Sattasniemi herds. Fear of contamination of rivers and streams.	Sold globally, e.g. in Switzerland and Sweden
Anglo American Sakatti underground mine (planned)	Anglo American, UK	copper, nickel, cobalt, platinum, palladium, gold, silver concentrates	Fear of Viiankiaapa mire drying up. Expected dust, noise, light pollution, and increased traffic. Disturbance of the Oraniemi and Sattasniemi herds. Destruction of Oraniemi's winter pastures.	Sold globally (see information on Boliden-Kevitsa)
Gold panning (increase in permits since 2020)	Individual Finnish gold-panners	gold nuggets	Large areas of the Lappi district are panned for gold with excavators. Disturbance of reindeer pastures, sedimentation of streams.	Sold to retailers. Mostly used in jewelry or as collectibles by Finnish and foreign buyers

Table 1: Effects of hydropower, wind power, forestry, and the mining industry on reindeer husbandry in Sodankylä. Sources: Boliden-Kevitsa, n.d; ELY, 2023; Eurofins Ahma Oy, 2022a; FCG, 2020; Kröger, 2016; Leisti, 2012, 2014, 2017; Peltola and Niinistö, 2023; Pyhäjärvi, 2011; Rupert Resources, n.d; Turunen *et al*., 2020; interviews with reindeer herders between 2016 and 2024; The Supreme Administrative Court, 2017; information on the export of metals from Sodankylä's mines is based on general information on metals exported from Finland (Pokki, 2023).

Mining adds to the overall loss and deterioration of pastureland that began with hydropower development and forestry. The AASM mine, planned as an underground mine in the Viiankiaava mire, will include an above-ground factory area in Kuusivaara, outside the protected area, on deteriorating, forested land, which is important for the fall and winter grazing rotation of one Oraniemi herd of about 600 reindeer; in practice, the destruction of the pastures will mean the end of the herd. To compensate for the environmental damage in Kuusivaara, the company is implementing a voluntary biodiversity offset by protecting more than 2,900 hectares of old-growth forest in the neighboring municipality of Inari. Of course, the herders don't really see this as compensation, since it's being done far from where they live and practice reindeer husbandry. Overall, the AASM mine is expected to have multiple environmental impacts both within and outside the protected area, while the overall impacts of dust, traffic, and disturbance to reindeer will seriously affect both Oraniemi and Sattasniemi herders (FCG 2020; G 2016; I, 2020; Q, 2020). Anglo American acknowledges that the actual impact to reindeer herding will only be known once mining begins (AASM, n.d.).

The new projects are in the same area in the Sattasniemi and Oraniemi districts that reindeer herders have already had to abandon due to mining and wind power projects. The proposed Ikkari mine would destroy a significant part of the winter grazing land in the Sattasniemi district. Pasture rotation would become extremely difficult for the whole district and some herders would have to give up herding (R, 2024; S, 2024). The proposed mine, in addition to the planned Rajala wind turbine area, adds to the areas that are already off-limits for herding in the district—the existing Pahtavaara gold mine area, and the Keulakkopää wind turbine area. On the Oraniemi district's side, the expected impact area of the AASM mine is approximately 15–20 kilometers and extends all the way to the Boliden-Kevitsa mine. Since the opening of Boliden-Kevitsa in 2012, herders have reported that reindeer avoid areas up to ten kilometers from the site (D, 2016; C, 2023; F, 2023; L, 2023). Thus, collective herding practices have become impossible around the mine. Spring calving and fall gathering areas are also useless near the mine, as are the nearest summer pastures, where reindeer from several herds used to graze (O, 2023). This means that some herds remain in their winter pastures year-round, deprived of the important nutrition they used to receive from their summer pastures (F, 2023). Herders and villagers in Oraniemi report that mining dust makes the snow melt faster near the mine, and that brown dust falls as far as 15 kilometers from the mine after blasting. This dust is even visible on the satellite images of Viiankiaapa (C, 2023; F, 2023; L, 2023; Siivikko, 2023). In its recent environmental report, Boliden-Kevitsa simply states that the dust is within permit limits (Eurofins Ahma Oy, 2022b). The mine is in constant need of soil to cover the mine's excavations, and the company recently announced that it would have to clear 500 hectares of state-owned forest located on grazing land in the Sattasniemi district (Metsähallitus, 2023; M 2023).

Groundwater impacts and effluent from several mines contaminating the River Kitinen in Sodankylä are also a significant part of the expected cumulative environmental load of mining. Events at Boliden-Kevitsa in recent years suggest that water contamination may be worsening. The mine was in operation for five years when elevated concentrations of nickel and other metals were found in groundwater near the mine's tailings pond (Leisti, 2012; 2014). Groundwater concentrations of sulfate, chloride, and metals, especially nickel, have continued to increase at several of the mine's monitoring sites (Leisti, 2017; Eurofins Ahma Oy, 2022a). It is still unclear whether the protective pumping measures implemented by the company will prove effective (Leisti, 2023). In addition, environmental organizations and activists are calling for emission limits on xanthates, which are chemicals used to enrich ore. In extreme winter conditions, xanthates do not break down properly in the tailing pond, which means that the mine effluent may contain residues of these chemicals (K, 2023; Muzinda & Schreithofer, 2018). While it is difficult to know or predict the overall groundwater or surface water contamination situation at Boliden-Kevitsa, it has already affected how people perceive the river, with some no longer fishing, swimming, or using the river water for saunas (C, 2023; E, 2023).

5. Power asymmetries leading to the sacrifice of grazing lands

The realities described in the above sections suggest that municipalities like Sodankylä may be sacrificing more than they are receiving from mining. It is the reindeer herders who are at the forefront of this sacrifice. With a long history of living in close connection with the land, they are already experiencing what Nixon (2011, p. 2) describes as a "slowly unfolding environmental catastrophe" that may only be more widely

recognized when it is too late. It is crucial to recognize the combined and cumulative effects of the documented industrial changes, power asymmetries, and unpredictable aspects of the Arctic caused by climate change that makes reindeer husbandry more vulnerable.

Recent impacts from mining and mineral exploration suggest that the situation is worsening for Sodankylä's reindeer herders, who have already had to adapt to the cumulative impacts of shrinking their territories due to hydropower and forestry by using less grazing land and giving their reindeer expensive extra feed in the winter. Compared to these earlier industries, mining not only reduces the already limited space available for herding and its collective social practices, but it also brings increased environmental impacts in the form of cumulative pollution and deforestation, causing reindeer to avoid grazing near mine sites. With the latest mining expansion, the herders of Sodankylä are more firmly integrated into the uneven development of the global political economy, wherein the centers of power are built on inequality and the use and abuse of sacrificial extractive peripheries to produce the material for capital accumulation (Ye *et al*., 2019). The current hubris around mineral discoveries in Sodankylä builds on its earlier extractivist history. It continues to be fed by recent green extractivist dynamics, where the spectacle of newly discovered mineral resources for the green transition adds to previous power asymmetries and builds new patterns and legitimations of land control (see Dunlap & Riquito, 2023; Fairhead *et al*., 2012; Le Billon, 2021; Tsing, 2000). As suggested by Heikkinen (2024), green extractivism "invisibilizes" multi-scalar power dynamics and how they render traditional livelihoods vulnerable to both climate change and environmental degradation.

In the case of Sodankylä, power asymmetries materialize between herders, municipal and state authorities, and companies, which causes herders to be at the forefront of cumulative impacts and to lose their territories to mining, with some herders having to give up their livelihoods, as in the case of the AASM and Ikkari mines. The herders in Sodankylä repeatedly highlighted the power imbalances at play when districts negotiate with state authorities and companies regarding mineral exploration, mining, forestry, or gold panning (E, 2023; F, 2023; J, 2023; Q, 2020; R, 2024). The districts of Sodankylä consistently submit comments on projects to the authorities. The obligation in the Reindeer Husbandry Act (1990) for authorities and companies to negotiate does not benefit the herders, because even when the herders emphasize their traditional rights to the area, they are ignored (R, 2024). Districts lack lobbyists, time, and legal resources to initiate lengthy grievance procedures during the permitting process, and some herders have just a basic education and lack the technical skills to challenge companies with sophisticated negotiation strategies (F, 2023; R, 2024). In Finland, as in Sweden, the assumption by policymakers that the negotiations with herders will ultimately result in the acceptance of mining or forestry, in the long run, marginalizes herders' dissent and broader opportunities to redistribute power and access to resources (Gallardo *et al*., 2017).

In a green extractivist landscape of global capitalism and environmental governance where the Finnish state has also supported the mining industry through low taxes and the Green Mining Program, Kirsch (2010) makes the compelling argument that 'sustainable' mining has become a key corporate strategy to suspend criticism. The discrepancies between the herders' long-term observations and the companies' portrayal of contamination as a manageable and inherent part of the process stand in stark contrast, as noted elsewhere (Gross, 2021; Heikkinen *et al*., 2023). The language of scientific objectivity and certainty about negative and positive impacts, with the latter part of the industry's discourse about mining producing essential 'transition' or 'green' minerals for climate change mitigation, or the employment priorities of municipalities, helps to legitimize mining in a context where the long-term and inevitable environmental impacts of mining are unpredictable (Kirsch, 2014).

Larsen and others (2022) have observed similar circumstances in Sweden regarding Sámi herders' lands, where the actual impacts on reindeer and pastures are much more serious than authorities and companies admit. This corporate-driven power dynamic is visible in the case of Anglo American Sakatti (AASM), where in 2023 the regional authorities found that its environmental impact assessment could not rule out possible damage to the groundwater of the double-protected Viiankiaapa mire. However, in a precedent case in Finland, the company decided to go ahead with its plans, seeking an exemption from the Environmental Protection Act to dismantle peatland protection in the area, and applying to the government and the EU Commission for an exemption from the Natura 2000 program (ELY, 2023; Pelli, 2023). The assumption that mining and conservation, or mining and reindeer, can coexist with 'minimized' impacts allows mining to override

environmental protection by applying broader political pressure for increased operations (see Adams, 2017; Larsen *et al*., 2022; Le Billon, 2021).

6. Conclusions

In this article, I have linked the experiences of reindeer herders in Sodankylä to past industrial land use patterns and the recent expansion of mining, which is justified across the EU and globally as necessary for the green transition and for supplying the raw materials needed in modern society. Transformations experienced in the region are linked to the history of state control over both Indigenous and non-Indigenous lands in Lapland, as well as the recent push by the state and the EU to ease permit conditions and intensify extractive operations. A *green sacrifice zone* has been created affecting Sodankylä's herders by the cumulative impacts of overlapping extractive industries and recent mining expansion. This story offers a perspective on how, since the national modernization of the state, there has been a slow deterioration of the natural environment and pre-existing territorial relations enabled by power asymmetries.

In the article, I have suggested that the green sacrifice zone implicated in the recent mining expansion built slowly through the cumulative effects of overlapping extractive practices and the historical expectation that commonly used lands are open to resource extraction and thus sacrificed in support of an abstract "greater good." The construction of reservoirs and hydropower stations in the 1960s–1980s is seen by herders as the beginning of major changes that then came, while increasingly intensive forestry led to a deterioration in the last remaining nutritious reindeer pastures. Along with increased mining, both industries have gained national and global legitimacy under the green extractivist agenda of global capitalism. Recent dispossession through mining has challenged the continuity of reindeer herding livelihoods and collective practices, while climate change adds to the unpredictability of local livelihoods.

Power asymmetries in this history of extractivist expansion are related to a web of historically produced and contemporary grievances over extractive land use practices that have marginalized herders' territorial relations. In Sodankylä, these power asymmetries are related to how resource extraction and the damage it causes are legitimized or rationalized, even in protected areas such as Viiankiaapa. They are also apparent in how negotiations and environmental accountability processes with companies and state authorities marginalize herders in a pro-mining municipality. The asymmetries can be summarized as incommensurability in "languages of valuation" (see Martinez-Alier, 2008), where the reindeer herders' lifeworld never affects the broader population or those who drive extractive development, such as state authorities, municipal decision-makers, and the mining companies that herders must negotiate industrial projects with. They are not really being heard. The herders emphasize the multiple harms they experience as a minority in relation to the different industrial projects being developed in their already-affected and climate-vulnerable territories. They seek recognition from corporations, authorities, and society at large by articulating their interdependence and intergenerational rights to territories. They continue their way of life proudly and with the perspective that future generations can also practice reindeer husbandry. Meanwhile, extractivism may soon affect all lands since once a place has been sacrificed, it will never fully recover. In the words of one herder, "Mining is a comprehensive threat because it leaves no living space behind" (H, 2023).

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