Ecological Economics 191 (2022) 107247

Contents lists available at ScienceDirect

Ecological Economics

journal homepage: www.elsevier.com/locate/ecolecon

ANALYSIS

On thin ice – The Arctic commodity extraction frontier and environmental conflicts

Ksenija Hanaček [a,*], Markus Kröger [b], Arnim Scheidel [a], Facundo Rojas [c], Joan Martinez-Alier [a]

[a] Institute of Environmental Science and Technology (ICTA), Autonomous University of Barcelona (UAB), Spain
[b] Faculty of Social Sciences, Global Development Studies, University of Helsinki, Finland
[c] Grupo de Historia Ambiental-IANIGLA-CONICET, Facultad de Filosofía y Letras, Universidad Nacional de Cuyo, Argentina

ARTICLE INFO

Keywords:
Commodity frontier
Arctic
Coloniality
Environmental conflict
EJAtlas

ABSTRACT

This article contributes to the discussion on socio-environmental conflicts and extractive projects in the Arctic region. Fifty-three socio-environmental conflicts are analysed, using data from the Global Atlas of Environmental Justice. Based on descriptive statistics, regression and network analysis, the paper reveals that socio-environmental conflicts predominantly overlap with Indigenous peoples' territories, from which a transversal opposition takes place, including Indigenous, non-Indigenous and international actors alike. The main commodities involved in these conflicts are related to fossil fuels, metals, and transport infrastructure. Associated large-scale extractive activities are bringing negative socio-environmental impacts at the expense of Indigenous groups, fishermen, and pastoralists, with loss of traditional knowledge and practices being significantly higher in Indigenous territories of high bio-cultural values associated to the environment. Our findings suggest that repression against activists is significantly more likely to occur in absence of preventive mobilization, and in Arctic countries with low rule of law. The chances to achieve the cancellation of a conflictive extractive project are significantly higher if dependency on natural resource rents in a country is low.

1. Introduction

The Arctic region is rapidly warming and experiencing vast sea ice and permafrost loss (Landrum and Holland, 2020). The region experienced its warmest summer on record in 2020, with the second-lowest sea ice cover, almost reaching the lowest 2012 levels (NASA, 2020a, 2020b). The sea ice loss contributes to expanding extractive activities, facilitating new shipping routes and, consequently, faster global trade (Landrum and Holland, 2020; Saebi et al., 2020). As one of the remaining land regions with extensive areas of mineral exploration and extraction potential, the Arctic is of particular interest to extractive industries (Boyd et al., 2015). The World Economic Forum Global Agenda Council on the Arctic estimates that total mining, oil, natural gas, and infrastructure investments will reach 1 trillion USD by 2030 (Roston, 2016).

However, climate change and economic interests in the Arctic cannot be separated from local struggles against historically unjust and disproportionate socio-environmental impacts in areas predominantly inhabited by Indigenous groups (Avango and Peder, 2003; Cameron, 2012; Keil, 2014; Martinez-Alier, 2002). European colonization of Arctic lands began in the mid-sixteenth century (Coates, 1985). Old and new commodities (gold, oil, natural gas) were and still are extracted at substantial social and environmental costs (Shadian, 2018). Arctic peoples, such as Indigenous groups, pastoralists and fishermen rely on the land and its natural resources (Stotts, 2017). Hence, such large-scale extractive investments, together with contemporary climate change, pose threats to the communities' livelihood, socio-environmental, and cultural well-being (Alvarez et al., 2020). The threats manifest in the inability of communities to access their land, their loss of territorial rights, adverse effect on their health, biodiversity loss, as well as the loss of culture and identity linked to changes in their surrounding icescapes (Herrmann and Heinämäki, 2017; John, 2016; Kumpula et al., 2011).

While the term 'resource frontiers' relates to processes of land appropriation and exploitation of nature, commoditizing resource frontiers refers to the extensive biophysical and socio-environmental transformation of 'underused' areas such as the Arctic today, for extraction and trade purposes (Kröger and Nygren, 2020; Moore, 2000). As the extraction of raw materials and energy in the Arctic increases, socio-environmental conflicts, as recorded in the Global Atlas of Environmental Justice (EJAtlas), are also expected to increase (Haberl et al.,

* Corresponding author.
E-mail address: ksenija.hanacek@uab.cat (K. Hanaček).

https://doi.org/10.1016/j.ecolecon.2021.107247
Received 10 January 2021; Received in revised form 9 September 2021; Accepted 13 September 2021
Available online 13 October 2021

2019; Kumpula et al., 2011; Martinez-Alier, 2015; Muradian et al., 2012). Even if economic growth would not occur, the extraction of materials and energy and the disposal of waste, needed to sustain the current world economy, would expand, because energy dissipates and materials are only recycled to a small extent (Haas et al., 2015, Haas et al., 2020). The world economy is not circular; rather, it is entropic (Georgescu-Roegen, 1971; Martinez-Alier, 1987).

New resource and extractive frontiers bring an unequal distribution of socio-environmental well-being for local Indigenous and non-Indigenous peoples (Kröger, 2022; Peluso and Lund, 2011). However, opposition and resistance at the extractive frontiers arise globally to protect land, traditional economies and customary ways of life (Scheidel and Schaffartzik, 2019). This resistance against extractive industrialization results in socio-environmental conflicts (Martinez-Alier, 2002; Martinez-Alier et al., 2010). Such conflict is expressed as collective mobilization against investment projects that cause socio-environmental harm (Martinez-Alier et al., 2016; Temper et al., 2018). Depending on the location, the actors involved, and the socio-environmental assets at stake, conflict can take many different forms and directions, at different stages and of differing duration (Silva-Macher and Farrell, 2014).

Socio-environmental conflicts, for instance, can arise over access to and control of land (Ribot and Peluso, 2003) through land enclosure or its appropriation by state authorities, multinational companies, or social elites (Robbins, 2012). Conflicts often develop over environmental injustices based on class, race, gender, and ethnicity discriminations (Pulido, 2017; Sultana, 2020). The literature further indicates that socio-environmental conflict occurs not only as resource conflicts but as a social struggle to preserve the human-nature relationships that are threatened through extractive use and management of the environment, by either state or private entrepreneurs (Coombes et al., 2012). Furthermore, conflict can manifest openly, with evident mobilization of individuals and groups, and can ultimately become a social movement (Temper et al., 2015). However, conflict can also take more latent forms, without visible protests (Beltrán, 2015).

Through these different forms of mobilization, people confront new extractive frontiers, and call for new and different interpretations of social justice (Schlosberg, 2013; Schlosberg and Carruthers, 2010). Socio-environmental resistance against resource extraction is thus an essential component in understanding worldview alternatives to harmful extractive trajectories (Brown et al., 2010; Cressey, 2011; Kröger, 2020; Zabala, 2019). The many attempts to base resistance against extraction on the grounds of ethno-territorial rights is an example (Kröger and Lalander, 2016).

Activities at extractive frontiers involve processes of occupation, biophysical transformation and depletion of local socio-environmental assets (Muradian et al., 2012). Large-scale extraction has reached Indigenous and non-Indigenous lands of the Arctic – awaking the resistance of local communities and others to these activities (Kröger, 2019; Kröger, 2016; Lassila, 2020; Lassila, 2018). People are calling for more active involvement in determining issues related to physical exploitation and climate change in the region (Dorough, 2014; Nuttall, 2013) that challenge extractive industries, the states, and others with economic interests who jeopardize the environment and the traditional way of life of local communities (Dwyer and Istomin, 2009; Kröger, 2019; Naykanchina, 2012). Thus, an analysis of socio-environmental conflict in the Arctic beyond specific countries and commodities is called for to gauge the impact of economic extraction of natural resources on the traditional ways of life and survival of affected Arctic communities (Alvarez et al., 2020; Lassila, 2020; Muradian et al., 2012).

To do so, this article analyses fifty-three socio-environmental conflicts across the entire Arctic as a single regional unit. Based on mixed methods of descriptive statistics, regression and network analysis, we systematically investigate protests against ongoing and projected resource extraction in the Arctic. The main focus is on social struggles in the context of the global economy and resource extraction and the biophysical transformation of the region (Krausmann et al., 2008). Further, the article, focuses on the human geographies of resource extraction, such as land degradation, threats to cultural traditions, the environment, and the marginalization of local communities.

2. Commodity frontiers and socio-environmental conflicts in the Arctic

In essence, frontiers can be merely resource frontiers (prior to any large scale trade), commodity frontiers for trade purposes (Moore, 2000), or a combination of both (Kröger and Nygren, 2020). Commodity frontiers are based on two interrelated processes. Namely, commodity widening, such as through the expansion and occupation of lands destined to extraction (e.g. in the Arctic region), and commodity deepening, which involves intensification of existing commodity production through socio-technical innovation (e.g. nickel mining, oil drilling, new infrastructure) (Banoub et al., 2020). Commodity frontiers have inherently extractive and exploitative characteristics (Moore, 2000), which often involve environmental injustice, inequalities, and degradations at the expense of both Indigenous and non-Indigenous peoples (Beckert et al., 2021; Martinez-Alier, 2002). Another important characteristic that frontiers have frequently in common is the resistance of people to injustice, inequality, and degradation (Conde, 2017; Temper et al., 2015; Schneider, 2020). However, mobilization and resistance are not present across all the cases of frontier expansions, but these depend on the fostering of contentious agency by particular would-be resistance actors, typically local communities, there being a wide variety of local responses to extractivist expansions (Kröger, 2020).

In the specific case of the Arctic region, frontier occupation and extractivism on commons and Indigenous lands are not new (Muller-Wille, 1987; Stuhl, 2016). The Arctic resource frontier came into existence in the sixteen century through the colonial geography of the West, mainly via the Nordic countries, other major countries in the West, and Russia, all of which were subsequently motivated by large-scale and intensive industrial extraction for trade and profit (Avango et al., 2014). For instance, the Dutch and the British established whaling stations and coal extraction processes on Svalbard in 1610; the Ivigtut cryolite deposit extraction began in Greenland in 1854; the 1898 Klondike gold rush occurred between Skagway, Alaska and Yukon in Canada (Boyd et al., 2015), among others.

What is new to the current wave of frontier expansion, however, is the increased rapidity and volume of extraction occurring in the region (Kröger, 2019). Climate change is facilitating access to some resources in the Arctic (Landrum and Holland, 2020; Saebi et al., 2020), while changing political and economic agendas are attempting to legitimize new pathways towards extraction, thereby creating destructive attitudes to the environment and to Arctic peoples (Bennett, 2016; Huntington, 2016). Such agendas are generally applied without the full consultation and participation of the affected people, especially Indigenous groups (Cameron, 2012). Thus, the present wave of Arctic extractivism continues to maintain patterns of the colonial 'past' (Escobar, 2008; Körber et al., 2017; Stuhl, 2016). However, for many Arctic people, the land is not a commodity which can just be acquired at will, but an important element for interrelated and interdependent environmental and socio-cultural well-being (Nuttall, 1998; The Arctic Council, 2015a).

The effect of this resource depletion is a threat to the continuation of Indigenous traditions, identities, and human-nature relationships when large-scale extraction occupies their lands (Naykanchina, 2012; Coombes et al., 2012; Lassila, 2020). This extraction and exploitation has pushed local communities in the Arctic and their traditional system of beliefs to the margin (Bennett, 2016). Yet, the benefits of extractive economies are meant for a few local actors or distant foreigner investors (Moore, 2018), while the cost of extractive economies are imposed upon Indigenous people, pastoralists and fishermen (Cameron, 2012; Dwyer and Istomin, 2009).

To maintain political and economic control of the Arctic (Muller-Wille, 1987), two contradictory trends can be seen in the global resource politics of the region (Naykanchina, 2012, p.20). Namely, a vast increase in extractive activities and infrastructure projects on traditional Indigenous lands undermine the recognition of Indigenous territorial rights and traditional land-use, such as reindeer herding, hunting and fishing (Herrmann et al., 2014; Herrmann and Heinämäki, 2017; Naykanchina, 2012). Therefore, common lands and traditional ways of life in the Arctic are being rapidly replaced by metal mining, fossil fuel extraction, wind-power parks, transport infrastructure and hydropower projects (Naykanchina, 2012). Consequently, the high levels of industrialized extraction and utilization of resources are causing often irreversible socio-environmental damage. This is giving rise to intense socio-environmental conflict in the region (Ahtuangaruak, 2018; Keil, 2014; Nuttall, 2013; Nuttall, 1998).

3. Global trends and the Arctic

Geographically, the Arctic is a polar region of approximately 30 million square kilometres, spanning three continents and eight states: Alaska in the US, the Northern Territory of Canada, Arctic Russia, Greenland, Iceland, Northern Finland, Sweden, and Norway (The Arctic Council, 2015b). The Arctic includes any location in high latitudes where the average daily summer temperature does not rise above 10 degrees Celsius (NSIDC, 2020). This includes the Subarctic area of the southern tip of Greenland, the southern coast of Iceland, and the northern part of Kamchatka, Russia.

The Arctic region also contains security and military interests of nation-states, as well as political and economic interests (Heininen, 2014). For instance, integral parts of modern industrialized nation-states include Sápmi in Fennoscandia, the Yukon in the Northwest territories and Nunavut in Canada, and the Yamalo-Nenets Autonomous region of the Russian Federation. In short, almost all Indigenous homelands have been claimed and controlled by nation-states to the south of the Arctic. Different state-corporate nexuses, located outside the circumpolar North, impose their own economic interests for which both land and resources are needed (Muller-Wille, 1987). In the process, Indigenous peoples of the Circumpolar North lose access to and control over their land and its traditional use.

Within this context, development projects and planning in the Arctic are being driven by ideas of advanced technological progress and economic growth (Egerman et al., 2003). Some of its regions are integral parts of modern industrialized nation-states (although this is not the case for Greenland, an autonomous territory within the Kingdom of Denmark) (Muller-Wille, 1987; Nuttall, 2012). These states cater to particular economic sectors and corporations in different extractive sectors, easing their access to Arctic Indigenous and other territories.

The Canadian state is notorious for supporting via diplomacy, spying and other operations the global expansion of the mining industry (Bélanger, 2018; Keeling and Sandlos, 2015). The Canadian state-mining nexus continues to provoke major socio-ecological injustices in many parts of the world including the Arctic, as in the forceful expansion to Fennoscandia and particularly Finland by Canadian gold and other mining companies (Kröger, 2016).

In Alaska, the oil and gas extraction business has been marked by recent attempts of the Trump administration (2017–2021) to open up drilling in conservation areas. Arctic policies may change with government fluctuations following, however, a general trend to extractive expansion. Besides Russia, the United States has been an important player building major logistical and military infrastructures in the Arctic. After the end of the Cold War in the 1990s, these infrastructures are currently being rebuilt, to serve resource extraction and great power competitions (Dodds and Nuttall, 2019). These militaristic goals play a major role in the Russian contemporary attempts to claim sovereignty over Arctic territories and resources. Other Arctic powers, especially the Nordic states, seem to be much less inclined to expand militarily and forcefully to grab territories or resources (Kröger, 2019).

Currently, Russia and Norway are the states with the strongest citizen support for expanding Arctic resource extraction (Morgunova, 2020). Russia has a particularly strong state rhetoric, which tries to build legitimacy for hydrocarbon expansion in the Arctic as an emblem of Russian nationalism, tying these two in a problematic way, which neglects the climate emergency (Tynkkynen, 2018). This narrative, however, has been successful in gaining support in Russia for Arctic extraction. In both Russia and Norway, there is extensive state support for especially hydrocarbon but also mining expansion. The key Norwegian corporations are Statoil and Yara, but foreign oil corporations could also follow to the Arctic if Norway decides to expand its offshore drilling.

In Finland and Sweden, there is a marked expansion of forestry extractivism, especially for constructing a mega pulp mill in Kemi, Finland, which would use fibrewood from very slow-growing Arctic forests to make pulp (Kröger, 2022). Sweden and Finland both have received rising criticism of the trend to replace forests with tree plantations, for the sake of wood energy and pulp production. In Fennoscandia, there are also a rising number of other land-use related conflicts around wind farm, infrastructure and tourism expansions – all sectors supported by a large array of political parties and state institutions. Fennoscandia has also a host of different kinds of mines and mining expansion projects, ranging from established underground mines in Kiruna, Sweden, and Kemi, Finland, to produce iron ore and chromite by national companies, to open-pit mines by Canadian and other foreign operators, for gold, rare earth and battery minerals (Kuokkanen, 2019). These are also largely state supported, but there is difference in mining policies, Sweden and Norway being less accessible to foreign capital than Finland (Kröger, 2016).

Greenland is the most visible example of the tensions between sovereignty, indigeneity, and foreign and local pressures to extract resources (Kuokkanen, 2019). The European Union, the United States and Canada all have a stake in these politics, and a growing number of other rising powers, particularly China, aim to enter as well (Dodds and Nuttall, 2019). The Greenland mining hype, contentiously framed as a way to secure independency by some, has recently experienced a blowback due to rising resistance (see e.g. Duxbury, 2021). While there are many obstacles and risks to future expansion, our analysis indicates that the 2000–2020 period has shown a marked commodity extraction expansion in the Arctic. This could have been much stronger without sanctions to Russia, climate crises and concerns, and rising resistance. In Russia, especially in Siberia, permafrost and its melting has deterred extractive operations as there are massive and rising costs involved in trying to rebuild sunk infrastructures (Kröger, 2022).

However, the Arctic region is not a *terra nullius* or an 'empty polar region' to be exploited and extracted at will (Gritsenko, 2018). On the contrary, it is home to approximately four million people, 12% of whom are Indigenous (except for Iceland) (The Arctic Council, 2015b). There is a diversity of cultural, historical and economic backgrounds among Arctic peoples, and there are many examples of Indigenous respect for the elements of nature that are deemed to be sacred (Herrmann and Heinämäki, 2017). The Arctic lands, waters, coasts and icescapes are places of Indigenous mobility and occupancy (Aporta et al., 2014). Arctic Indigenous peoples include, for example, the Sámi in northern Finland, Sweden, Norway and Northwest Russia, the Nenets, Khanty, Evenk and Chukchi in Russia, the Aleut, Yupik and Inuit (Iñupiat) in Alaska, the Inuit (Inuvialuit) in Canada and the Inuit (Kalaallit) in Greenland.

Each September, Arctic sea ice reaches its minimum (NASA, 2020a). The average Arctic sea ice extent in September 1979 was equal to 7.05 million square kilometres. A sharp decline was recorded by September 2020 to 3.92 million square kilometres of ice extent. Accordingly, September Arctic sea ice has been declining at a rate of 13.1% per decade since the beginning of satellite records in 1979 (NASA, 2020a).

This rapid and disruptive ice change in the Arctic has led to high hopes among powerholders for investment, development, and economic growth (Kröger, 2019; Kröger, 2016). Melting ice means that the Arctic Ocean is accessible to navigation and commodity shipping through the

Northern Sea Route, the Northwest Passage, and the future Trans Arctic shipping route via the North Pole. These new sea trade routes shorten travel time between the main ports of Asia, Northern America and Northern Europe. Furthermore, the ice melts allow a greater range for icebreakers: ships that are indispensable to the development of polar trade routes, that cut both the ice and the distance between important ports in the region (Drewniak et al., 2018).

What is occurring in the Arctic can be seen as a microcosm of the world as a whole, mirroring the speed at which socio-environmental well-being and values – often incommensurate with monetary values – are sacrificed to the altar of extraction and economic growth (Martinez-Alier, 2002; Stammler, 2005). The following sections of this article systematically analyse resource and commodity frontier expansion in the Arctic, the associated emergence of socio-environmental conflicts, and resistance to the extractive frontiers in the region.

4. Methods

4.1. Data sources

The cases of conflict analysed in this paper were gathered from the Global Atlas of Environmental Justice (www.EJAtlas.org), an online open access database and interactive map that documents socio-environmental conflicts in a standardized manner (Temper et al., 2015). The EJAtlas has become the most comprehensive database on environmental conflicts globally available (Scheidel et al., 2020). As Drozdz (2020) remarks, the collaborative maps from the EJAtlas provide examples of how critical mapping can reframe the dominant top-down cartographic narrative.

The EJAtlas project started in 2012 and reached 3500 environmental conflict cases as of July 2021. Although a global inventory, the EJAtlas does not cover with the same intensity countries and regions. Further to this, some cases of the EJAtlas might have more detailed information than others. As a database, the EJAtlas is mainly based on secondary sources, such as newspapers, NGO reports, legal proceedings, and academic studies which are more abundant and available for some places than others.[1] This is especially the case for countries or regions where free media in general and media coverage of environmental problems in particular, is restricted. Three of the authors of this article are among the group of editors of the EJAtlas. They have revised the existing information on the Arctic and added new cases in collaboration with other scholars and activists.

Beckert et al. (2021, p.3) indicate that studying "how and why commodity frontiers have expanded, moved and adapted over time is a key element for understanding global capitalism", however, an important challenge remains: "how to account for the enormous variety and specificity of actors and places involved in this history". The EJAtlas is a valuable global database for studying the places where commodity frontiers are expanding, as well as the affected actors calling for socio-environmental justice. For the purpose of this study, we include fifty-three socio-environmental conflicts, most of them above latitude 65°, and all of them north of 55°. Thus, some cases are located in the so-called 'Subarctic area' (see Appendix A for the list of analysed cases). To achieve this sample, conflict cases that were already registered in the EJAtlas were selected and updated by the authors ($n = 30$). New cases were added to the platform ($n = 23$) to increase the initial sample size. All newly identified cases were entered, moderated and published in the EJAtlas by the authors based on available secondary information. For four cases, the authors also performed field research - case 20 (both Kirkenes and the nickel plant in Petsamo), case 27 (Kiruna), case 30 (Inari), case 32 (Talvivaara) – which further informed the authors' understanding of extraction dynamics in the Arctic commodity frontier.

4.2. Data analysis

For the analysis of the fifty-three socio-environmental conflicts, we used descriptive statistics, network analysis and a regression analysis to understand both the patterns as well as some of the determinants of key conflict outcomes.

Descriptive statistics of the datasets were used to explore the general characteristics of conflicts located at the Arctic commodity frontier. Analysed variables from the EJAtlas dataset include i) *conflict locations*; ii) *conflict intensity*, referring to the scale of mobilizations and level of violence present in a given conflict; iii) *conflict type* according to economic sectors causing a conflict, iv) the most frequent *commodities* related to socio-environmental conflicts, v) the frequency of different *types of groups protesting*, and the *network size*, which refers to the number of different organizations identified to be involved within the cases. The latter variable was identified through the codification of the qualitative conflict descriptions in *Nvivo* software.

Network analysis (Fuhse and Gondal, 2015; Golbeck, 2013) was used to identify the social actors who participated in the conflicts. The aim was to obtain the pattern of connections among the actors by using *modularity* or community detection algorithm (Newman, 2006). For this, we used variables of the type of groups protesting, the different organizations involved, and their country of origin identified in each of the cases. Modularity measures both dense connections between actors within modules and sparse connections between actors in different modules throughout network (Ji et al., 2015). Next, we used *betweenness centrality* algorithm to detect which actors act as 'bridges' in the network. As a measure of influence, the centrality algorithm calculates the number of times an actor lies on the shortest path between other actors, by taking whole network into account, not only the local connectivity that an actor belongs to (Golbeck, 2013).

Finally, we used *binomial regression analysis* to model two levels of nominal outcomes (dependent variables) as a linear combination of the predictor variables. We specifically analysed the following reported outcomes: i) *repression*, referring to acts of subduing protests by government, security staff, militias, or corporate actors; ii) *loss of traditional knowledge, practices, cultures*; and iii) whether a conflictive project was *cancelled or not* in relation to the specific conflict. We selected predictor variables that according to the literature may have potential influence on these outcomes (see below explanation of each model). The predictor variables include actor characteristics of the conflict, i.e., whether the cases involved *Indigenous* people or not; protest strategies, i.e., *preventive mobilizations*, describing whether resistances started before project implementation or not; and the *count of different mobilization forms* employed, which is an indicator of the tactical diversity of resistances; and external variables to control for structural factors of the country and year in which the conflict is taking place, i.e., indicators for the *rule of law*, *intentional homicides*, and *total natural resource rents* (as % of GDP).

The *index of the rule of law* is a 0 to 1 ranked portrait of jurisdictions in the eight Arctic countries based on eight factors: constraints on government powers, absence of corruption, open government, fundamental rights, order and security, regulatory enforcement, civil justice, and criminal justice (worldjusticeproject.org; Butt et al., 2019). The index of the rule of law varies across the Arctic region. For instance, the rule of law was 0.89 for Norway and 0.47 for the Russian Federation for the year 2020. *Intentional homicides*[2], expressed as murders per 100,000 people, is an indicator of the structural patterns of violence and crime prevalent in a country and year in which a conflict unfolds (Jeffords and Thompson, 2016). *Total natural resources rents* (%GDP)[3] are the sum of

[1] For more information on the EJAtlas database, see Scheidel et al. (2020); Temper et al. (2018, 2015).

[2] World Bank via UN Office on Drugs and Crime's International Homicide Statistics database: Intentional homicides (per 100,000 people) https://data.worldbank.org/indicator/VC.IHR.PSRC.P5

[3] World Bank: Total natural resources rents (% of GDP) https://data.worldbank.org/indicator/NY.GDP.TOTL.RT.ZS

oil rents, natural gas rents, coal rents (hard and soft), mineral rents, and forest rents, expressed as percentage of a country's GDP. It is an indicator of a country's dependence on natural resource exploitation (Le Billon and Lujala, 2020).

A priori the regression analysis, we conducted and assured assumption checks. Namely, collinearity or variance inflation factor (VIF) of independent variables for both binominal regression, where VIF < 2.5 and Tolerance >40. When VIF was higher than 2.5 between independent variables, we conducted secondary models, so that highly corelated independent variables are not used in a model simultaneously (Kock and Lynn, 2012; Wheeler, 2007). Further, we conducted secondary models also because our data sample is small ($n = 53$) and the significance indicators thus easily disperse in multiple regression; and by omitting corelated variables we reduce multicollinearity and dispersion (Midi et al., 2010; Mosteller and Tukey, 1977). Full models predicting dependent variables can be found in Appendix B to D.

The models included the following predictor variables:

a) *Repression* (dependent variable) * *preventive mobilizations* to test whether the timing of mobilizations, identified by Scheidel et al. (2020) as a successful resistance strategy to achieve positive conflict outcomes, may influence occurrence of repression; * *Count forms of mobilization*, to test whether tactical diversity, identified as another successful resistance strategy (ibid), influences the occurrence of repression; * *Rule of law*, to test whether a higher rule of law, including the better protection of human rights, may result in lower levels of repression (Butt et al., 2019); * *Intentional homicides,* to test whether occurrence of repression may be explained by the more general patterns of violence occurring in a country in which conflicts are located (Jeffords and Thompson, 2016; Le Billon and Lujala, 2020); * *Natural resources rents* (%GDP), to test whether a country's higher dependency on natural resources increases pressure to implement a conflictive project by private and state actors, even at higher social and environmental costs, including repression (Le Billon and Lujala, 2020).
b) *Loss of traditional knowledge/practices/culture* (dependent variable) * *Involvement of Indigenous people*, where our hypothesis is that when Indigenous people are affected traditional knowledge/practices and cultures could be lost more frequently compared to cases where Indigenous people are not present, because Indigenous people preserve traditional knowledge/practices and cultures (Barnhardt and Angayuqaq, 2005; Naykanchina, 2012); * *Count forms of mobilization* where we test whether tactical protest diversity can contribute to avoid knowledge loss (Scheidel et al., 2020); * *Preventive mobilization*, with which we test whether the timing of mobilization can contribute to avoid knowledge loss (Scheidel et al., 2020); * *Rule of law*, to explore whether effective laws that assure adequate project implementation, including the protection of human rights and minorities, could support to avoid knowledge loss; * *natural resources rent* (%GDP) to explore whether a high dependency on natural resources means that state and private pressure to implement a project is high, even at the cost of social impacts such as knowledge loss (cf Le Billon and Lujala, 2020).
c) *Project Cancelled* (dependent variable) * *Count of mobilization forms,* to test whether tactical diversity may influence higher rates of project cancellation (Scheidel et al., 2020); * *Preventive mobilization,* to test whether the timing of mobilization influences project cancellation (Scheidel et al., 2020); * *Rule of law*, to test whether with higher levels of democracy, more legal and formal means are available to stop a project that does not meet human rights standards, environmental regulations, and other legal concerns (Raftopoulos, 2017); * *Natural resources rent* (%GDP), to explore if more dependent a state is on resource incomes, the higher the pressure to push a project through, the more difficult to achieve project cancellation (cf Le Billon and Lujala, 2020).

5. Results

5.1. Extractivism and environmental conflicts

Of the fifty-three socio-environmental conflict cases identified, eight are situated in the United States (Alaska), six in Canada, two in Greenland, three in Iceland, five in Norway, another five in Sweden, three in Finland and twenty-one in Russia. Moreover, the geography of these environmental conflicts overlaps with predominantly Indigenous peoples' territories (Fig. 1).

In general, conflict intensity in Arctic countries is of medium intensity, characterized by visible mobilizations, such as street protests, marches and rallies. There were also some low intensity conflicts, without visible mobilizations. However, some high intensity conflicts, in which repressive reaction with violence has taken place (e.g., arrests and violent targeting of individuals or groups protesting against the projects) are found in some instances in Alaska, Iceland, Norway and Russia (Fig. 2).

Conflicts include cases around the Arctic with common, comparable characteristics, and a variety of economic activities (Fig. 3). These frequently include oil and gas exploration, extraction or refining, or transport infrastructure networks, such as pipelines across Canada, the US and Russia. Mineral ore exploration and the associated tailings from mines are frequent in Canada, Russia, and in the European Arctic (Greenland, Sweden, Finland and Norway). Conflicts over land acquisition and water access rights were found, for instance, in Iceland and Norway. Conflicts caused by climate change, such as vanishing glaciers and small islands, were common in Alaska, US.

The commodities that most frequently related to socio-environmental conflicts were crude oil, electricity, and natural gas, as well as iron ore and copper (Fig. 4). Looking at each country, oil and gas extraction was observed for high latitudes in the US, Canada and Russia. In the lower latitudes of the US and Canada, we found gold and copper mining conflicts. In Greenland, there were environmental conflicts related to copper and uranium extraction, whereas in Iceland the conflicts concern dams and water distribution for electricity production for aluminium smelting. In Sweden, Norway, and Finland mining-related conflicts included those relating to copper, iron, nickel, uranium, and, again, hydropower for electricity. In Russia, besides oil and gas extraction, there were socio-environmental conflicts related to coal, copper and nickel extraction.

5.2. The network of social groups on the frontline against extractivism in the Arctic

The most frequent groups protesting against extractive projects in the Arctic region are local environmental justice organizations (EJOs), Indigenous or traditional communities, neighbours, citizens, and international EJOs, followed by local scientists and local government or political parties (Fig. 5). Within the general groups in Fig. 5, we identified 31 different local EJOs, 34 Indigenous groups, 23 International EJOs, 3 local governments and 1 organization of scientists/professionals involved in resistance against the projects. Frequent forms of protest include media-based activism, development of networks and collective action, creation of alternative knowledge reports, and street protest/marches (Fig. 6).

According to network analysis, resistance against extractive projects in the Arctic region is transversal (Fig. 7). The *modularity class* algorithm of the network analysis revealed transversal resistance within seven cluster groups across the Arctic that intervened in joint protests. In each of the clusters detected, Indigenous people were present. Based on the *betweenness centrality* algorithm of the network analysis, neighbours, citizens and local Indigenous and non-Indigenous communities are the social actors with most influence in protests at the network level.

Clusters are formed by the frequency of connections among the appearing social groups in all the fifty-three conflicts analysed. Cluster I

1. Kivalina climate change court case, Alaska
2. Oil Drilling in the Arctic National Wildlife Refuge, Alaska
3. Climate Change Displacement of Native Alaskans
4. Pebble gold and copper mine in Bristol Bay, Alaska
5. Shell's drilling for oil in the Arctic, Alaska
6. Northstar oil field, Alaska
7. Red Dog mine toxic tailings to Kotzebue and Kivalina, Alaska
8. Iñupiat people resist offshore oil drilling and gas development plans in Point Hope, Alaska
9. Mackenzie Valley Pipeline
10. Yellowknife gold mine and arsenic pollution
11. Iron Ore mining in Baffin island, Nunavut territory
12. Hamlet of Clyde River v. Petroleum Geo-Services Inc., Nunavut
13. Peel Watershed Regional Land Use Planning Conflict
14. Diavik Diamond mine by Rio Tinto, kimeberlite waste, Northwest Territories
15. Greenland Mineral Ltd.'s Kuannersuit/Kvanefjeld Rare Earth-Uranium Project
16. Isua Iron Ore Mining Project
17. Kárahnjúkar dam
18. Hydroelectric Power Station, Laxá River, Skútustaðahreppur
19. Thjórsárver reservoir
20. Protest against heavy pollution from Russian nickel plant, Kirkenes
21. Oil drilling, Lofoten
22. Reppardfjord-Nussir copper mining case
23. The People versus Arctic Oil litigation
24. Alta River Hydro Power Plant
25. Large-scale Wind Farm in Sami reindeer land
26. Rönnbäcken Nickel Mine, Västerbotten
27. Relocation of Kiruna town due to iron ore mine
28. Vindelälven hydel project
29. Gállok-Kallak Iron Mine
30. Saami-Metsähallitus Forest Conflict, Inari
31. Hanhikivi Nuclear Power Plant, Pyhäjoki
32. Talvivaara nickel mining company
33. Gazprom's Obskaya – Bovanenkovo railroad Yamal Peninsula
34. Sabetta port
35. Closure/modernisation of Monchegorsk nickel and copper smelter, Kola peninsula
36. Coal mining in Arctic's natural reserve, Taymyr
37. Prirazlomnoye oil field
38. Oil Extraction at Numto Nature Preserve
39. Norilsk pollution (nickel)
40. Gas and oil extraction in Kamchatka
41. The right to fish in the Kamchatka region
42. Shiyes Landfill in Arkhangelsk region
43. Timber logging in the Dvinsky Forest
44. Floating nuclear power plant, Pevek
45. Oil spills in Komi Republic
46. Oil Spills in Khanty-Mansi Region
47. Yamal mega natural gas project
48. Bovanenkovo – Ukhta 2 undersea gas pipeline Baydaratskaya Bay
49. Potassium mining sinkholes in Berezniki
50. Arctic Oil Spill in Norilsk, Russia
51. Liquefied natural gas project -LNG 2, Gydan peninsula, Arctic Russia
52. Resistance against diamond mines, Sakha, Russia
53. Copper/gold mining, nuclear power in Nagleyngyn, Arctic Russia

Fig. 1. Arctic commodity extraction frontiers, Indigenous territories, and environmental conflicts documented in the EJAtlas. Own elaboration with data from: Crump et al., 2017; Indigenous Peoples' Secretariat of the Arctic Council; Arctic Biodiversity Assessment (CAFF, 2013); and Arctic Monitoring and Assessment Programme of the Arctic Council.

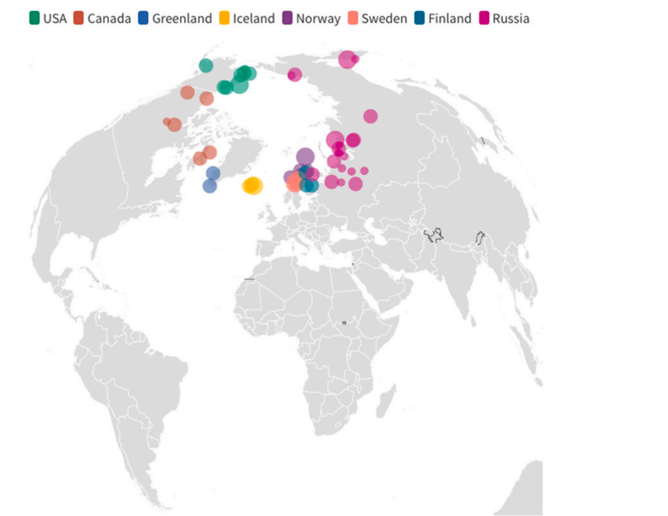

Fig. 2. Socio-environmental conflict intensity per country. The larger the circle, the more intense the socio-environmental conflict trajectory, in terms of levels of mobilization and violence (e.g. arrest or violent targeting of protesters). High intensity conflicts are found in Alaska (US), Iceland, Norway and Russia. N = 53.

(green) represents neighbours, citizens, and local Indigenous and non-Indigenous communities as central actors, both at local cluster level and network level. This cluster encompasses 33.93% of all social groups. The central actors closely relate to local environmental justice organizations (EJOs) in Sweden and Russia, and Indigenous groups in Sweden, Russia, and Canada alike; thereby building up a social movement (white). Cluster II (blue) comprises international as well as local EJOs in Iceland, Norway, Greenland, and Russia, including the Indigenous communities of those countries (except for Iceland) (19.64%). Cluster III (red) includes local EJOs and Indigenous groups in Norway, Russia and Canada, political parties, and farmers and fishermen in the countries (18.75%).

Cluster IV (orange) is made up of local EJOs in Finland, groups that have experienced ethnic or racial discrimination, Indigenous people of Russia and Canada, recreational users, and women (8.04%). Cluster V (white) indicates social movements involving the International Indigenous Treaty Council and local EJOs in Norway and Russia (8.04%). Cluster VI (pink) involves local EJOs in Canada and Alaska and their Indigenous peoples (7.14%). Cluster VII (yellow) includes local EJOs in Finland and Alaska (US) as well as Alaskan Indigenous communities (4.46%).

5.3. Repression, socio-environmental consequences at stake, and project cancellation

Repression against protesters can involve diverse acts of subduing, including violent targeting of activists, criminalization of dissent, or increased police and military presence. In total, ten of the fifty-three cases reported some form of repression. According to the regression analysis (Table 1), there is a negative and significant relation of repression and preventive mobilizations, indicating that repression is less likely to occur if mobilizations start when an extractive project is not yet implemented. Further, there is a positive and significant correlation for diversity of mobilization forms and repression; suggesting that when more diverse forms of mobilizations are employed by protesters, conflict

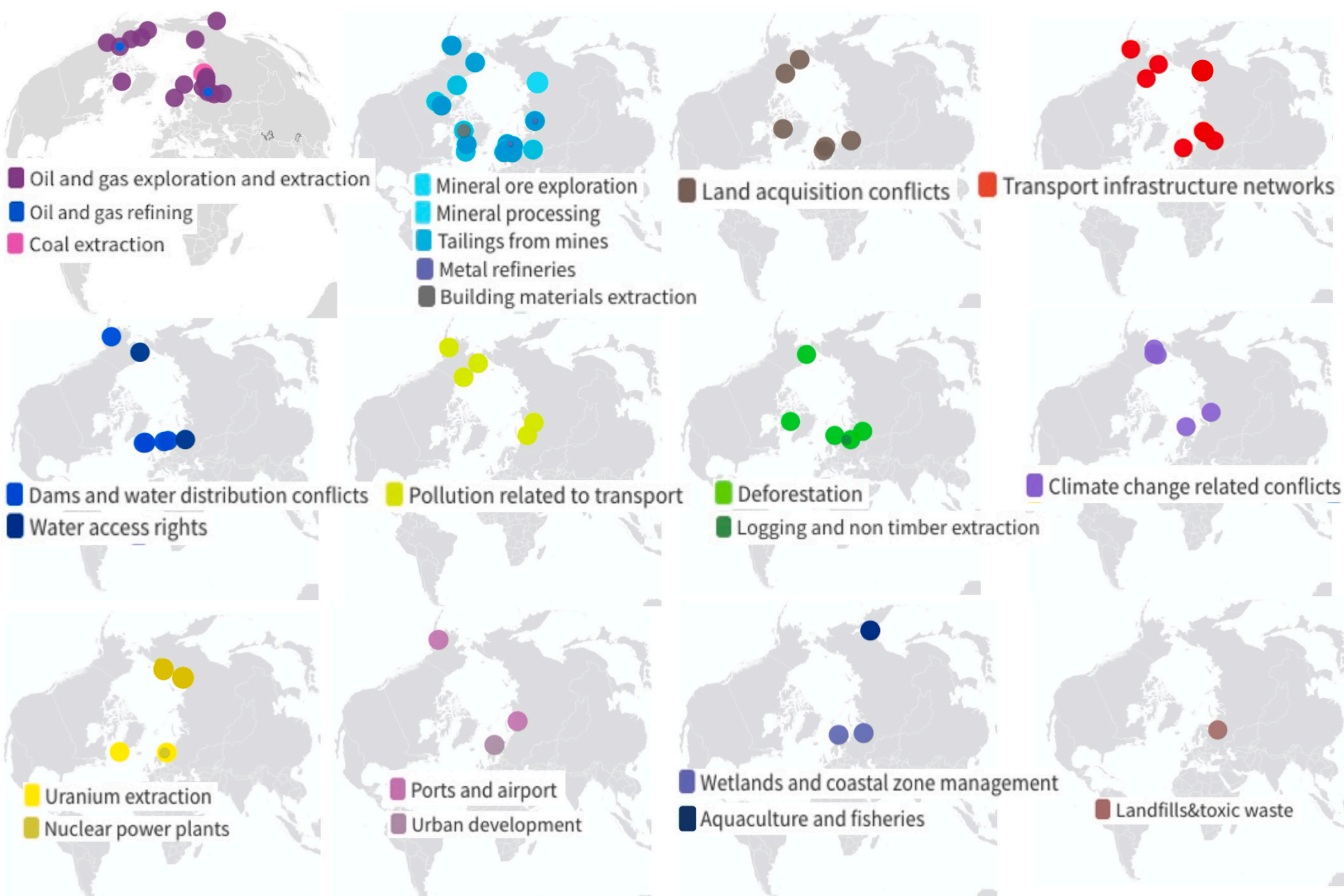

Fig. 3. Socio-environmental conflicts in the Arctic according to specific economic sectors and activities. Variables are not mutually exclusive. N = 53.

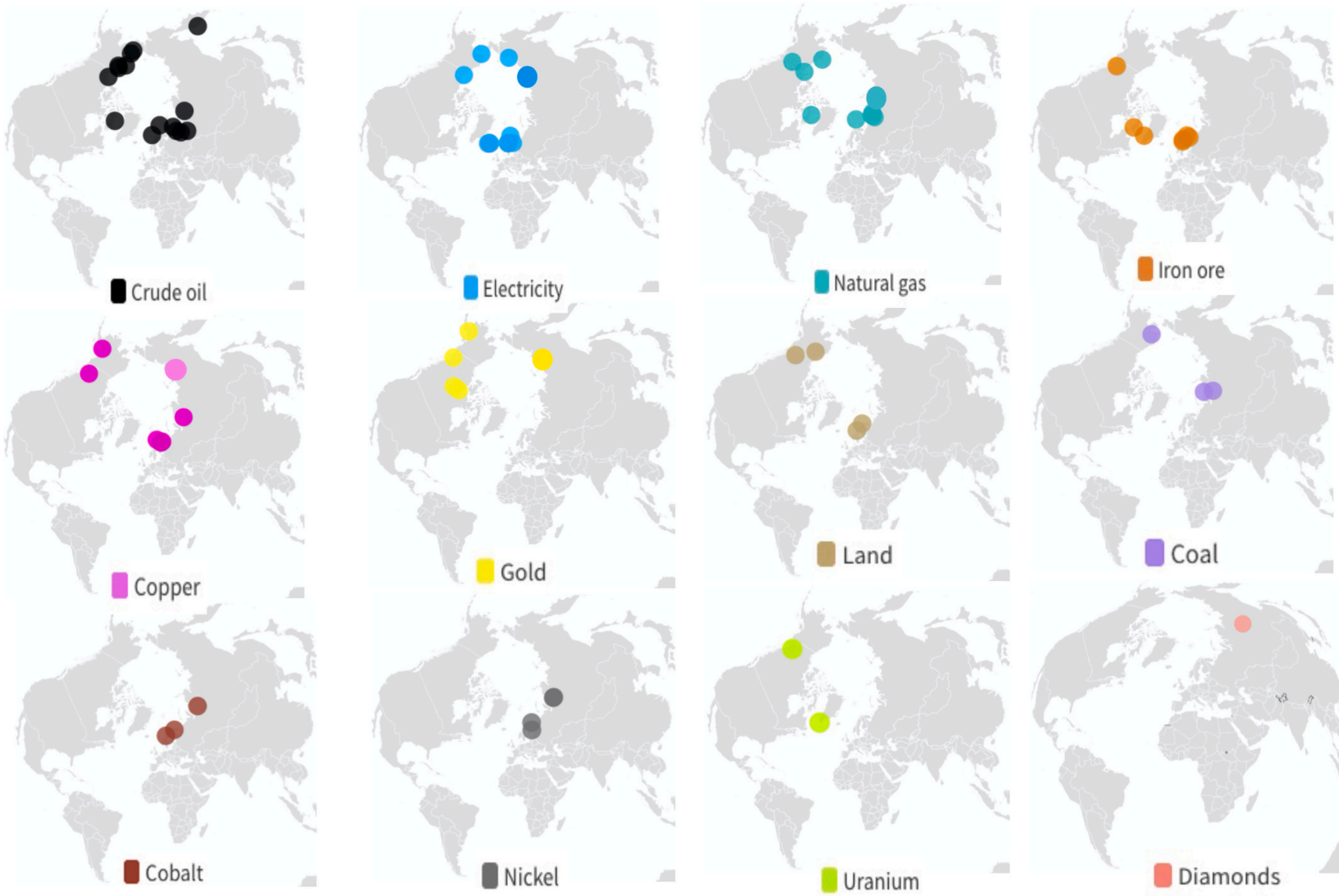

Fig. 4. The most frequent commodities related to socio-environmental conflicts. Variables are not mutually exclusive. N = 53.

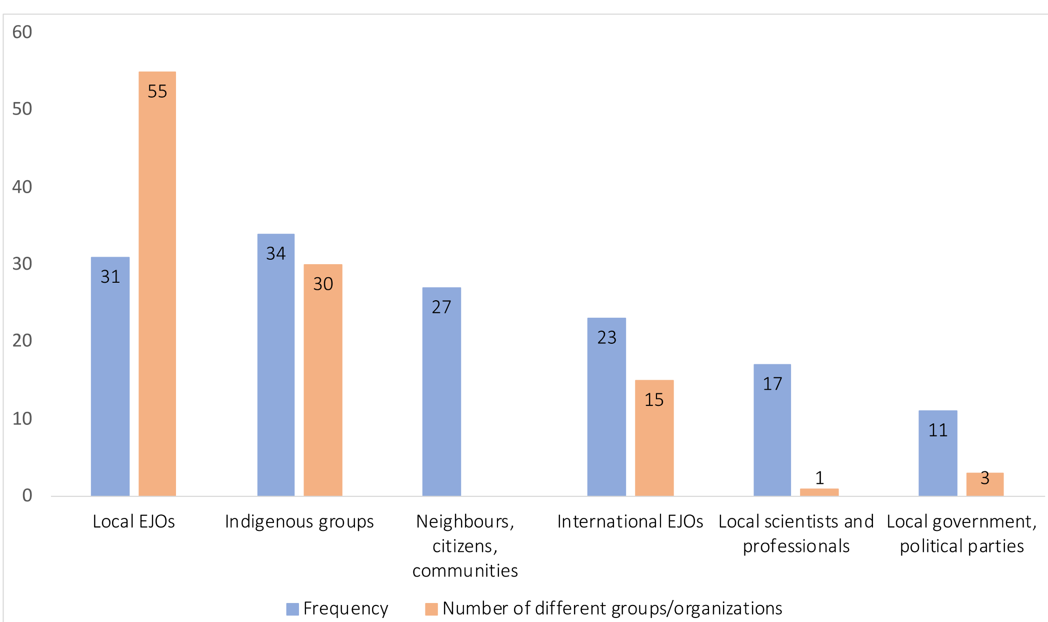

Fig. 5. Frequency of type of groups protesting across the 53 analysed conflict cases (blue); number of different groups/organizations identified within the analysed cases (orange). Note: Frequency of types of groups protesting are not mutually exclusive; EJOs refers to Environmental Justice Organisations. N = 53.

cases more frequently involve incidences of repression. Moreover, we identified a positive correlation of repression with the level of intentional homicides and the dependency on natural resources rents (% GDP) in a country at the time of conflict start, and a negative correlation between repression and rule of law. Although the models show a high statistical significance, individual model coefficients for the trends

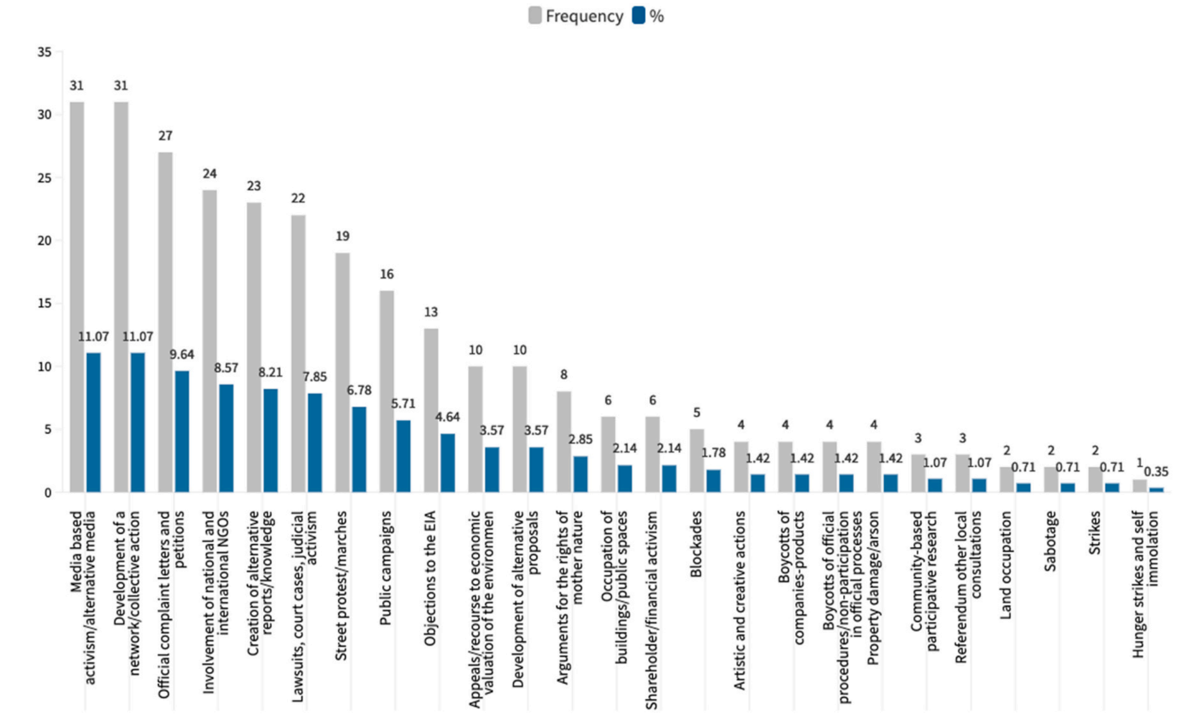

Fig. 6. Forms of mobilization. Frequency of cases (grey) and percentage of all cases (blue). Variables are not mutually exclusive. N = 53.

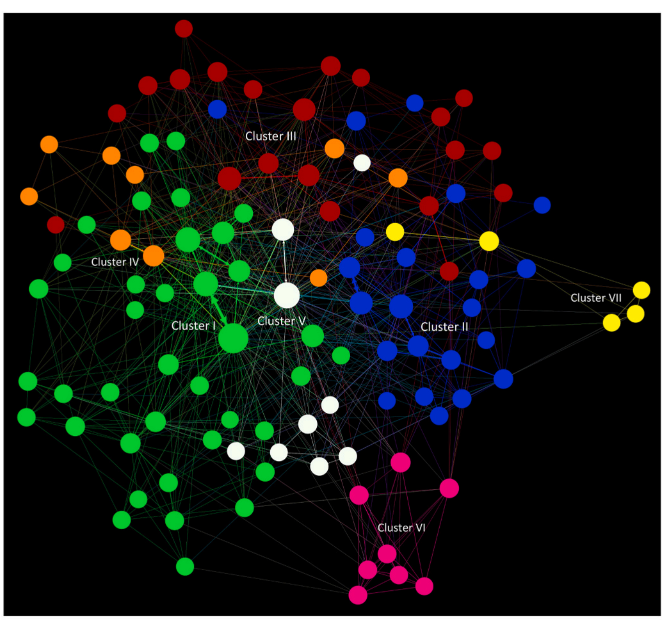

Fig. 7. Transversal resistance with the involvement of different social groups against extractive projects in the Arctic. The more central the cluster and the bigger its circles, the higher its influence in protests at the network level. In this case, the central cluster is formed of neighbours, citizens and local Indigenous and non-Indigenous communities (Cluster I (green)). Indigenous communities intervened in each of the seven clusters. N = 53.

between repression and intentional homicides, natural resources rents (% GDP), and rule of law was not confirmed.

Both models predicting loss of traditional knowledge, practices and culture are highly significant. According to the regression analysis, the probability of socio-cultural loss due to extractive activities, such as traditional knowledge, practices, and culture, is significantly higher if the mobilization stage is not preventive (negative correlation) and when Indigenous people are involved in the resistance (positive correlation). Even though loss of traditional knowledge, practices, and culture appears in the model to be more likely the case when rule of law is high (positive relation) and dependence on total natural resources rents (% of GDP) is low (negative correlation), the statistical significance for both coefficients was not confirmed. Similarly, there is an indication that loss of traditional knowledge, practices, and culture decreases (negative correlation) with diverse mobilization strategies but without confirmed statistical significance. The variation in the loss of traditional knowledge according to two factors, preventive and Indigenous resistance, can be explained with 61%.

The models predicting project cancellation show statistical significance; and while there is a positive and significant correlation for project cancellation and preventive resistance, there is a negative significant correlation between project cancellation and dependency on natural resource rents (%GDP). Furthermore, the results show positive correlation between rule of law and project cancellation, where statistical significance was close but not confirmed in this case.

6. Discussion

6.1. Colonial resource and commodity frontiers of the circumpolar North

The Arctic is typically assumed to be situated geographically in the "Global North". However, our results on the Arctic commodity frontiers suggest that crisp Global South-North divides are hard to support analytically. The increased resource extraction in the Arctic region suggests rather the claim that commodity frontiers move globally, leading to the peripheralization and damaging of regions around the world. There are many pockets now in the Arctic and other parts of the assumed "Global North" that increasingly fulfil the role of supplier of raw materials at cheap prices but with a heavy socio-environmental cost. These processes sustain hegemonic or partially colonial relations between core economic states (e.g. US, Russia, Canada, Finland, Norway, Sweden) and the Circumpolar North 'periphery'– home to local communities and Indigenous groups (Cameron, 2012; Muller-Wille, 1987).

In fact, this has been the case already for long, as the Arctic

Table 1
Binominal regression model coefficients.

	R2	Overall p	Estimate	SE	z	p
Repression						
Rule of law	0.382	0.003**	−2.521	2.018	−1.250	0.211
Preventive mobilisation1			−2.837	1.395	−2.034	0.042*
Forms of mobilization			0.367	0.139	2.643	0.008**
Total natural resources rents (% GDP)	0.376	0.003**	0.0874	0.0744	1.17	0.240
Preventive mobilisation1			−2.8464	1.3829	−2.06	0.040*
Forms of mobilization			0.3420	0.1364	2.51	0.012*
Intentional homicides	0.371	0.002**	0.0398	0.0467	0.852	0.394
Preventive mobilisation1			−3.2957	1.3840	−2.381	0.017*
Forms of mobilization			0.3615	0.1383	2.614	0.009**
Loss of traditional knowledge, practices, cultures						
Rule of law	0.591	<0.001***	1.316	1.838	0.716	0.474
Preventive mobilisation1			−3.703	1.138	−3.255	0.001**
Forms of mobilization			−0.262	0.162	−1.622	0.105
Indigenous involved1			3.035	1.076	2.822	0.005**
Total natural resources rents (% GDP)	0.594	<0.001***	−0.0640	0.0764	−0.838	0.402
Preventive mobilisation1			−3.7372	1.1497	−3.250	0.001**
Forms of mobilization			−0.2515	0.1630	−1.542	0.123
Indigenous involved1			3.0482	1.0893	2.798	0.005**
Project cancelled						
Rule of law	0.113	0.058*	3.40	2.01	1.69	0.090
Preventive mobilization	0.200	0.027*	1.8336	0.915	2.004	0.045*
Forms of mobilization			0.0445	0.103	0.434	0.664
Total natural resources rents (% GDP)	0.179	0.016*	−0.209	0.109	−1.91	0.056*

Notes: For variable *Preventive mobilization* the contrasts are: Preventive mobilization1 = 1–0; for variable *Indigenous involved* the contrasts are: Indigenous involved1 = 1–0. Each table row indicates one model. For regression analyses including all variables in the same model, see Annex.

Indigenous populations whose sovereignty and territories have been violated have witnessed. The Arctic has been a colonized territory and remains partly colonized through the expansion of new commodity frontiers. It supplies land for new transport infrastructure (ports and pipelines), fossil fuels and metals (iron ores, nickel, copper, and gold) across all territories. Thus, beyond the South-North distinction, this article shows how historical trajectories of resource extraction, and the current expansion of commodity frontiers manifest themselves in peripheral regions beyond North-South divides. Environmental conflicts arise in both the Global South and the "South in the North".

One can regard the Arctic as a semi-colonial resource and commodity frontier (Egerman et al., 2003; Körber et al., 2017), where the areas with ethno-territorial rights present pockets of autonomy, while the many cases of expanding extractivisms are colonial-type violations of local people's rights. Accordingly, the geography and the changing climate in the Arctic present important considerations in this resource frontier (like permafrost melting and new sea routes) in the *longue durée* of the region, moving to a greater extractivist push amid increasing uncertainties and risks (Kröger, 2022). This process is already evidenced by the number of extractive commodity projects and significant socio-environmental consequences suffered by local communities who complain accordingly about their impact.

Furthermore, increasing carbon dioxide from the burning of fossil fuels contributes to rising greenhouse gases that are melting the sea ice. This also allows for greater resource extraction, consequently leading to further sea ice melting, with strong negative impacts on local, global and Arctic environments (Kröger, 2016). In this sense, oil and gas, mining and the shipping industries are the biggest drivers and possible beneficiaries of the Arctic ice melt. To see the Arctic as a resource extraction frontier is not new. The term 'extractivism' from Latin American political ecology (Svampa, 2019) has already been used in studies of Arctic environmental conflicts.

A special issue on the Arctic in the journal *Extractive Industries and Society* (Wilson and Stammler, 2016) focused on whether costs and benefits are shared in such a way that current extractive projects obtain a so-called social license to operate (SLO), meaning approval or acquiescence to the investments. However, this article does not aim to give advice to private or public companies on how to exercise Corporate Social Responsibility or to achieve so-called SLO while increasing their business. In contrast, we put socio-environmental injustices ocurring in the region into a more systematic and historical perspective, which shows that the Arctic has been, and is becoming more and more, a commodity extraction frontier, a commodity transport frontier, and, to some extent, a waste disposal frontier. The ecological distribution conflicts arising at these frontiers contest the associated negative socio-environmental impacts, and in the case of the Arctic, have contributed to the cancellation of damaging projects in about 20% of cases. Thus, effective resistance at the frontlines of extractivism can lead to a social transition towards the reaffirmation of Indigenous sovereignty (Temper et al., 2020) and towards a more sustainable and just economy (Scheidel et al., 2018; Temper et al., 2018).

6.2. Transversal resistances across the Arctic

Resistances against the expansion of commodity extraction, transport and waste disposal frontiers was found through, across, and beyond the Arctic region. This transversal opposition is important for considering how the Arctic is transformed both physically and socially (Anguelovski and Martínez Alier, 2014; Martinez-Alier et al., 2016). While there are, of course, important structural differences across the Arctic countries, including different degrees of democracy, structural patterns of violence, or dependency on natural resource rents, there are also important similarities across the Arctic commodity frontier. That is, the commodities extracted in the different territories of the Arctic are rather similar, and the aggrieved populations (often Indigenous peoples and pastoralists) present comparable claims through common repertoires of collective action.

In this context, the question can be asked: Is there an environmental justice movement across the Arctic, i.e., within the eight countries (with their provinces) in which the selected fifty-three conflicts have taken or are taking place? As we have seen, network analysis shows some transversal connections that resist socio-environmental harms. The clusters in the network do not coalesce around single countries (Canada, Russia, etc.), while Indigenous groups appear in all clusters, connected to other social actors, such as EJOs (national or international), to neighbours and citizens, to professionals or scientists, and to other

Indigenous groups. The qualitative network analysis sustains the fact that protests are in essence "related" by a joint effort of connected actors and groups that mobilize against coloniality (Gritsenko, 2018; John, 2016) and calling for socially and environmentally more just pathways (Temper et al., 2018).

6.3. Impacts and outcomes of socio-environmental conflicts in the Arctic

Social mobilizations in the Arctic against coloniality and for environmental justice may come, however, with a substantial burden for activists and affected groups. Instances of repression, which appear to be more likely among conflicts marked by numerous and diverse forms of mobilizations, reflect not only the suppression of protest actions but also undermine different understandings of sustainability and worldviews (Del Bene et al., 2018). If open demonstrations are restrained, the region is more likely to suffer both social and environmental degradation and a continuation of extractive projects. As Gobby et al. (2021) put it, *criminalization of activists can derail environmental defence struggles*. Furthermore, extractive projects tend to affect disproportionately environments populated by Indigenous and other marginalised populations (Scheidel et al., 2020). This global trend is also reflected in the Arctic, where Indigenous people are involved in 64% of the analysed conflict, and where loss of traditional knowledge caused by conflictive projects is significantly more likely to occur when Indigenous people are affected.

However, it is important to recognize that Indigenous peoples, while being severely affected, are also key actors contesting the colonial and current expansion of the Arctic commodity frontier. In line with Lassila, 2020, the long history of colonial extraction is opposed by claims of traditional cultural significance of the environment in different places that precisely promote decolonization. Here, we see again how traditional cultures oppose the continuous domination of modern, colonial, extractive tendencies. Orta-Martínez and Finer, 2010, similarly found that conflicts in the Peruvian Amazon against oil extraction were mainly expressed in a language of Indigenous identity and territorial rights, and also in the language of risks to health.

In this regard, Arctic peoples have continually, traditionally and sustainably protected the environment, with a responsibility to maintain and enhance the environment for future generations (Ahtuangaruak, 2018). A strong attachment to community land, fertile pasture, or sources of medicine is central to the communities' customs and cultural beliefs (John, 2016). Arctic peoples, therefore, rely on the environment not only for their physical, but also for their cultural and spiritual needs, thereby protecting and maintaining environmental and cultural relationships (Krumpen et al., 2019; Kumpula et al., 2011).

In this context, preventive mobilizations that anticipate potential adverse socio-environmental impacts in order to protect and maintain the environment for future generations play an important role to achieve positive outcomes. According to our analysis, preventive mobilizations can play a key role for achieving the cancellation of conflictive projects, the avoidance of repression of activists, as well as the prevention of negative project impacts, such as loss of traditional knowledge, practices, and cultures in the Arctic. However, successful preventive mobilizations do not occur in a social vacuum but are shaped further by structural factors of the countries in which environmental conflicts occur. As our results have shown, the higher a country's dependence on natural resource rents, the lower may be the chances for activists to successfully stop socially conflictive and environmentally damaging projects, arguably, because the state's pressure to implement conflictive resource use projects is higher (cf. Le Billon and Lujala, 2020). This shows how colonial and current commodity frontiers shape not only the specific places where commodities are extracted and processed, but also the political economy of the countries in which conflicts and mobilizations occur.

7. Conclusion

This article investigated fifty-three socio-environmental conflicts in the Arctic region. The Arctic has been used to expand commodity extraction frontiers, especially for metals and fossil fuels. Despite of being located in the Global North, the Arctic frontier shares similar political ecologies with resource and commodity extraction frontiers in the so-called Global South. This suggests that clear-cut distinctions for North and South do not always apply, but both peripheral regions in the South and the North are being targeted by extractive capital.

However, people confront coloniality, weak governments, and repression, because of the harm that extractive tendencies perpetrate on the environment and on socio-cultural well-being. Correspondingly, there is a growing number of environmental conflicts across all the Arctic countries and provinces. While state-corporate hybrids tend to impose settler colonial relations through extractive projects, interwoven in different forms of repression, these projects operate on thin ice, as their socio-environmental impacts are far reaching, and resistances against these projects are mounting. We observe a strong social response by interconnected local protagonists, often Indigenous communities, from which a transversal movement for socio-environmental justice takes place. Their bottom-up, preventive, peaceful struggle tends to defend and preserve environmental and socio-cultural well-being, calling for environmental sustainability, equity, and justice.

Declaration of Competing Interest

None.

Acknowledgments

We are grateful to anonymous referees for their invaluable comments and suggestions provided. We thank all those who contributed cases to the EJAtlas, moderated them or offered information on environmental conflicts in the Arctic region. We are thankful to Brototi Roy, Naw Thiri May Aye, Dalena Tran, Eleonora Fanari, Daniela Del Bene, Aida Lopez, Mariana Walter, Bowen Gu, Yannick Deniau and Teresa Sanz for their comments and suggestions provided during the writing process. Our research benefited from financial support from the European Research Council (ERC) Advanced Grant ENVJUSTICE (grant number 695446); the Academy of Finland (grant number 316725); and the Catalan AGAUR Beatriu de Pinós grant (2017 BP 00023).

Appendix A. List of socio-environmental conflict cases analysed in this article

No.	Case	Country	Latitude	Longitude	Type of conflict
1	Kivalina climate change court case, Alaska	USA	67.63	−164.52	Fossil Fuels / Climate Change
2	Oil Drilling in the Arctic National Wildlife Refuge, Alaska	USA	69.80	−148.19	Biodiversity Conservation
3	Climate Change Displacement of Native Alaskans	USA	66.228	−166.121	Fossil Fuels / Climate Change
4	Pebble gold and copper mine in Bristol Bay, Alaska	USA	59.90	−155.28	Mineral Ores
5	Shell's drilling for oil in the Arctic, Alaska	USA	71.348	−156.858	Fossil Fuels /Climate Change
6	Northstar oil field, Alaska	USA	70.44	−148.79	Fossil Fuels/Climate Change

(continued on next page)

(*continued*)

No.	Case	Country	Latitude	Longitude	Type of conflict
7	Red Dog mine toxic tailings to Kotzebue and Kivalina, Alaska	USA	68.052	−162.141	Mineral Ores
8	Iñupiat people resist offshore oil drilling and gas development plans in Point Hope, Alaska	USA	68.34	−166.82	Fossil Fuels /Climate Change
9	Mackenzie Valley Pipeline	Canada	69.34	−133.94	Fossil Fuels / Climate Change
10	Yellowknife gold mine and arsenic pollution	Canada	62.45	−114.37	Mineral Ores
11	Iron Ore mining in Baffin island, Nunavut territory	Canada	67.19	−69.12	Mineral Ores
12	Hamlet of Clyde River v. Petroleum Geo-Services Inc., Nunavut	Canada	70.47	−68.59	Fossil Fuels /Climate Change
13	Peel Watershed Regional Land Use Planning Conflict	Canada	63.66	−136.54	Infrastructure and Built Environment
14	Diavik Diamond mine by Rio Tinto, kimeberlite waste, Northwest Territories	Canada	64.49	−110.28	Mineral Ores
15	Greenland Mineral Ltd.'s Kuannersuit/Kvanefjeld Rare Earth-Uranium Project	Greenland	60.98	−45.99	Mineral Ores
16	Isua Iron Ore Mining Project	Greenland	65.50	−50.33	Mineral Ores
17	Kárahnjúkar dam	Iceland	64.91	−15.85	Industrial Utilities
18	Hydroelectric Power Station, Laxá River, Skútustaðahreppur	Iceland	65.308	−17.166	Water Management
19	Thjórsárver reservoir	Iceland	64.567	−19.248	Industry and Utilities
20	Protest against heavy pollution from Russian nickel plant, Kirkenes	Norway	69.72	30.05	Industry and Utilities
21	Oil drilling, Lofoten	Norway	68.47	13.86	Fossil Fuels / Climate Change
22	Reppardfjord-Nussir copper mining case	Norway	70.46	24.26	Mineral Ores
23	The People versus Arctic Oil litigation	Norway	74.97	37.04	Fossil Fuels /Climate Change
24	Alta River Hydro Power Plant	Norway	69.92	23.30	Water Management
25	Large-scale Wind Farm in Sami reindeer land	Sweden	65.44	15.38	Energy/Climate Change
26	Rönnbäcken Nickel Mine, Västerbotten	Sweden	65.53	15.41	Mineral Ores
27	Relocation of Kiruna town due to iron ore mine	Sweden	67.85	20.19	Mineral Ores
28	Vindelälven hydel project	Sweden	65.93	16.30	Water Management
29	Gállok-Kallak Iron Mine	Sweden	66.70	19.12	Mineral Ores
30	Saami-Metsähallitus Forest Conflict, Inari	Finland	69.26	27.91	Biomass and Land
31	Hanhikivi Nuclear Power Plant, Pyhäjoki	Finland	64.46	24.26	Nuclear
32	Talvivaara nickel mining company	Finland	63.97	28.06	Mineral Ores
33	Gazprom's Obskaya – Bovanenkovo railroad Yamal Peninsula	Russia	70.31	68.39	Infrastructure and Built Environment
34	Sabetta port	Russia	71.25	72.11	Infrastructure and Built Environment
35	Closure/modernisation of Monchegorsk nickel and copper smelter, Kola peninsula	Russia	67.95	32.87	Industry and Utilities
36	Coal mining in Arctic's natural reserve, Taymyr	Russia	73.50	80.50	Fossil Fuels /Climate Change
37	Prirazlomnoye oil field	Russia	69.25	57.34	Fossil Fuels / Climate Change
38	Oil Extraction at Numto Nature Preserve	Russia	63.52	61.31	Fossil Fuels/Climate Change
39	Norilsk pollution (nickel)	Russia	69.34	88.20	Mineral Ores
40	Gas and oil extraction in Kamchatka	Russia	55.71	155.76	Fossil Fuels / Climate Change
41	The right to fish in the Kamchatka region	Russia	57.20	156.88	Biomass and Land
42	Shiyes Landfill in Arkhangelsk region	Russia	61.90	48.91	Waste Management
43	Timber logging in the Dvinsky Forest	Russia	63.28	43.08	Biomass and Land
44	Floating nuclear power plant, Pevek	Russia	69.70	170.25	Nuclear
45	Oil spills in Komi Republic	Russia	66.02	57.51	Fossil Fuels /Climate Change
46	Oil Spills in Khanty-Mansi Region	Russia	61.48	68.89	Fossil Fuels /Climate Change
47	Yamal mega natural gas project	Russia	70.56	67.53	Fossil Fuels /Climate Change
48	Bovanenkovo – Ukhta 2 undersea gas pipeline Baydaratskaya Bay	Russia	68.65	68.25	Infrastructure and Built Environment
49	Potassium mining sinkholes in Berezniki	Russia	59.40	56.74	Mineral Ores
50	Arctic Oil Spill in Norilsk, Russia	Russia	69.14	89.37	Infrastructure and Built Environment
51	Liquefied natural gas project -LNG 2, Gydan peninsula, Arctic Russia	Russia	71.78	76.72	Fossil Fuels /Climate Change
52	Resistance against diamond mines, Sakha, Russia	Russia	65.02	117.09	Mineral Ores
53	Copper/gold mining, nuclear power in Nagleyngyn, Arctic Russia	Russia	69.15	168.68	Mineral Ores

Appendix B. Full model predicting Repression

Names	Effect	Estimate	SE	t	p
Rule of law	Rule of law	−0.1615	0.5173	−0.312	0.756
Total natural resources rents (% of GDP)	Total natural resources rents (% of GDP)	0.0104	0.0201	0.519	0.606
Preventive mobilization1	1–0	−0.3200	0.1307	−2.448	0.018*
Count forms of mobilization	Count forms of mobilization	0.0478	0.0166	2.879	0.006**

Appendix C. Full model predicting Loss of traditional knowledge, practices, cultures

Names	Effect	Estimate	SE	t	p
Rule of law	Rule of law	0.15556	0.5187	0.300	0.766
Total natural resources rents (% of GDP)	Total natural resources rents (% of GDP)	−0.00809	0.0202	−0.400	0.691
Count forms of mobilization	Count forms of mobilization	−0.02677	0.0166	−1.611	0.114
Preventive mobilization1	1–0	−0.58872	0.1343	−4.384	<0.001***
Indigenous presence1	1–0	0.42407	0.1183	3.586	<0.001***

Appendix D. Full model predicting Project Cancellation

Names	Effect	Estimate	SE	t	p
Rule of law	Rule of law	−0.4260	0.5089	−0.837	0.407
Total natural resources rents (% of GDP)	Total natural resources rents (% of GDP)	−0.0286	0.0197	−1.448	0.154
Preventive mobilization1	1–0	0.1516	0.1286	1.179	0.245
Count forms of mobilization	Count forms of mobilization	0.0167	0.0163	1.026	0.311

*Note that there is high collinearity (VIF) between Rule of law and Total natural resources rents (% of GDP) and therefore these variables are influenced by one another in this full model, which also results in different correlation direction towards the independent variable. The phenomenon is known as suppression (see (Mosteller and Tukey, 1977).

References

Ahtuangaruak, R., 2018. Resisting environmental destruction on indigenous lands. In: The Last Oil Symposium at the University of New Mexico.

Alvarez, J., Yumashev, D., Whiteman, G., 2020. A framework for assessing the economic impacts of Arctic change. Ambio 49, 407–418. https://doi.org/10.1007/s13280-019-01211-z.

Anguelovski, I., Martínez Alier, J., 2014. The "Environmentalism of the Poor" revisited: territory and place in disconnected glocal struggles. Ecol. Econ. 102, 167–176. https://doi.org/10.1016/j.ecolecon.2014.04.005.

Aporta, C., Bravo, M.T., Taylor, G.R.F., 2014. The Pan-Inuit Trails Atlas. Carleton University, Geomatics and Cartographic Research Centre. Available at: http://paninuittrails.org/index.html.

Avango, D., Peder, R., 2003. Heritage, conservation, and the geopolitics of Svalbard: writing the history of arctic environments. In: Egerman, D.C., Nils, G., Haefele, M.H., Latham, M. (Eds.), Arctic Environmental Modernities: From the Age of Polar Exploration to the Era of the Anthropocene, pp. 125–143. https://doi.org/10.1007/978-3-319-39116-8_8.

Avango, D., Hacquebord, L., Wråkberg, U., 2014. Industrial extraction of Arctic natural resources since the sixteenth century: technoscience and geo-economics in the history of northern whaling and mining. J. Hist. Geogr. https://doi.org/10.1016/j.jhg.2014.01.001.

Banoub, D., Bridge, G., Bustos, B., Ertör, I., González-Hidalgo, M., de los Reyes, J., 2020. Industrial Dynamics on the Commodity Frontier: managing time, space and form in mining, tree plantations and intensive aquaculture. Environ. Plan. E Nat. Sp. 0, 1–27. https://doi.org/10.1177/2514848620963362.

Barnhardt, R., Angayuqaq, K.O., 2005. Indigenous knowledge systems and Alaska native ways of knowing. Anthropol. Educ. Q. 36, 8–23. https://doi.org/10.1525/aeq.2005.36.1.008.

Beckert, S., Bosma, U., Schneider, M., Vanhaute, E., 2021. Commodity frontiers and the transformation of the global countryside: a research agenda. J. Glob. Hist. 1–16. https://doi.org/10.1017/S1740022820000455.

Bélanger, P., 2018. Extraction Empire Undermining the Systems, States, and Scales of Canada's Global Resource Empire, 2017—1217. MIT Press.

Beltrán, M.J., 2015. Latent Conflicts in Mining Activities: Water Appropriation in Cobre Las Cruces Coppermine. Political Ecology for Civil Society.

Bennett, M.M., 2016. Discursive, material, vertical, and extensive dimensions of post-Cold War Arctic resource extraction. Polar Geogr. 39, 258–273. https://doi.org/10.1080/1088937X.2016.1234517.

Boyd, R., Bjerkgård, T., Nordahl, B., Schiellerup, H., 2015. Mineral Resources in the Arctic, Treatise on Geophysics, Second edition. Geological Survey of Norway. https://doi.org/10.1016/B978-0-444-53802-4.00200-1.

Brown, V.A., Harris, J.A., Russell, J.Y., 2010. Tackling Wicked Problems: Through the Transdisciplinary Imagination. https://doi.org/10.4324/9781849776530.

Butt, N., Lambrick, F., Menton, M., Renwick, A., 2019. The supply chain of violence. Nat. Sustain. 2, 742–747. https://doi.org/10.1038/s41893-019-0349-4.

Conservation of Arctic Flora and Fauna (CAFF), 2013. Arctic Biodiversity Trends. Selected indicators of change. International Secretariat. Akureyri, Iceland.

Cameron, E.S., 2012. Securing indigenous politics: a critique of the vulnerability and adaptation approach to the human dimensions of climate change in the Canadian arctic. Glob. Environ. Chang. 22, 103–114. https://doi.org/10.1016/j.gloenvcha.2011.11.004.

Coates, K.S., 1985. Canada's Colonies: A History of the Yukon and Northwest Territories. BC Studies: The British Columbian Quarterly, Lorimer.

Conde, M., 2017. Resistance to mining. A review. Ecol. Econ. 132, 80–90. https://doi.org/10.1016/j.ecolecon.2016.08.025.

Coombes, B., Johnson, J.T., Howitt, R., 2012. Indigenous geographies I: mere resource conflicts? The complexities in Indigenous land and environmental claims. Prog. Hum. Geogr. 36, 810–821. https://doi.org/10.1177/0309132511431410.

Cressey, D., 2011. Scientific challenges in the Arctic: open water. Nature 478, 174–177. https://doi.org/10.1038/478174a.

Crump, J., Westerveld, L., Barners, R., 2017. Indigenous Peoples of the Arctic. Story Maps. GRID-Arendal. Available at: https://www.arcgis.com/apps/Cascade/index.html?appid=2228ac6bf45a4cebafc1c3002ffef0c4.

Del Bene, D., Scheidel, A., Temper, L., 2018. More dams, more violence? A global analysis on resistances and repression around conflictive dams through co-produced knowledge. Sustain. Sci. 13, 617–633. https://doi.org/10.1007/s11625-018-0558-1.

Dodds, K., Nuttall, M., 2019. The Arctic: What Everyone Needs to Know. Oxford University Press.

Dorough, D.S., 2014. Declaration on the rights of indigenous peoples. In: 11th Annual Conference on the Parlamentarias of the Arctic Region: Governance Models and Decision Making Process. United Nations Permanent Forum on Indigenous Issues, Whitehorse, Yukon, Canada.

Drewniak, M., Dalaklis, D., Kitada, M., Ölçer, A., Ballini, F., 2018. Geopolitics of Arctic shipping: the state of icebreakers and future needs. Polar Geogr. https://doi.org/10.1080/1088937X.2018.1455756.

Drozdz, M., 2020. Maps and protest. In: International Encyclopedia of Human Geography. https://doi.org/10.1016/b978-0-08-102295-5.10575-x.

Duxbury, C., 2021. EU's Plan to Source Rare Earths Takes a Hit in Greenland. Politico.

Dwyer, M.J., Istomin, K.V., 2009. Komi reindeer herding: the effects of socialist and post-socialist change on mobility and land use. Polar Res. 28, 282–297. https://doi.org/10.1111/j.1751-8369.2009.00108.x.

Egerman, D.C., Nils, G., Haefele, M.H., Latham, M., 2003. Staging Growth: Modernization, Development, and the Global Cold War, Culture, Politics, and the Cold War. University of Massachusetts Press, Amherst.

Escobar, A., 2008. Territories of Difference: Place, Movements, Life. Duke University Press, Redes.

Fuhse, J., Gondal, N., 2015. Networks and meaning, second ed.. In: International Encyclopedia of the Social & Behavioral Sciences, Second edition. Elsevier. https://doi.org/10.1016/B978-0-08-097086-8.10447-7.

Georgescu-Roegen, N., 1971. The Entropy Law and the Economic Process. Harvard University Press, Cambridge, London.

Gobby, J., Temper, L., Burke, M., von Ellenrieder, N., 2021. Resistance as governance: transformative strategies forged on the frontlines of extractivism in Canada. Extr. Ind. Soc., 100919 https://doi.org/10.1016/j.exis.2021.100919.

Golbeck, J., 2013. Network structure and measures. Anal. Soc. Web 5, 25–44. https://doi.org/10.1016/b978-0-12-405531-5.00003-1.

Gritsenko, D., 2018. Energy development in the Arctic: resource colonialism revisited. In: Goldthau, A., Keating, M.F., Kuzemko, C. (Eds.), Handbooks of Research on International Political Economy Series. Edward Elgar Publishing.

Haas, W., Krausmann, F., Wiedenhofer, D., Heinz, M., 2015. How circular is the global economy?: an assessment of material flows, waste production, and recycling in the European union and the world in 2005. J. Ind. Ecol. https://doi.org/10.1111/jiec.12244.

Haas, W., Krausmann, F., Wiedenhofer, D., Lauk, C., Mayer, A., 2020. Spaceship earth's odyssey to a circular economy - a century long perspective. Resources, Conservation and Recycling 163, 105076. https://doi.org/10.1016/j.resconrec.2020.105076.

Haberl, H., Wiedenhofer, D., Pauliuk, S., Krausmann, F., Müller, D.B., Fischer-Kowalski, M., 2019. Contributions of sociometabolic research to sustainability science. Nat. Sustain. 2, 173–184. https://doi.org/10.1038/s41893-019-0225-2.

Heininen, L., 2014. Northern geopolitics: actors, interests and processes in the circumpolar Arctic. In: Polar Geopolitics?: Knowledges, Resources and Legal Regimes. https://doi.org/10.4337/9781781009413.00023.

Herrmann, T.M., Heinämäki, L., 2017. Experiencing and Safeguarding the Sacred in the Arctic: Sacred Natural Sites, Cultural Landscapes and Indigenous Peoples' Rights, pp. 1–8. https://doi.org/10.1007/978-3-319-48069-5_1.

Herrmann, T.M., Sandström, P., Granqvist, K., D'Astous, N., Vannar, J., Asselin, H., Saganash, N., Mameamskum, J., Guanish, G., Loon, J.B., Cuciurean, R., 2014. Effects of mining on reindeer/caribou populations and indigenous livelihoods: community-based monitoring by Sami reindeer herders in Sweden and First Nations in Canada. Polar J. 4, 28–51. https://doi.org/10.1080/2154896X.2014.913917.

Huntington, H.P., 2016. The connected arctic. Environment. https://doi.org/10.1080/00139157.2016.1112197.

Jeffords, C., Thompson, A., 2016. An empirical analysis of fatal crimes against environmental and land activists. Econ. Bull. 36, 827–842.

Ji, X., Machiraju, R., Ritter, A., Yen, P.Y., 2015. Examining the distribution, modularity, and community structure in article networks for systematic reviews. In: Annual Symposium Proceedings. US National Library of Medicine, pp. 1927–1936.

John, A.T., 2016. Alaska Indigenous Governance Through Traditions and Cultural Values, Indigenous Governance. Native Nations Institute, University of Arizona, Tucson, AZ.

Keeling, A., Sandlos, J., 2015. Mining and Communities in Northern Canada: History, Politics, and Memory. University of Calgary Press.

Keil, K., 2014. The arctic: a new region of conflict? The case of oil and gas. Coop. Confl. 49, 162–190. https://doi.org/10.1177/0010836713482555.

Kock, N., Lynn, G.S., 2012. Lateral collinearity and misleading results in variance-based SEM: an illustration and recommendations. J. Assoc. Inf. Syst. 13, 546–580. https://doi.org/10.17705/1jais.00302.

Körber, L.-A., MacKenzie, S., Westerståhl Stenport, A. (Eds.), 2017. Arctic Environmental Modernities: From the Age of Polar Exploration to the Era of the Anthropocene, Arctic Environmental Modernities. Springer International Publishing, Cham. https://doi.org/10.1007/978-3-319-39116-8.
Krausmann, F., Fischer-Kowalski, M., Schandl, H., Eisenmenger, N., 2008. The global sociometabolic transition. J. Ind. Ecol. https://doi.org/10.1111/j.1530-9290.2008.00065.x.
Kröger, M., 2016. Spatial causalities in resource rushes: notes from the Finnish mining boom. J. Agrar. Chang. https://doi.org/10.1111/joac.12113.
Kröger, M., 2019. The global land rush and the Arctic. In: Finger, M., Heininen, L. (Eds.), The Global Arctic Handbook. Springer International Publishing, pp. 27–43.
Kröger, M., 2020. Iron Will. Global Extractivism and Mining Resistance in Brazil and India. University of Michigan Press.
Kröger, M., 2022. Arctic resource extraction in the context of climate crises and ecological collapses. In: The Routledge Handbook on Global Land and Resource Grabbing. Routledge, New York.
Kröger, M., Lalander, R., 2016. Ethno-territorial rights and the resource extraction boom in Latin America: do constitutions matter? Third World Q. 37, 682–702. https://doi.org/10.1080/01436597.2015.1127154.
Kröger, M., Nygren, A., 2020. Shifting frontier dynamics in Latin America. J. Agrar. Chang. 1–23. https://doi.org/10.1111/joac.12354.
Krumpen, T., Belter, H.J., Boetius, A., Damm, E., Haas, C., Hendricks, S., Nicolaus, M., Nöthig, E.-M., Paul, S., Peeken, I., Ricker, R., Stein, R., 2019. Arctic warming interrupts the Transpolar Drift and affects long-range transport of sea ice and ice-rafted matter. Sci. Rep. 9, 5459. https://doi.org/10.1038/s41598-019-41456-y.
Kumpula, T., Pajunen, A., Kaarlejärvi, E., Forbes, B.C., Stammler, F., 2011. Land use and land cover change in Arctic Russia: ecological and social implications of industrial development. Glob. Environ. Chang. 21, 550–562. https://doi.org/10.1016/j.gloenvcha.2010.12.010.
Kuokkanen, R., 2019. At the intersection of Arctic indigenous governance and extractive industries: a survey of three cases. Extr. Ind. Soc. 6, 15–21. https://doi.org/10.1016/j.exis.2018.08.011.
Landrum, L., Holland, M.M., 2020. Extremes become routine in an emerging new Arctic. Nat. Clim. Chang. https://doi.org/10.1038/s41558-020-0892-z.
Lassila, M.M., 2018. Mapping mineral resources in a living land: Sami mining resistance in Ohcejohka, northern Finland. Geoforum 96, 1–9. https://doi.org/10.1016/j.geoforum.2018.07.004.
Lassila, M., 2020. The Arctic mineral resource rush and the ontological struggle for the Viiankiaapa peatland in Sodankylä, Finland. Globalizations 0, 1–15. https://doi.org/10.1080/14747731.2020.1831818.
Le Billon, P., Lujala, P., 2020. Environmental and land defenders: global patterns and determinants of repression. Glob. Environ. Chang. 65, 102163. https://doi.org/10.1016/j.gloenvcha.2020.102163.
Martinez-Alier, J., 1987. Ecological Economics: Energy, Environment and Society. Blackwell Oxford. https://doi.org/10.2307/3146632.
Martinez-Alier, J., 2002. The Environmentalism of the Poor: A Study of Ecological Conflicts and Valuation. Edward Elgar Publishing, Northampton, MA, USA.
Martinez-Alier, J., 2015. Ecological economics. In: International Encyclopedia of the Social & Behavioral Sciences, Second edition. https://doi.org/10.1016/B978-0-08-097086-8.91008-0.
Martinez-Alier, J., Kallis, G., Veuthey, S., Walter, M., Temper, L., 2010. Social metabolism, ecological distribution conflicts, and valuation languages. Ecol. Econ. 70, 153–158. https://doi.org/10.1016/j.ecolecon.2010.09.024.
Martinez-Alier, J., Temper, L., Del Bene, D., Scheidel, A., 2016. Is there a global environmental justice movement? J. Peasant Stud. 43, 731–755. https://doi.org/10.1080/03066150.2016.1141198.
Midi, H., Sarkar, S.K., Rana, S., 2010. Collinearity diagnostics of binary logistic regression model. J. Interdiscip. Math. 13, 253–267. https://doi.org/10.1080/09720502.2010.10700699.
Moore, J.W., 2000. Sugar and the expansion of the early modern world-economy. Commodity frontiers, ecological transformation, and industrialization. Review 23, 409–433.
Moore, J.W., 2018. The Capitalocene part II: accumulation by appropriation and the centrality of unpaid work/energy. J. Peasant Stud. https://doi.org/10.1080/03066150.2016.1272587.
Morgunova, M., 2020. Why is exploitation of Arctic offshore oil and natural gas resources ongoing? A multi-level perspective on the cases of Norway and Russia. Polar J. 10, 64–81. https://doi.org/10.1080/2154896X.2020.1757823.
Mosteller, F., Tukey, J.W., 1977. Woes of regression coefficients. In: Data Analysis and Regression: A Second Course in Statistics. Pearson.
Muller-Wille, L., 1987. Indigenous peoples, land-use conflicts, and economic development in circumpolar lands. Arct. Alp. Res. https://doi.org/10.2307/1551399.
Muradian, R., Walter, M., Martinez-Alier, J., 2012. Hegemonic transitions and global shifts in social metabolism: implications for resource-rich countries. Introduction to the special section. Glob. Environ. Chang. 22, 559–567. https://doi.org/10.1016/j.gloenvcha.2012.03.004.
NASA, 2020a. Arctic Sea Ice: Averege September Minimum Ice Extent.
NASA, 2020b. Heat and Fire Scorches Siberia.
Naykanchina, A., 2012. Indigenous Reindeer Husbandry: The Impacts of Land Use Change and Climate Change on Indigenous Reindeer Herders' Livelihoods and Land Management, and Culturally Adjusted Criteria for Indigenous Land Uses. https://reindeerherding.org/images/projects/Nomadic_Herders/publications/UNPFII-2012-Reindeer-Husbandry_Final23Nov.pdf.
Newman, M.E.J., 2006. Modularity and community structure in networks. Proc. Natl. Acad. Sci. 103, 8577–8582. https://doi.org/10.1073/pnas.0601602103.
NSIDC, 2020. All about Arctic climatology and meteorology: what is the Arctic [WWW Document]. Sci. Data Res. Available at: https://nsidc.org/cryosphere/arctic-meteorology/arctic.html.
Nuttall, M., 1998. Protecting the Arctic: Indigenous Peoples and Cultural Survival. Routledge Taylor & Fancis Group (doi:9789057023552).
Nuttall, M., 2012. Imagining and governing the greenlandic resource frontier. Polar J. 2, 113–124. https://doi.org/10.1080/2154896X.2012.679563.
Nuttall, M., 2013. Zero-tolerance, uranium and Greenland's mining future. Polar J. 3, 368–383. https://doi.org/10.1080/2154896X.2013.868089.
Orta-Martínez, M., Finer, M., 2010. Oil frontiers and indigenous resistance in the Peruvian Amazon. Ecol. Econ. 70, 207–218. https://doi.org/10.1016/j.ecolecon.2010.04.022.
Peluso, N.L., Lund, C., 2011. New frontiers of land control: introduction. J. Peasant Stud. 38, 667–681. https://doi.org/10.1080/03066150.2011.607692.
Pulido, L., 2017. Geographies of race and ethnicity II: environmental racism, racial capitalism and state-sanctioned violence. Prog. Hum. Geogr. 41, 524–533. https://doi.org/10.1177/0309132516646495.
Raftopoulos, M., 2017. Contemporary debates on social-environmental conflicts, extractivism and human rights in Latin America. Int. J. Hum. Rights 21, 387–404. https://doi.org/10.1080/13642987.2017.1301035.
Ribot, J.C., Peluso, N.L., 2003. A theory of access. Rural Soc. 68, 153–181. https://doi.org/10.1111/j.1549-0831.2003.tb00133.x.
Robbins, P., 2012. Political Ecoloy: A Critical Introduction, 2nd ed. John Wiley & Sons Ltd.
Roston, E., 2016. The world has discovered a $1 trillion ocean. Bloom. Bus. 2.
Saebi, M., Xu, J., Curasi, S.R., Grey, E.K., Chawla, N.V., Lodge, D.M., 2020. Network analysis of ballast-mediated species transfer reveals important introduction and dispersal patterns in the Arctic. Sci. Rep. 10, 1–15. https://doi.org/10.1038/s41598-020-76602-4.
Schneider, M., 2020. Editorial Introduction: Mineral Frontiers. Commodity Frontiers 1, 1–iii. https://doi.org/10.18174/CF.2020a17973.
Scheidel, A., Schaffartzik, A., 2019. A socio-metabolic perspective on environmental justice and degrowth movements. Ecol. Econ. 161, 330–333. https://doi.org/10.1016/j.ecolecon.2019.02.023.
Scheidel, A., Temper, L., Demaria, F., Martínez-Alier, J., 2018. Ecological distribution conflicts as forces for sustainability: an overview and conceptual framework. Sustain. Sci. https://doi.org/10.1007/s11625-017-0519-0.
Scheidel, A., Del Bene, D., Liu, J., Navas, G., Mingorría, S., Demaria, F., Avila, S., Roy, B., Ertör, I., Temper, L., Martínez-Alier, J., 2020. Environmental conflicts and defenders: a global overview. Glob. Environ. Chang. 63 https://doi.org/10.1016/j.gloenvcha.2020.102104.
Schlosberg, D., 2013. Theorising environmental justice: the expanding sphere of a discourse. Environ. Polit. 22, 37–55. https://doi.org/10.1080/09644016.2013.755387.
Schlosberg, D., Carruthers, D., 2010. Indigenous struggles, environmental justice, and community capabilities. Glob. Environ. Polit. https://doi.org/10.1162/glep_a_00029.
Shadian, J.M., 2018. Navigating political borders old and new: the territoriality of indigenous inuit governance. J. Borderl. Stud. https://doi.org/10.1080/08865655.2017.1300781.
Silva-Macher, J.C., Farrell, K.N., 2014. The flow/fund model of Conga: exploring the anatomy of environmental conflicts at the Andes-Amazon commodity frontier. Environ. Dev. Sustain. 16, 747–768. https://doi.org/10.1007/s10668-013-9488-3.
Stammler, F., 2005. Reindeer nomads meet the market. Culture, property and globalisation at the "End of the land.". In: Halle Stud. Anthropol. Eurasia, p. 6.
Stotts, J., 2017. The politics of Arctic sovereignty: oil, ice, and Inuit governance. Polar J. https://doi.org/10.1080/2154896x.2017.1382231.
Stuhl, A., 2016. Unfreezing the Arctic: Science, Colonialism, and the Transformation of Inuit Lands. University of Chicago Press.
Sultana, F., 2020. Political ecology 1: from margins to center. Prog. Hum. Geogr. https://doi.org/10.1177/0309132520936751.
Svampa, M., 2019. Neo-extractivism in Latin America. Cambridge University Press. https://doi.org/10.1017/9781108752589.
Temper, L., del Bene, D., Martinez-Alier, J., 2015. Mapping the frontiers and front lines of global environmental justice: the EJAtlas. J. Polit. Ecol. 22, 254–278. https://doi.org/10.2458/v22i1.21108.
Temper, L., Demaria, F., Scheidel, A., Del Bene, D., Martinez-Alier, J., 2018. The Global Environmental Justice Atlas (EJAtlas): ecological distribution conflicts as forces for sustainability. Sustain. Sci. 13, 573–584. https://doi.org/10.1007/s11625-018-0563-4.
Temper, L., Avila, S., Del Bene, D., Gobby, J., Kosoy, N., Le Billon, P., Martinez-Alier, J., Perkins, P., Roy, B., Scheidel, A., Walter, M., 2020. Movements shaping climate futures: a systematic mapping of protests against fossil fuel and low-carbon energy projects. Environ. Res. Lett. 15 https://doi.org/10.1088/1748-9326/abc197.
The Arctic Council, 2015a. Arctic Matters: The Global Connection to Changes in the Arctic. National Academy of Sciences, Washington, D.C. https://doi.org/10.17226/21717.
The Arctic Council, 2015b. Indigenous Peoples of the Arctic.
Tynkkynen, V.P., 2018. Contested Russian Artic (Introduction). In: Tynkkynen, V.-P., Tabata, S., Gritsenko, D., Goto, M. (Eds.), Russia's Far North: The Contested Energy Frontiers. Routledge, pp. 1–25.

Wheeler, D.C., 2007. Diagnostic tools and a remedial method for collinearity in geographically weighted regression. Environ. Plan. A 39, 2464–2481. https://doi.org/10.1068/a38325.

Wilson, E., Stammler, F., 2016. Beyond extractivism and alternative cosmologies: Arctic communities and extractive industries in uncertain times. Extr. Ind. Soc. https://doi.org/10.1016/j.exis.2015.12.001.

Zabala, A., 2019. Mobilizing for justice. Nat. Sustain. 2, 164. https://doi.org/10.1038/s41893-019-0253-y.