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Governing the green economy in the Arctic

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Abstract
In Sweden's Norrbotten County, a "green transition" driven by market demand and new normative structures is underway, creating a regional mega-project designed to put Sweden at the forefront of emerging green industries. These industries, such as carbon-neutral steel fabrication, battery production, and data center hosting, all require large amounts of energy, land, and minerals. This paper applies the regional environmental governance framework to Arctic data to examine which stakeholders have the capacity to impose their agenda on the Arctic environment and the points of conflict and collaboration during this period of accelerated growth. The paper tests the assumption that regional governance accommodates a plurality of interests. A case study examining Norrbotten County's industrial mega-project centered around Luleå, Sweden, identifies a dominant coalition uniting government and industry that supports norms seeking to reduce greenhouse gas emissions in this region. However, the existing regional governance model does a poor job of integrating the local Indigenous Sámi preferences for land use. At the core of the difference between actors advancing the green economy and the local Sámi reindeer herders are divergent conceptions of nature and sustainability.

Keywords Sustainability · Regional environmental governance · Arctic · Green economy

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1 Introduction

Climate change requires states, and increasingly non-state and subnational actors, to engage in mitigation efforts (International Panel on Climate Change, 2022). The EU has adopted an integrated strategy to address climate change through its Emissions Trading System, Effort-Sharing Regulation, and other land use, forestry, agriculture, and energy legislation, assigning targets to specific countries based on their GDP per capita. The Nordic Council of Ministers adopted a strategy for sustainable development as early as 2001 (Wøien Meijer & Orsolya, 2021) and, after the 2015 UN Paris Agreement, released a Declaration on Carbon Neutrality, committing to accelerate climate policy (Weber & Søyland, 2020). Within this context, Sweden has pledged to reach or surpass many of the climate goals set by the EU and the United Nations, particularly around eliminating greenhouse gas emissions, even as it increases current energy usage. The national parliament has adopted the goal of zero net emissions of greenhouse gasses by 2045. Achieving the ambitious renewable energy targets under the subsequent Swedish Climate Act (such as reaching a fossil-free Swedish car fleet by 2030 and 100% renewable Swedish electricity production by 2040) will precipitate institutional, social, and capacity challenges (Avelino & Wittmayer, 2016). Immediate and long-term sustainability in northern and rural areas therefore requires novel approaches to ensure governance and institutional arrangements account for different regional objectives (Meadowcroft & Steurer, 2018).

The push to reduce emissions and reach both national and international climate goals is drawing attention to northern Sweden and its energy, mining, and manufacturing megaproject. A successful green transition in the north has the potential to reduce Sweden's greenhouse gas emissions by nearly 10% (Bonde et al., 2020). Such a transition requires access to an abundance of renewable energy (Avila et al., 2018), making the region's hydroelectric and wind power resources a growing focus for both domestic and foreign investors. However, the development of new data centers, iron pelletization methods, green steel production, and lithium-ion battery manufacturing will place intense pressure on local energy production capacity. Combining new "green" industries with renewable power generation creates social and environmental sustainability challenges (Bergek, 2010; Knaster, 2010) including competition for land use that elucidate contradictions in the actors' conceptions of sustainability (Gual, 2019; Xue, Weng, & Yu, 2018).

While the benefits from increased hydroelectric and wind power, fossil-free steel, and batteries for electric vehicles are undisputed, there are clearly costs. Energy production reduces biodiversity in local rivers and repurposes land away from traditional uses. Indigenous Sámi reindeer herders face new constraints on where they can move their herds. Cities and urban areas in northern Sweden must address housing shortages, attract new workers, and expand infrastructure and services. These challenges bring to the fore the trade-offs among environmental protection, economic growth, and social equity, the crux of the sustainability issue.

Debates on the matter of sustainability emerge due to different understandings of its integration into decision-making (Biermann, 2013; Bruff & Wood, 2000; Bulkeley & Castan Broto, 2013). Specifically, much of the debate surrounding sustainability is attributed to strong and weak versions of the concept (Huang, 2018), where weak sustainability allows for trade-offs, or substitutions, among economic, social, and environmental goals, while strong sustainability prioritizes environmental protection.

These divergent views on sustainability place focus on governance arrangements in their ability to account for different interests in reaching and implementing decisions. Because of

the historic ineffectiveness of environmental agreements at the global level, increased coordination at the regional level aims to reduce the scale of the challenge and improve prospects for coordination (Balsiger & VanDeveer, 2012). Thus, a growing body of scholarly work on regional environmental governance (REG) focuses on analyzing the relationship between key actors and themes within a distinct geographic area. Northern Sweden is one such geographic region.

Governing the construction of this regional mega-project requires managing rapid and sweeping change. Several tasks stand at the heart of this governance process. First, policymakers must make trade-offs among the benefits of new energy production, resource extraction, and manufacturing and the potential costs to the local environment, Indigenous community, and urban standard of living. Second, policymakers seeking to govern the region must coordinate among a variety of different actors, including different levels of government (EU, Swedish, county, and municipal), corporations, Indigenous people's organizations, non-profit groups, and current and prospective residents of the area. Third, those involved in governance need to address the rapidly changing social and built environments of the urban areas, which includes investing in infrastructure and services to attract a new workforce. Finally, governance requires integrating across multiple regions and scales. In our case study, Luleå, the capital of Norrbotten County, is far from an isolated component in the green transition. At the regional level, the evolving green economy requires a network of supporting resources and industries which affects the development of the surrounding towns in Norrbotten and neighboring counties. At the national level, northern Sweden will interlink with the drivers present in southern Sweden, where much of the country's economy is based. At the EU level, Sweden has the advantage of resources and cheap energy. It is a logical supplier of steel for Germany's car and appliance industries. In the broader international context, Russia's war on Ukraine is speeding the transition to renewable energy by moving the European economy away from a reliance on Russian fossil fuel exports.

The key findings of this paper show that the regional governance arrangement in northern Sweden positions the industrial players as the driving force behind the green transition, with government officials and research institutes playing a largely supportive role. There is little pushback from the population except for specialized interests, such as the Sámi reindeer herders who lose access to land due to the new development and possess few opportunities to shift the overall direction of development. While the new economy growing in Sweden's north may produce fewer greenhouse gasses, the power relationship looks similar to the old economy.

The article proceeds in the following way. After this introduction, we provide a concise overview of the regional environmental governance framework, using it to identify what is important in understanding the nature of the green transition in northern Sweden. We then analyze the position of key actors in relation to weak and strong sustainability and their perception of the transformation to a green economy. Finally, the article discusses the REG approach in understanding actors' perceptions and its effectiveness in highlighting the power dynamics in the environmental governance of a geographical region.

2 REG as a framework for governing the green transition in northern Sweden

Along with the other articles in this special issue, we situate our analysis within a REG framework. As a field of study, REG lacks a consistent definition of "region," with understandings ranging from environmental landforms, supranational organizations, multi-state

legal agreements, or even collective social movements (Debarbieux, 2012, p. 120). Balsiger proposes that regions are at the very least transboundary, potentially involving both state and non-state groups, yet does not specify what type of boundary is to be crossed (Balsiger & VanDeveer, 2012, p. 8). While several studies consider regional governance to occur between or across multiple states (Badenoch, 2002; Balsiger & VanDeveer, 2012; Conca, 2012; Obydenkova, 2022; Selin, 2012), our research focuses on a geographic area mostly contained within one state, Sweden, for several reasons. First, the industrial megaproject in the North is, indeed, transboundary in that it transcends the purview of any one actor yet involves a multiplicity of stakeholders within the private, public, and third sectors, who at times collaborate, cooperate, or form symbioses in various formal and informal institutions. Second, the transition concerns multiple environmental entities (such as rivers, mountains, forests) which have uses and services upon which multiple actors depend. Third, the many actors hold competing views of how these environmental entities are to be governed. In this sense, the "regional" denotes not only the literal geographical area in which this green transition is occurring but also the complex network of actors, environmental entities, and interests which together form an ecosystem of governance.

Existing research also presents a wide variety of perspectives of what the "environmental" concerns, from climate change policy to specific environmental entities or sustainable development more broadly (Balsiger & Debarbieux, 2011). Studying environmental governance at the regional level allows for analysis of how actors make decisions about specific environmental entities and how their respective understanding of the environment informs that decision-making (Balsiger & VanDeveer, 2012). In northern Sweden, for example, environmental entities might include the Kiirunavaara mountain (which contains a large iron ore body) or the Lule River. Different actors might approach these entities with diverging epistemologies, understanding the Kiirunavaara mountain as a natural resource, potential ski slope, or grazing land for animals, or the Lule River as a source of hydroelectric power or fish, or as a transportation route.

Analyzing the diverging perceptions of the environment in northern Sweden plays a large role in understanding how REG unfolds because it provides insight into the ways in which actors prioritize their interests in relation to environmental entities. The global demand for carbon-free raw materials production, climate policies set by supranational organizations, a national interest in reducing carbon emissions, a local push for population growth and job creation, as well as corporate interests, Indigenous economic and cultural activity, tourism, and other considerations all set expectations for the use and development of environmental entities.

To examine the relationship among actors, environmental entities, and interests, we explore approaches to the environment through the framework of weak and strong sustainability. Weak sustainability makes substitutability necessary, where costs to the environment are compensated by social and economic benefits (Giddings, Hopwood, & O' Brien, 2002). Therefore, weak sustainability harmonizes policy with existing markets through measures such as carbon taxes, "green" technologies, and socially responsible trade. Weak sustainability corresponds to a "triple bottom line" perspective which incorporates environmental and social outcomes with conventional economic outcomes (Elkington, 1998). Weak sustainability is often associated with ecological modernization, where strategies and policy premised on mitigating climate change are connected to technological innovation. Therefore, many of the positive growth indicators such as population, employment, and gross domestic product remain embedded in a weak sustainability approach. Strong sustainability, in contrast, requires decision-making that precludes existing markets (Stål & Bonnedahl, 2016) and instead argues that protecting the environment and its functions

is a precondition to reaching social and economic goals (Daly, 2005; Hopwood, Mellor, & O'Brien, 2005). Rather than looking to off-set environmental damage through pricing and technological solutions, priority should be placed on decision-making that accounts for planetary boundaries (Steffen et al., 2018) and restoring environmental functions (Stål & Bonnedahl, 2016). Strategies that reflect a strong sustainability approach look at reducing overall human impact on ecosystems and, therefore, advocate policy that reduces the use of resources and prioritizes the protection of ecosystems over built infrastructure. The various actors involved in the governance of northern Sweden's mega-project effectively subscribe to one or the other of these conflicting approaches to sustainability, which are rooted in fundamentally different understandings of the environment.

Governance in this case expands beyond formal policymaking actors, tapping into social and professional networks as well as other institutions that facilitate the diffusion of environmental norms (Balsiger & VanDeveer, 2012; Conca, 2012). Due to the plurality of actors, entities, and interests that participate in the green transition in northern Sweden, we approach governance as the diffusion of norms among and across actors in multiple sectors and levels of decision-making. The governance of environmental entities thereby becomes a process of negotiating "trade-offs" between ecological, economic, and social aspects of sustainable development (Balsiger & VanDeveer, 2012) so that the prevailing norm diffuses across the political ecosystem.

REG has, in some cases, been proven to more effectively diffuse norms and facilitate the implementation of environmental policies than governance at a global or national level (Conca, 2012; Klinke, 2012). This may be due to the relative proximity of decision-making to local political issues and environmental entities, as well as enjoying a legitimacy not found at higher levels of government (Balsiger & VanDeveer, 2012; Schwindenhammer, 2018), or the ability of regional-level governance to take into account a plurality of affected and relevant stakeholders (Tiwari & Joshi, 2015; Wallington, Lawrence, & Loechel, 2008). However, other studies of REG demonstrate that regional supranational organizations or frameworks do not necessarily have significant impacts on local environmental governance (Selin, 2012).

Perhaps the most significant question determining the effectiveness of REG is *for whom* or *to what end* it diffuses environmental norms (Klinke, 2012). Successful diffusion of norms may take the form of one prevailing understanding or agreement being accepted by formal and informal decision-makers and stakeholders. In our case, this would take the form of *either* strong or weak sustainability principles being comprehensively pursued and implemented by public, private, and third-sector actors alike. Effective REG takes the form of the plurality of actors and their environmental norms being taken into consideration. In the case of northern Sweden, this might materialize as actors agreeing upon a middle-ground in how they conceptualize the sustainability principles that guide the green transition, or a negotiation in which different environmental entities are governed by different sets of environmental epistemologies.

3 Formal governance in Sweden

While the focus of this research is the ecosystem of governance of the green transition in northern Sweden, it is crucial to consider the facilitating role of the state and other levels of political organization. Examining state-level mandates draws attention to the political, economic, and social structures that inform secondary and tertiary levels

of governance (Duit, Feindt, & Meadowcroft, 2016). Although a unitary state, Sweden functions within a multi-level governance system. The national government sets several environmental and climate objectives, particularly around emission reductions, that meet international commitments but require regional and local implementation. Thus, to fulfill many of the commitments made, national, regional, and local stakeholders are required to coordinate around shaping future sustainability. Previous research on topics such as water, wildlife, bioenergy, and climate governance indicates that the coordination of policy is one of the main challenges for implementing Swedish and European environmental and climate policy (Matti, Petersson, & Söderberg, 2021; Sandström, Söderberg, Lundmark, Nilsson, & Fjellborg, 2020; Söderberg & Eckerberg, 2013). Northern Sweden is a region central to the governance of natural resources, Indigenous rights, and renewable energy production, which brings to light the challenges of managing the implementation of different policy goals and the interests of different stakeholders.

Formally, all legislative powers reside at the national level in Sweden, within the Swedish Parliament (Riksdag), but various responsibilities are delegated to subnational levels. Municipal and regional authorities bear the responsibility of implementing environmental and planning legislation at the local level. Municipalities handle building permits and, as a result, play a significant role in infrastructure development. For example, the Swedish Board of Housing, Building and Planning requires municipalities to include suitable areas for wind power in their comprehensive plans. Included in these plans are consideration of shared land use, environmental impact, cultural heritage, and socio-economics, which involves gathering input from different interests. However, when these considerations include matters of national interest, the County Administrative Boards at the regional level are engaged.

As the home for the majority of mineral extraction, hydropower generation, and reindeer herding in Sweden, Norrbotten already faces competing interests over land use. Plans for expanding wind power, electrifying the vehicle fleet, "greening" steel production, and all the related infrastructure require significant development in the coming years. A regional environmental governance perspective puts focus on the coordinating capacity within the region to handle the challenges related to the green transition, particularly the ability or willingness to account for interests that run counter to the current strategy.

Accordingly, the REG framework sets our research question: Which interests shape regional environmental governance in northern Sweden? Though a concern to be able to compete in the evolving global green economy is driving rapid economic and social change in the region, does the existing form of governance adequately consider the various competing interests in northern Sweden?

4 Methods

To investigate these questions in the context of northern Sweden, we performed an informant interview study (Esaiasson, 2017) with relevant actors across the region, which we supplemented with visits to key industrial sites. Our aim was to build an understanding of the ecosystem of actors in the region, investigate the connections among them, and clarify

their interests or goals. During a period of 3 weeks between May 22 and June 7, 2022, the multidisciplinary research team conducted 27 interviews and eight site visits.

The team employed a purposeful sampling method to initially identify 24 organizations, agencies, and companies whose scopes appeared relevant to this research (Wu Suen, Huang, & Lee, 2014). These actors were found via a combination of web searches on municipal and county websites, reading local newspapers, and recommendations from members of the research team, with particular attention paid to recruiting representatives from a diversity of organizations. Of these 24, six did not respond or were unavailable for interviews. Several prospective interviewees either deferred the research team to a colleague better suited to the project's scope or, at the research team's request, recommended additional organizations or departments of relevance to the research in a process of snowball sampling (Parker, Scott, & Geddes, 2019). While snowball sampling can be limited in that the selection of participants is influenced by the biases and interests of those who recommend them, the research team ensured that a diverse pool of initial interviewees were recruited via purposive sampling, so that subsequent recommendations represented an array of interests. The resulting 27 interviewees were selected to participate in the research as representatives of their organizations, agencies, or companies rather than in a personal or individual capacity. Our results therefore do not feature quotes or direct attribution of data to any one interviewee; rather, they present the ecosystem of actors and interests as discussed by the actors themselves. While the sample of interviewees lacks input from Meta (the parent of Facebook) and a handful of other private actors who did not respond or were unwilling to participate, the research team reached a saturation point after conducting approximately two-thirds of the interviews (Saunders et al., 2018).

Interviewees included employees from Luleå Municipality, representing the offices of urban planning, societal development, labor market development, and youth and social services, as well as municipality-owned companies, including public transit, waste management, and business development. At county and regional levels, interviewees represented transit, regional development, and water management. Municipal actors were also interviewed in Boden, representing societal and business development as well as labor and welfare services, and Kiruna, representing urban planning and tourism development. In Jokkmokk, interviewees included Sámi community leaders and a Sámi youth organization. Other actors included non-academic researchers, data center workers and managers, and non-profit cross-sector coordination organizations.

Each interview drew on a set of semi-structured questions that explored the role of the organization, agency, or company in the context of the region's industrial redevelopment and planned growth. The interviews lasted approximately 1 to 2 hours and took place in the interviewees' offices or private meeting spaces at the Luleå University of Technology (LTU).

Site visits were conducted in key industrial locations across Norrbotten County and were identified by reading local newspapers or via recommendations from interviewees. These locations included the LKAB iron ore mine in Kiruna, the Northvolt battery factory in Skellefteå, hydroelectric plants throughout the region, the Markbygden wind farm near Piteå, and several privately operated data centers. The team also visited sites of prospective

industrial development, which included the proposed Kallak mine, northwest of Jokkmokk, and the H2 Green Steel mill in Boden.

5 Data: actors supporting weak sustainability dominate those backing strong sustainability

As the REG framework anticipates, northern Sweden boasts a multiplicity of public, corporate, and third sector actors who each play a role in governing the transition to a new green economy. Map 1 displays the geographic location of the various components of the northern Sweden industrial mega-project. Table 1 lays out the key public, private, and third sector players in the system along with their key goals and perceptions of sustainability.

Analyzing the various actors in the region, their interests, and preferences for land use demonstrates that they hold different understandings of the natural environment. The industrial actors and their allies at various levels of government support a weak conception of sustainability, with its focus on continued consumer consumption and economic growth. A small minority, consisting of Sámi reindeer herders, youth advocates for addressing climate change, and conservationists, backs a strong form of sustainability, with an emphasis on preserving nature and traditional lifestyles. These different conceptions of the natural environment underlie conflicts between the two coalitions on how land in northern Sweden should be used. Figure 1 displays the two main coalitions.

Within this context, the needs of industry shape the overall form of governance. Iron ore and other resource extraction, electricity generation, and industrial production define land use policies and generate the need for additional labor, meaning that urban areas must grow to meet the new demands. State entities at the national, county, and municipal levels cooperate closely with the industrial sector in terms of supporting the expansion of the

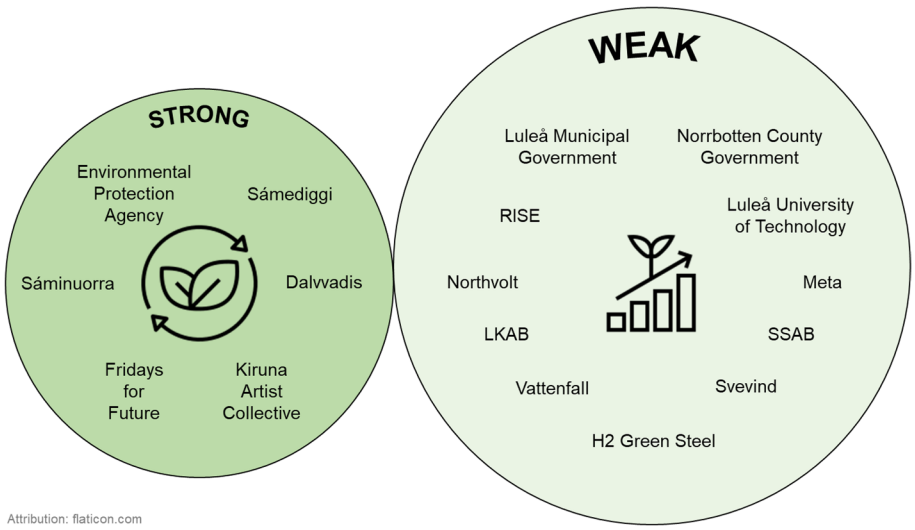


Fig. 1 Coalitions supporting strong and weak sustainability in northern Sweden

Table 1 Public, industry, and societal stakeholders in northern Sweden

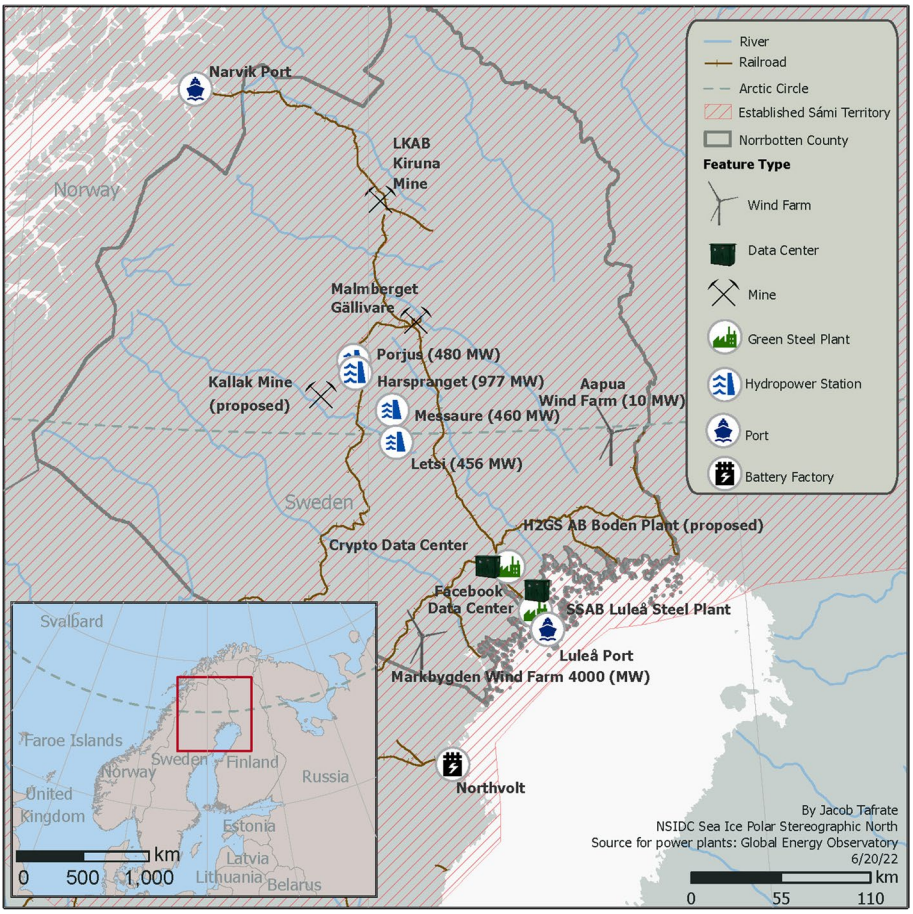
Name	Type	Role	Goals	Perception of sustainability
Luleå Municipal Government	Political/administrative institution	Responsible for building permits, which are key to land use and harbor use/access	Increasing population by 20K to support increased industrial production due to aging population, needs to build housing communities to attract and support new workers	Weak—focus on population growth with built infrastructure development to accommodate
Norrbotten County Government	Political/administrative institution	Regional Board holds authority over land use and environmental permits	Expanding wind and promoting hydro industries, goal of increasing population of region by 100K	Weak—priority on economic development associated with base industries
Sámediggi (Sámi Parliament)	State agency	Swedish Sámi Parliament Act, consults with Swedish government on issues of land use rights, health, social equality	Mitigate energy industry encroachment on reindeer herding industry, protect a viable cultural and economic future for Sámi	Strong—restrict infrastructure development that affects landscape/ecosystems
Environmental Protection Agency	State agency	Conducts environmental assessments, carries out government assignments on environmental issues	Ecosystem and environmental stewardship, integrate EU/international standards into Swedish regulation	Strong—prioritizes ecosystem protection
Dalvvadis	Economic/cultural association	Represents Sámi businesses and reindeer herding in Jokkmokk municipality and greater area	Increase the viability of reindeer herding and its associated industries, including cultural awareness	Strong—maintaining environmental/landscape conditions conducive to reindeer herding
Luleå University of Technology	Public educational institution	Studies labor market statistics for regional government; has business, space, and physics research satellite campus in Kiruna	Increase student population and expand research	Weak—supports industrial development related to green transition

Table 1 (continued)

Name	Type	Role	Goals	Perception of sustainability
RISE	Non-profit research	Tech research at ICE Data center in Luleå, data center greenhouse in Boden, has other innovation-in-industry projects	Establish partnerships with industrial partners in the Luleå-Boden corridor, find innovative, value-added business ventures (heat production)	Weak—embedded in the growth of the innovation sector and new corporate investment
LKAB	State-owned company	Operates iron ore mine in Kiruna, plans to use hydrogen to create sponge iron at mine in Kiruna	Expand operations, including newly discovered rare earth element deposit	Weak—increasing resource extraction, supporting the expansion of the energy transition
SSAB	Publicly traded company	Plans to build new green steel mill in Luleå, part of green steel collaboration with LKAB and Vattenfall called HYBRIT	Transition into carbon-neutral steel making, develop hydrogen gas-powered facilities, recruit new employees	Weak—new steel production techniques require massive energy production and infrastructure
Vattenfall	State-owned company	Operates hydroelectric plants throughout northern Europe, provides electricity for steel industry	Renovate existing hydroelectric plants	Weak—long-standing environmental changes that will be required for future energy needs
Svevind	Privately held company	Building new Markbygden wind farm near Piteå	Continue planned expansion of wind power production in the Piteå region	Weak—facilitating the transition that requires additional carbon-free energy through infrastructure development
H2 Green Steel	Privately held company	Plans to build new green steel mill in Boden, powered by hydrogen gas	Establish carbon-free steel production in northern Sweden for global distribution	Weak—energy-intensive steel production, a component to the green transition
Meta	Publicly traded company	Has data center in Luleå, part of the growth of the "Node Pole"	Expand data servers for Europe, powered by carbon-free energy	Weak—new infrastructure development that requires green energy production

Table 1 (continued)

Name	Type	Role	Goals	Perception of sustainability
Northvolt	Privately held company	Has new battery plant in Skellefteå	Supply growing electric vehicle production and expand into other battery markets	Weak—battery production a central component to the green transition, particularly for transportation
Sáminuorra	Youth non-profit organization	Seeks to secure Sámi land use rights threatened by industry encroachment, backs future viability of reindeer herding, culture, language	Increase awareness of risks to Sami culture and livelihoods due to increasing infrastructure development	Strong—primacy for cultural preservation that requires access to existing environment and landscapes
Kiruna Artist Collective	NGO	Civil society for artists interested in the politics of Kiruna and the mine	Facilitate political debate around existing and planned resource use	Strong—shift discourse on resource use and politics
Fridays for Future	Environmental non-profit organization	Against building of new mine in Jokkmokk, concerned with minimizing industry's effect on the environment	Prevent mineral extraction and other natural resource use, in areas that impact the environment and Sami reindeer herding	Strong—reduce resource extraction, particularly projects with negative impacts on the environment



Map 1 The industrial mega-project in northern Sweden

industrial infrastructure on northern lands and attracting new residents to work in the growing facilities. The industrial expansion and the urban growth needed to support it occupy the very land that the Sámi and other advocates of strong sustainability seek to preserve. In the existing system of governance, these actors have a voice, but little ability to implement their preferences in practice.

5.1 Advocates of weak sustainability (industry and government)

With their weak conceptualization of sustainability, Swedish industry and government view the environment primarily in terms of resources that can be extracted and used to promote their goals of achieving a green economy. In this case, a green economy is one that reduces greenhouse gas emissions but does not take into consideration the extensive land that must be sacrificed to generate the electricity needed to make it work. This conception of sustainability means that consumers can continue their existing lifestyle without having to consider the interests of groups that want to use the land needed to support that lifestyle

for different purposes. Electric cars made from fossil-free steel and lithium-ion batteries can replace existing models that burn gasoline and rely on coal-fired iron smelters.

5.1.1 Industry

The mining companies of northern Sweden extracting iron ore and other environmental products are the foundation of the regional economy. Although mining has long been part of the traditional economy, the need for steel and batteries makes it crucial for the green economy of the future. Converting traditional mining practices into ones that require no fossil fuels marks a first step in developing the green supply chain (Muslemani, Liang, Kaesehage, Ascui, & Wilson, 2021).

With its main operations in Kiruna, the state-owned mining company LKAB is currently developing a hydrogen-based process to produce carbon-free sponge iron. The production of fossil-free steel would make northern Sweden competitive in the global supply chain of industries that plan to market climate-friendly steel, with European car and appliance manufacturers prominent among them.

Despite its efforts to transition to the green economy, the mining sector incurs costs in terms of land use. The LKAB mine in Kiruna has historically interrupted Sámi reindeer herding routes, violating development limits set by the Swedish Parliament in 1867 (Myhr, 2015, p. 118). Additionally, extracting the iron ore is causing subsidence below Kiruna's existing town center, forcing the mine to finance construction of a new center three kilometers to the east. Since the city is dependent on the mine for its survival and many residents work for LKAB, there is little visible protest beyond a few opposition posters from the Kiruna Artist Collective. Many residents would prefer to maintain the existing city but accept the priority of the mine for their town's current and future livelihood.

The construction of the new city center and living areas abound with contradictions. Planners have designed the new part of town to promote a green lifestyle, with denser housing than existed earlier. Nevertheless, there are concerns about the sustainability of the new construction: it is located downhill from the former center in a spot that is 10–15 °C colder, incurring higher heating costs and on land that may contain iron ore, potentially requiring another move in the future.

Given Kiruna's interruption of reindeer herding paths, it is not surprising that the Sámi are protesting the British mining company Beowulf's plans to build a new iron ore mine in Kallak, northwest of Sámi cultural capital Jokkmokk. As with other mines, the new facility would squeeze reindeer herding communities out of lands they traditionally use. The project is currently at the stage of producing an environmental impact report.

The operating and planned mines intend to keep the iron ore flowing to steel plants, which have operated for decades with a heavy reliance on coal but are also planning a transition to fossil-free production techniques (Hoffmann, Hoey, & Zeumer, 2020). SSAB's steel mill in Luleå is collaborating with LKAB and Vattenfall through HYBRIT, a project aiming to convert fossil-free iron pellets into green steel. Similarly, newcomer H2 Green Steel (H2GS) plans to build a fossil-free steel mill in Boden, 35 km northeast of Luleå, launching construction in July 2022. Once operational, plant operators anticipate that the Boden plant will be able to remove 90% of the carbon dioxide generated during traditional steel production (Liljas, 2022). Steel accounts for approximately 7–9% of global anthropogenic CO_2 emissions and therefore is a prime target for decarbonization strategies.

The new processes for making steel are energy intensive. The HYBRIT and H2GS plants are estimated to increase Sweden's annual electricity consumption by up to 50%,

requiring significant expansions of local renewable production or imports (Sveriges Television, 2021). Historically, numerous hydroelectric dams in the north have generated this power. New sources of electricity come from the construction of Europe's largest onshore wind farm, Markbygden, just west of Piteå. Again, the green energy these sources provide is not cost free. Construction of the hydropower dams in northern Sweden eradicated the salmon that used to swim in its rivers. The wind farms require a huge amount of land, with each turbine requiring its own road and extensive clearing of the forest for servicing. The intense demand for additional electricity generation will therefore only intensify the existing demands for land with its costs to local biodiversity and Indigenous lifestyles.

The vast energy and other natural resources in the area are attracting a variety of new industries which put additional pressure on local land resources. Facebook brought northern Sweden to international prominence as a tech hub with its announcement in 2011 that it would build its first data center outside the USA in Luleå, adjacent to the Luleå University of Technology campus (Petersens & Viden, 2014). Northern Sweden is attractive to the data center industry because of its cheap and renewable energy, reliable energy grid, cold climate, abundant land, strong connectivity, and stable political system. Facebook has continued to invest in the area and grow its capacity. In its wake, Boden has attracted additional data centers, including several devoted to mining cryptocurrency. With the construction of Northvolt's battery factory, the region will move into new types of production to power the green economy which seeks to electrify transportation and many other applications. When it reaches full capacity, the factory will produce 70 million batteries while consuming 2% of Sweden's overall energy.

5.1.2 Government

All levels of Sweden's government support the drive for a greener economy. The need to balance between industrial growth and environmental protection is enabled by both government and industry subscribing to basic norms focused on the idea that it is necessary to fight climate change and that it is possible to do so while developing a thriving economy.

Municipal Sweden's governmental structure is designed around the principle of local self-government and places significant decision-making power with the municipality as the entity closest to the individual. Municipal governments have jurisdiction over many public services including schools, utilities, geriatric care, and social services. Sweden's tax system is structured so that municipalities are funded primarily by the income taxes of their residents, while sales, property, and other taxes are routed to the state. Municipalities receive varying levels of funding from the state and regional governments, who distribute non-income tax revenue according to needs and priorities. Because all income tax revenue remains at the local level, municipalities are incentivized not only to retain residents within their jurisdictions but also to ensure that their working population does not decrease (through increased unemployment, population decline, or an increasing proportion of retired to employed adults). Municipalities also own a considerable amount of land, which they can sell to developers to promote new forms of development. This structure gives Swedish municipalities, including Luleå, considerable capacities in developing and maintaining their cities.

The municipal government of Luleå is pioneering efforts to grow the city from 80,000 to 100,000 residents by the year 2030 in order to provide the needed workers required for

the planned industrial expansion and mitigate the costs of an aging (and retired) population (Dahlin, 2022). This goal is outlined in the municipal vision plan and is reiterated by municipal employees across departments, including the head of the municipal government, urban planners, economic developers, and societal strategists (Lulea Kommun, 2022b). The relatively low levels of unemployment in Luleå mean that the city has to attract workers from outside the municipality (Luleå Kommun, 2022a, p. 19). To attract this population, as well as accommodate such drastic anticipated growth, Luleå must invest in infrastructure and public services, which involves expanding and developing the built environment.

County County governments in Sweden are relatively weak in comparison to municipal and national governments since they do not have the power to collect taxes, although they receive funds from the national government to be distributed to both public and private actors within the region. The county government promotes its priorities largely by facilitating collaborations with municipalities, businesses, industry, and Sámi organizations.

Norrbotten County has been identified as one of four priority areas in Sweden with greenhouse emission-heavy industries that will require support in transitioning its economy and society in the coming years (Moodie, Tapia, Löfving, Gassen, & Cedergren, 2021). Norrbotten has been undertaking a regional growth project since 2007 that developed in line with Swedish and EU goals for sustainable development. Most initiatives planned to facilitate a just transition concern supporting industrial facilities, funding technological innovation, developing a new workforce, and minimizing raw materials waste. Notably, the proposed actions skew towards facilitating the technological future necessary to pursue a green transition, rather than mitigating the social and cultural impacts of such a change (Moodie et al., 2021).

National Within the context of REG, the national government seeks to ensure that the country meets its climate change goals while continuing to develop along green lines. The national government is the actor that must deal with the most basic problem of ensuring that the economic changes do not undermine the interests of the most vulnerable segments of the population. In the case of northern Sweden, this means balancing the needs of Sámi reindeer herders with the effort to grow the new green economy. Since the Swedish government prioritizes the goal of reducing greenhouse gas emissions, the interests of the Sámi often are overruled (Stjernström, Pashkevich, & Avango, 2020).

The Sámi have been recognized as an Indigenous people with different standing in the Swedish Parliament since 1977 but were not written into the constitution until 2011. The Sámi are formally represented in the Swedish government by the Sámi Parliament, which is a legally recognized body of self-determination acting as both a popularly elected representative entity independent of the Swedish state and a State administrative agency. The Sámi Parliament as an agency is primarily tasked with addressing issues of Sámi culture, including the administration of reindeer herding. Nationally, the Sámi are a small minority within Sweden and have only a handful of representatives in the Swedish Parliament (Sami Parliament, 2022a).

The Sámi have a limited number of rights under Swedish and international law. The Sámi Consultation Law, signed in January of 2022, requires that all levels of government consult the Sámi Parliament on issues of "special significance," including questions of "land use, enterprise issues, reindeer husbandry, fishing, hunting, predator animals, mines, wind power, forestry issues, cultural issues, place names, and biodiversity on reindeer grazing grounds, as well as issues related to Sámi preschools, education and research, and

elderly care specifically for the Sámi." This law does not award the Sámi Parliament a right to veto decisions, only to be formally consulted; if the Sámi Parliament does not agree on an issue, the Swedish Parliament holds authority (Sami Parliament, 2022b). Certain Swedish laws protect reindeer husbandry, but those protections are limited. For example, the Sámi have a right to land and water, meaning that no public or private landowner may do anything to their property that would damage the land and water needed for reindeer husbandry. However, which land and water is needed for that purpose is narrowly defined, allowing for consequential damages. In sum, the Swedish political system gives the Sámi representatives little political weight to advocate for their interests.

Supranational The EU was mentioned frequently among high-level policy actors in county and municipal governments in northern Sweden, who attributed the origin of their goals for a green transition to the supranational organization. Through the European Green Deal, adopted by the European Commission in 2019, strategies for transitioning to a green economy while meeting Paris Agreement emissions targets set the stage for sustainability decision-making. As previously mentioned, the European Commission also grants funds to Norrbotten County to assist it in ensuring that the green transition is territorially just. However, the initiatives funded in pursuit of justice prioritize innovation, technological development, and capacity-building projects, rather than projects exploring the social and cultural consequences of this change, many of which would deal with the diverging understandings of the environment and land in question (Moodie et al., 2021).

5.2 Advocates of strong sustainability (non-governmental organizations)

Disagreements over land use, whether for mining or power generation, are among the core reasons for non-governmental organizations to engage in Sweden's political process. While there is a consensus among all actors for a transition away from fossil fuels in favor of renewable energy production, there is a lack of agreement over what priorities should shape the new economy and who should ultimately bear the costs of bringing green steel and renewable energy to market. The non-governmental organizations (NGOs) stand out from the industrial and governmental actors in terms of their different conception of sustainability and their relative lack of political power. The key NGO actors are Sámi organizations, youth advocating for climate policy, and conservationists. These groups seek to preserve the northern lands for their traditional uses rather than energy and steel production but have little ability to enforce their preferences.

The "green transition" in northern Sweden has massive implications for the Sámi population. According to the Sámi Parliament and environmental activist groups, mining and natural resource extraction constitute a threat to the traditional lifestyle of reindeer herding in northern Sweden (Larsen et al., 2022).

As noted above, the new iron ore mine approved for development in Kallak is a major concern for several Sámi communities in the region, whose seasonal herding paths cross the prospective mining site. In February 2022, the Sámi Parliament submitted its final opinion opposing the mine, stating that it would devastate protected nature-based reindeer husbandry in the area and infringe on Sámi culture and rights. They maintain that "reindeer husbandry in the area is the land use that in the most appropriate way promotes a long-term economy in an ecological, social and socio-economic perspective" (Sami Parliament, 2022d). Despite the Sámi Parliament's official position, Beowulf mining was awarded a license for an iron ore mine in the Kallak region by the

Swedish Parliament in March 2022 and plans to begin work after completing an environmental impact assessment.

The Sámi have their own knowledge tradition that differs considerably from the Swedish market economy of what a green transition should look like. The Sámi idea of a sustainable world adaptable to climate change is centered around the ability of the environment to support reindeer herding and therefore their traditional lifestyle. The reindeer are a natural part of the "mountain ecosystem" that the Sámi seek to preserve (Sami Parliament, 2022c). Reindeer herding hinges on careful management of grazing activities to preserve future food prospects for herds. Efforts backed by industrial and Swedish governmental bodies to extract resources from the mountain environment to promote sustainability appear to the Sámi as directly detrimental to their own idea of sustainability. Similar intrusions come from the UN's declaration of UNESCO Laponia World Heritage Site, which benefits tourists rather than reindeer herders and the Swedish government's protection of wolves, who hunt the reindeer (state compensation for reindeer lost to wolves is only one-quarter of their market value) (Kent, 2008, pp. 268-269).

Sámi reindeer herders have few resources to make their case and compel action in the Swedish political system. Only about 2500 people, one-tenth of Sweden's Sámi population, engage in reindeer herding (Liljas, 2022), most of whom need additional employment to supplement the income they receive from selling reindeer meat. These individuals typically work other part-time jobs in urban areas to support themselves and their families, a common practice since the 18th century (Kent, 2008, p. 119). Given the need to focus on income generation, there is little time to engage in politics.

Sáminuorra, the Sámi national youth organization in the Swedish part of Sapmi, seeks to influence Swedish policy on issues that matter to the Sámi people, particularly youth, while also working to preserve Sámi language and culture. Like other Sámi organizations, the group is little match for well-funded industrial interests. It is working with broader youth initiatives, such as Greta Thunberg's Fridays for Future, which has helped to give it additional publicity.

In some cases, the Sámi are able to extract concessions from firms that build on their land. For example, the Markbygden wind farm takes up a considerable amount of reindeer herding land so the farm operators pay to truck the reindeer to lands farther away for winter grazing. Unfortunately, those lands do not provide sufficient sources of natural food, so it is necessary to feed the reindeer, forcing them into closer contact with each other and increasing the risk of disease (Liljas, 2022).

6 Results

There is a general normative consensus among the various actors in northern Sweden in support of a transition to a green economy. This consensus is apparent in UN analyses and goals for the entire globe, EU directives for the continent, plans adopted by the Swedish state to play a leadership role in the transition, and efforts by the Norrbotten County and Luleå municipal authorities. The region does not depend on fossil fuel production so there are few interests advocating continuing dependence on it. Even the groups most affected by the transition recognize that the urgency of mitigating climate change requires a green transition.

The major industrial concerns in the region, even in traditional areas such as mining and steel making, have found ways to profit from the transition and are able to envision a future

in the new economy for a modified version of their operations. The abundance of renewable energy in the area makes the changes possible.

The central issue of dispute is over land use and how the government and industrial players can implement their expansion plans in ways that have least impact on traditional reindeer herders, local interests who do not want windmills in their vicinity, and conservationists. In sum, despite the consensus that a new green economy must be built in order to pave the way for change, there remains considerable disagreement over *how* change should occur and, most importantly, whose lives should be impacted the most.

Currently, industrial interests dominate government decision-making at all levels and drive changes in northern Sweden (Wøien Meijer & Orsolya, 2021). Sámi and other local interests that prefer to maintain traditional forms of land use have much less impact.

7 Discussion

What does bringing Arctic knowledge into dialogue with REG literature tell us? Is the regional governance system of northern Sweden open to a variety of voices and capable of integrating these diverse interests in a way that accommodates all their concerns?

This case study of northern Sweden helps to integrate the regional environmental governance framework with Arctic studies. REG analyses have usually focused on institutions that exclude Indigenous interests while such an approach is unthinkable in the Arctic context. A better understanding of the interests of the Sámi in northern Sweden as well as the frequent marginalization of these interests in the decision-making process helps make a REG framework more applicable to Arctic realities. Although the Sámi have expressed strong concerns about how the green economy and industrial development will affect their traditional lifestyle, there have been few effective examples of efforts to integrate these concerns into Swedish policies. In some cases, corporations have made concessions to Sámi complaints, but these are typically on an ad hoc basis.

Although the concept of "region" is only loosely defined in REG, we have found it to be a useful framework in studying northern Sweden. Norrbotten County's embeddedness in the EU and the Swedish national system has helped to spread green norms, supporting the creation of a consensus among the many regional players involved in the green economy transition, as the REG literature anticipates (Ambrosio, Hall, & Obydenkova, 2022; Hall, Lenz, & Obydenkova, 2021; Lavelle, 2021). In this sense, the regional level of governance has worked effectively in instilling sustainability norms in Norrbotten County (Conca, 2012; Klinke, 2012; Libman & Obydenkova, 2014; Ostrom, 1990; Selin, 2012). Similarly, the sustainability norms in this case are widely diffused among the population and accepted by industry, government, and NGO representatives alike.

However, if we consider sustainable development as "procedural norms for reconciling the tradeoffs between environmental, economic, and social dimensions of wellbeing" (Balsiger & VanDeveer, 2012, p. 58), the northern Swedish case becomes more complicated. There, the interests of the Sámi are clearly given lower priority than the priorities of Swedish, European, and global actors in seeking to implement the "green revolution." Northern Sweden has clearly made trade-offs, in this case favoring those who support the green economy, which effectively sacrifices the priorities of environmentalists and the Sámi, who represent only a small group compared to the larger strong sustainability coalition. In this case, in terms of the global politics of sustainable development (Fravel, Lavelle, & Odgaard, 2022; Lavelle, 2021), the overwhelming growth coalition favoring advancing the

green economy is pitted against the Sámi reindeer herders, who do not oppose the green transition but seek to shift its negative impacts off their lands.

Circumpolar Arctic management and governance structures are fragmented. What happens in Arctic areas is largely determined by which country the actions are happening in, due to the significant role of national public and financial policies, as well as dependence on national infrastructure (Wøien Meijer & Orsolya, 2021). Russia, with its authoritarian and centralized government, is starkly different from the rest of the Arctic, and, even among the Western Arctic countries, there are considerable differences between the European and North American Arctic (Burns, Orttung, Shaiman, Silinsky, & Zhang, 2021). Likewise, there is considerable variation across northern Sweden.

Among international institutions, the role of the EU is the most important in terms of norm diffusion. The EU priority of reducing greenhouse gasses has clearly prevailed and is widely supported throughout the region of northern Sweden. While the Arctic Council addresses environmental rather than security issues, its work is on hold due to Russia's war of aggression against Ukraine. Nevertheless, even when it was operating, its output had little influence over industrial development policies. The role of the Nordic Council of Ministers is also less visible in northern Sweden.

With its rich iron ore deposits, abundant renewable energy, and extensive human capital, Luleå and the surrounding region in many ways represent a relatively successful case of sustainable development in the Arctic. It would be hard to replicate this success in Alaska, northern Canada, or Russia, where many of Sweden's assets are lacking. Also lacking in those areas is a consensus on the need to move forward with a green transition because those parts of the Arctic have relied heavily on fossil fuel production to spur their development. Perhaps this lack of agreement on an underlying norm is the most challenging obstacle in the other parts of the Arctic since it prevents investment of resources in green development.

8 Conclusion

This analysis tests a key argument of the regional environmental governance (REG) literature, namely that regional governance is open to a wide diversity of interests and can integrate them into a coherent environmental policy that reflects the overall goals of the population. Examining a case study of the region of northern Sweden, we find considerable support for this thesis. Our overall conclusion is that REG works in the sense that it facilitates one dominant approach to the green transition across the region but fails in that it does not sufficiently incorporate the plurality of voices and actors present. Nearly all actors in northern Sweden accept the goals of reducing greenhouse gas emissions and transitioning the economy away from the current reliance on fossil fuels. However, northern Sweden's regional governance does not account for different understandings of the environment and by extension, land use, that are contributing to conflicting interests in the region. Most stakeholders—various levels of government and industry—favor a vision of weak sustainability in which growth and consumption are still prioritized. But, a small minority—Sámi organizations, youth advocates, and environmental conservationists—favor strong sustainability, in which social and ecological elements are given primacy.

This case study of northern Sweden contributes to better integrating the REG and Arctic literatures. Overall, northern Sweden's governing system does a good job of integrating the interests of industry and local and regional governments as demonstrated

in the coordinated pursuit of green economic goals. However, the existing system does not take into account the interests of the Sámi reindeer herders who make up a small minority of the population. In fact, there is little recourse for them to start engaging in governance given that the mechanisms for such engagement in the region are limited. In this light, the Arctic realities and analyses of them are helpful for highlighting the limits of the REG approach. Evidence from northern Sweden suggests that an understanding of the regional level of governance is incomplete without considering the costs of the green transition to Indigenous inhabitants. In northern Sweden, the Sámi conceive of nature in different terms than those who see the environment mainly through the lens of extracting resources. They prefer traditional uses for the land rather than using it for mining iron ore or generating electricity.

Additionally, linking the REG literature with the concepts of weak and strong sustainability provides insights into the nature of the coalition currently promoting the green transition in northern Sweden. Based on the evidence we gathered, the existing coalition of industry and government promotes a weak version of sustainability and leaves little room for the kind of strong sustainability that would guarantee Sámi interests.

While the majority of interests win out in the case of northern Sweden, such an outcome is not always the case. In the Canadian Arctic, for example, minority rights are better protected for First Nation groups. For example, the *Mackenzie Valley Resource Management Act* was established in the Northwest Territories between the Government of Canada, Government of the Northwest Territories, and the Indigenous government organizations to establish co-management boards for land use decisions. Co-management represents a shift in Indigenous-state collaborations (Bateyko, 2003) and a "change from a system of centralized authority and top-down decisions to a system which integrates local and state-level management in arrangements of shared authority, or at least shared decision-making" (Rusnak, 1997, p. 2).

Future research investigating the nexus between REG and Arctic concerns can hopefully dig deeper into the institutional structure regulating Arctic life to better understand how these policymaking bodies can incorporate an in-depth understanding of Indigenous interests and ensure that they are better accounted for in future policies and development practices. Additionally, future studies should examine the consequences of the existing relationship for long-term economic and social sustainability in the region and seek ways to measure the benefits of a more inclusive approach.

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Declarations

Competing interests The authors declare no competing interests.

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